7 World Scientific Studies in International Economics

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Preface

Financial markets have become increasingly globalized in recent years. Theory suggests that this may either increase or decrease risk to national financial markets. It may decrease national risk exposure — increase financial stability — through diversifying risk across a greater number of countries. It may increase national risk exposure — decrease financial stability — through binding the national markets close together so that problems in one or a group of countries are rapidly transmitted to a large number of other countries. The papers published in this volume explore this issue. They were presented at a two-day conference at the Federal Reserve Bank of Chicago on September 27–28, 2007, co-sponsored with the International Monetary Fund. The conference was the Tenth Annual International Banking and Finance Conference sponsored by the Federal Reserve Bank of Chicago on important current issues confronting the international financial system.

Most of the papers were prepared after the initial outbreak of the "subprime mortgage" turmoil that swept through international financial markets after the summer of 2007. They discuss the relative strengths of the risk diversification and risk transmission processes; examine the empirical evidence to date; consider the relative roles of banks, nonbank financial institutions and capital markets in both risk diversification and risk transmission; evaluate the current status of crisis resolution in a global context; and speculate as to where to go from here in terms of understanding, resolution, prevention, and public policy. In addition to the papers presented at the regular conference panels, the book includes special keynote addresses.

The conference speakers and the conference audience represented more than 30 countries and international organizations, making the conference international in views presented as well as in topic matter. The group also represented a large number of different and diverse affiliations from both the public and private sectors, including academics, financial policy-makers, bank regulators, and bank and finance practitioners.

Publication of the papers in this volume is intended to share the ideas and analyses that were presented at the conference with a wider and more diverse audience in order to enhance our understanding of risk within the framework of global financial markets.

Jamie Caruana
International Monetary Fund

Douglas D. Evanoff
Federal Reserve Bank of Chicago

George G. Kaufman
Loyola University Chicago

Acknowledgments

Both the conference and this resulting volume represent a joint effort of the Federal Reserve Bank of Chicago and the International Monetary Fund. Numerous people at both organizations aided in their preparation and successful execution. The three editors served as the principal organizers of the conference program and are indebted to the assistance of many people who contributed at various stages of the endeavor. At the risk of omitting some, they wish to thank John Dixon, Ella Dukes, Jennie Krzystof, Hala Leddy, Loretta Novak, Elizabeth Taylor, Julia Baker, and Wempy (Ping) Homeric.

Special mention must be accorded to Blanca Sepulveda and Sandy Schneider who shared primary responsibility for administrative duties, and Kathryn Moran who compiled the information for both the program and this conference volume.

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Contents

I. SPECIAL ADDRESSES

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Through the Looking Glass: The Links between Financial Globalization and Systemic Risk

John Lipsky*
International Monetary Fund

Thank you for inviting me to speak here this afternoon. It is a pleasure and a privilege to address this conference. These proceedings are focused on some of the most pressing and pertinent financial sector issues. My remarks today will address one of them: namely, how to understand and limit systemic risk in a world that is increasingly financially integrated. As the financial system has broadened and deepened through securitization and globalization, it stands to reason that our concept of systemic risk also must be recalibrated. For sure, the range of questions we need to think through are difficult, as they inevitably will be intertwined with market liberalization and technological change. Reflecting the impressive list of contributors, however, I am confident that this conference will contribute tangibly to our understanding of the issues.

I will begin by posing a few questions — hopefully useful ones — and then offer some tentative answers during the balance of my remarks. In addressing the question of globalized systemic risk, four challenges are central: the first is to define, as precisely as possible, the meaning of "systemic risk" in a globalized financial market. Second, what tools and policies are available at present to control such risks? Third, what needs to be changed to be more effective in limiting systemic risks? And, fourth, can the IMF play a useful role in this regard?

1. Features of Financial Globalization

Before examining these questions, I'd like to mention some crucial features of the current landscape. A few months ago, I would have said that

* John Lipsky is first deputy managing director of the International Monetary Fund.

one of the most striking features of financial globalization has been the broadening reach of financial institutions and markets, creating an ability to disperse risk much more widely than previously. The process of globalized risk transfer is being facilitated by securitization and by the use of complex derivative transactions. As is well-understood, the key benefit of modern risk transfer instruments is that they allow investors to bear only the financial risks they wish to.

While I still believe this to be one of the most relevant facets of financial globalization, the events of the past few months have demonstrated that the process of risk dispersion contains some inherent potential problems. In particular, the complex composition of some derivative instruments — and the lack of transparency regarding some holders' balance sheets — make it hard to assess the risk exposure of individual entities, including some regulated institutions. For example, over the last couple of years, US sub-prime and other mortgage-backed assets have been a key ingredient of structured credit products that have been sold to a broad set of investors, many outside the United States. In fact, this aspect of financial globalization has worked well up to now — abstracting from the issue of whether investors became excessively exuberant.

Problems arose when it became apparent that the underlying assets were not performing very well — that is, when US house prices began to weaken and mortgage delinquencies rose quickly. At that point, the lack of transparency regarding both instruments and investors created a sudden loss of confidence in the predictability of the mapping of changes in the underlying housing market, to the prices of the relevant derivative securities. Liquidity disruptions emerged quickly — both in terms of the market liquidity of the instruments themselves and the funding liquidity of some of the institutions that purchased them.

Despite the widely held views that much mortgage credit risk had been transferred outside the banking system, a fair bit of this risk ended up in mid-sized banks, as well as in conduits and special investment vehicles (SIVs) associated with banks. Moreover, even though the conduits and SIVs were legally separate from the associated bank and thus were "off-balance-sheet", these vehicles had ties to banks through various guarantees and contingent credit lines. Thus, rising uncertainty and impaired liquidity forced banks and other intermediaries to fund (or acquire) these assets directly. In other words, financial innovation — at its current state of evolution — has increased banks' ability to move risk

off their balance sheets, but has not eliminated the possibility that it could return unexpectedly.

Another key feature of financial globalization is the expectation of continuous liquidity. Ready pricing of securities is assumed to be attainable at all times, effectively without limits. The bundling of assets and merging of cash flows was supposed to make this expectation more certain. The conventional view is that it is easier to price and trade a bundled security than to try to find buyers and sellers of the individual component assets.

There is a limit to this notion, however. It is difficult to price a complex security when the risks of the underlying cash flows cannot easily be observed and analyzed. When instruments become too opaque, only specialized investors have the ability to understand them. Such instruments are likely to have low or even no market liquidity. Effectively, they become "buy-and-hold" securities.

I want to be clear: I am not suggesting that there is something inherently flawed about securitization, and there is nothing wrong with tailoring financial transactions to individual investors who anticipate holding them to maturity. Indeed, in theory, these actions lower interest costs for borrowers and are an important element of the process of redistributing risk to those most willing and able to bear it.

Recent events, however, have demonstrated once again that the existence of fluid and continuous markets for complex instruments may not be counted on in moments of stress. Difficult-to-analyze securities will tend to complicate investors' ability to anticipate market shifts resulting from changing fundamentals and shifts in perceived credit risks. In 1987, for example, portfolio insurance was promoted as a new technique for hedging equity risk, allowing upside gains while protecting against downside losses by creating an implied put option. These hedges worked well when the bundled stocks and the associated index futures were liquid enough so that the relation between the two was predictable. Once that relationship broke down, however, and price continuity on stock exchanges was impaired, the futures market also suffered. Information was not conveyed in a timely manner, was misinterpreted, and ultimately produced perverse and volatile outcomes.

In early 1994, the Fed's unexpected interest rate rise altered the prepayment risk on mortgages in a way that many market participants had not anticipated. Those who thought they understood both the risks embedded in mortgaged-backed pools and how to hedge the associated convexity

risk found that their actions increased their own losses by inadvertently pushing prices down further.

What happened during these earlier instances is similar in many ways to the events of the last couple of months: issuance of sophisticated products grew so rapidly that market capacity implicitly became stretched. When uncertainty about pricing relationships increased, liquidity dried up and price gaps appeared, further boosting market volatility and raising uncertainty.

2. What is Systemic Risk?

Returning to the basic question of defining systemic risk in securitized globalized markets, experience suggests that systemic risk is created by unexpected events that heighten uncertainty sharply and impair market liquidity. Illiquidity leads to "price gaps" in individual markets and in the pricing of specific assets. The associated stress subsequently extends to the funding liquidity of financial institutions across the globe that are supporting those individual markets. Market illiquidity in turn can lead to potentially significant real economic effects, thus justifying policy action, especially by central banks.

Several aspects of this portrayal are associated with financial globalization. First, the impact of the identified systemic risk is wider than previously, encompassing more than an individual country or even a region. Thus, the impact of recent problems with US sub-prime mortgages extended to Europe as well as the United States, and liquidity problems have been registered as far away as Australia and Russia. And, the incidence of their impact probably is broader than previously. In the latest episode, the incidence has included shareholders in private banks, and taxpayers in the case of some public banks in Germany, depositors of a UK bank with no exposure to the original credit deterioration, investors in hedge funds, not to mention 40 percent of US nonbank mortgage originators.

3. How to Control Systemic Risk

The second of my four questions is: "How do we deal with systemic risk in today's environment?" This question is obviously complex, but recent

events (and those of the past as well) point to some basic principles. In general, enhancing transparency is a ubiquitous and key theme.

First, in addressing the events that lead to market illiquidity, the provision of information can be improved regarding the risks embedded in the underlying securities on which pricing is based. A critical issue is deciding who should have access to this type of information and who should provide it: if the instrument is traded in a public market, all potential buyers and sellers need to be able to access the appropriate information. If the instrument is a negotiated contract, adequate information needs to be accessible to those that are party to the contractual agreement. At present, however, there are an increasing number of instruments and markets that do not fall neatly into either category. For instance, if structured credit products are expected to be liquid in an over-the-counter market, the ability to look through the structure to the underlying assets and their characteristics would be important. However, it may not be realistic to expect that all potential end-investors will have the ability to do this. If not, can third parties be trusted to do it for them?

Second, in addressing uncertainty associated with funding illiquidity, information about institutions' asset structure (including, for instance, maturity and marketability) and their associated funding strategies would be important in judging how well funding liquidity is being managed. Most recently, many nonbanks, including conduits and SIVs, have undertaken the traditional maturity mismatch associated with banks. Some of the investors providing funding for this activity — typically, in the case of conduits and SIVs, through vehicles such as asset-backed commercial paper backed up by contingent credit lines — apparently were unaware of the risks involved. The entities holding the hard-to-value, potentially illiquid assets also did not adequately factor in the risks of market illiquidity or of a potential loss of their funding sources. For the public to assess the soundness of these new financial institutions, regulated entities will need to provide more information about their relationships with them, their specific exposures (through guarantees or contingent credit lines), and the associated revenues and costs.

I would like to stress that improvements in the practices of market participants — including issuers, investors and intermediaries — is not only possible, it is also likely to improve information flow and to reduce uncertainties. In many cases, the recent problems will induce new private sector initiatives — witness rating agencies' proposal to produce liquidity

ratings. However, new regulations also may be needed to induce parties to reveal information that they would rather not disclose.

Here, I would like to sound a note of caution: we must be careful not to focus excessively on new regulations intended to fight the last battle when the next one could be different. We already have made a lot of progress in recognizing that supervision should be "risk-based" and that regulation should be "incentive compatible". These principles should be kept in mind when we look ahead. The key will be to adapt these concepts to the problems of today with careful thought given to what we expect to happen tomorrow.

For this reason, I find some of the latest criticism of Basel II to be just a bit too facile. It has been claimed that conduits and SIVs were conceived as a means to avoid Basel II capital charges by placing assets off bank's balance sheets. In a Basel II world, however, it would be less costly to put the assets held by conduits and SIVs on the balance sheet than in the current Basel I world, since their risk-sensitive ratings likely would have required less capital charges than in Basel I. The current debate about ratings agency regulation is another area where we must tread carefully in order not to stifle innovation.

For example, many observers have pointed to the longstanding conflict of interest within ratings agencies' business model as a principal cause of recent difficulties. While rating agencies clearly misjudged the credit deterioration underlying some of the securities they rated — and incentives likely pressed them to rate too many complex structures too quickly — the notion that they are primarily to blame suggests that investors need not do their homework and can rely entirely on third parties. Clearly, investors share the blame for recent market difficulties. They should not take a credit rating letter grade on complex securities as the principal element of their due diligence process. Nonetheless, rating agencies will continue to play an important role in providing third-party opinions about credit risks, especially in areas where credit risks are difficult to assess. At the same time, ratings agencies no doubt realize that they need to adapt. When the instruments they rate for their probability of default are highly susceptible to market and liquidity risk as well, they should acknowledge and include an assessment of this as well.

In addition to making sure that market participants have access to the necessary information, there is a role for regulation when individually rational behavior from a set of financial institutions produces a collectively bad outcome: such an outcome is most likely in areas where it will

be difficult for market incentives to work properly. For instance, risk management systems place "risk-based" limits on traders' positions. These limits may work well when volatility is in "normal" ranges, but when volatility spikes abruptly, positions may need to be reduced rapidly in order to satisfy certain regulatory capital requirements or internal firm rules. Credit rating downgrades also can lead to abrupt valuation changes. At a minimum, risk management techniques need to account for market participants' likely actions during "tail" events, and this will be very difficult to accomplish satisfactorily.

As we all recognize, there are many interactive effects that crop up in times of stress but that are absent in normal circumstances. The most evident of these is related to liquidity stress, when many institutions simultaneously want to assure themselves of credit availability. Credit providers often cannot anticipate these circumstances with certainty. This problem was illustrated by the recent Canadian situation, where one issuer's difficulties in refinancing commercial paper led to 17 other issuers requesting funding from their liquidity providers, intensifying the ongoing market sell-off.

To summarize, my main message here is that we can use the current strains in financial markets to understand where market weaknesses have been exposed. Market practices themselves are likely to adapt to this knowledge. But where market incentives fail, the regulatory responses should be forward-looking, and not stifle the underlying process of financial innovation.

4. What Needs to Be Changed?

The third question is, "What do we need to change to be more effective at dealing with the aftermath of systemic risks?" Past financial crises have provided some "first aid kits", mostly in the form of deposit insurance for bank depositors, guarantee funds for pensions and mortgage lenders, legal structures for "bad" banks to resolve bad assets, and lender of last resort action by central banks. Globalization makes it harder to identify who will provide the "first aid kits". When the ownership of financial institutions is held by individuals, or by institutions, across several countries, this is a nontrivial problem. It could be that the parties most in need of emergency support are relatively uninvolved with the financial sector, even if financial markets may have been at the epicenter of the shock. Countries with well-developed financial systems, generally good information, and transparent

policies may be better able to cope with the economic effects of financial disturbances, but economies that lack these characteristics may not.

5. Role of the International Monetary Fund

A discussion of potential spillovers leads naturally to a last question: "What is the Fund's role in all this?" Given the Fund's universal membership and broad mandate, it could provide a catalytic role in bringing together policy-makers of various countries — along with other relevant international institutions — before, during, or after a systemic shock. The Fund could help identify potential or real cross-border financial disturbances, identify their transmission mechanisms, ensure that financial markets' "plumbing" (such as clearing and settlement systems as well as mechanisms for liquidity provision) are in good working order, and if necessary after a shock, to identify and facilitate solutions. Fund researchers are analyzing how systemic events are likely to take place in current circumstances — their precursors, linkages, and after-effects — and actions that can head them off and/or ameliorate their impact. The Multilateral Consultation, a novel tool introduced by the Fund specifically to facilitate frank and open discussions on key economic issues of mutual interest to our members, could be useful.

There may be other roles the Fund could and should play in this arena. As this conference progresses, I would be delighted to hear your suggestions about the Fund's role, or about any of the other questions I have posed today.

Thank you very much for your attention.

The Current Financial Crisis: Will Latin America Be Caught in the Web, Again?

Guillermo A. Calvo*
Columbia University

1. Introduction

The objective of this note is to offer a perspective about the current *sub-prime* crisis from the point of view of emerging market economies, with special emphasis on Latin America. The central line of the note is that financial factors are key to understand crises in emerging market economies since the 1980s. External financial factors, in particular, have been an important trigger, while domestic factors played a role in attenuating or multiplying their effects. Therefore, it is possible that the sub-prime crisis will be transmitted to emerging markets. However, I will argue in this note that the situation in those economies has changed for the better, although risks remain.

Section 2 offers a brief review of recent relevant research on emerging market economies, while Section 3 employs the insights of Section 2 to discuss the possible repercussions of the sub-prime crisis in Latin America.

2. What Have We Learned?

In this section, I will discuss three points on which there has been major progress compared to what was known before the Mexican Tequila crisis of 1994–1995. All of these points stress the relevance of financial factors, both external and domestic. This will serve as background for the discussion

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in Section 3 about the prospects of Latin America under the present *sub-prime* crisis.

The first point discusses the crucial role played by external financial factors; the second argues that variables such as foreign currency debts can play a major role in the likelihood of financial crises; and, lastly, the third point discusses a puzzling aspect of post-crisis economic recovery: as a general rule, it occurs without a matching expansion of bank credit, despite the fact that the crisis was associated with a sharp contraction in credit lines.

2.1 *Financial crises can stem from external financial problems*

This statement, which contains a lot of common sense, did not form part of the Washington Consensus.[1] In the 1980s the conventional wisdom was that, provided a country "put its own house in order", capital markets would always be willing to finance deficits caused by transitory shocks. This led to the conclusion that crises that were not associated with clear real and long-lasting factors (for example, an earthquake) were the result of bad economic policies. This point of view seemed to be confirmed by the many crises that followed the Mexican upheaval of August 1982, since many of the countries that suffered had significant fiscal imbalances.[2] Moreover, as the Tequila crisis (1994–1995) also began in Mexico, it is not surprising that the consensus was that Mexico, and also Argentina (the other casualty), must have done something "wrong" (although the sin was not easy to identify, especially in the case of Argentina).

This point of view suffered a major reverse with the Russian crisis of 1998, which was triggered by a default on domestic public debt payments in Russia — a country that was irrelevant on world financial markets (its gross domestic product, GDP, accounted for less than 1 percent of world GDP). Moreover, Russia neither was nor is a major trading partner of the emerging markets, most of which, to the surprise of most observers, suffered a substantial increase in their spreads (that is, the differentials between their interest rates and those paid by the United States on financial instruments of similar characteristics). This phenomenon lasted for many years, as Figure 1 clearly illustrates. The figure also shows that the

[1] For a discussion of the Washington Consensus in the light of recent financial crises, see Kuczynski and Williamson (2003).

[2] Incidentally, these crises gave major impetus to the Washington Consensus.

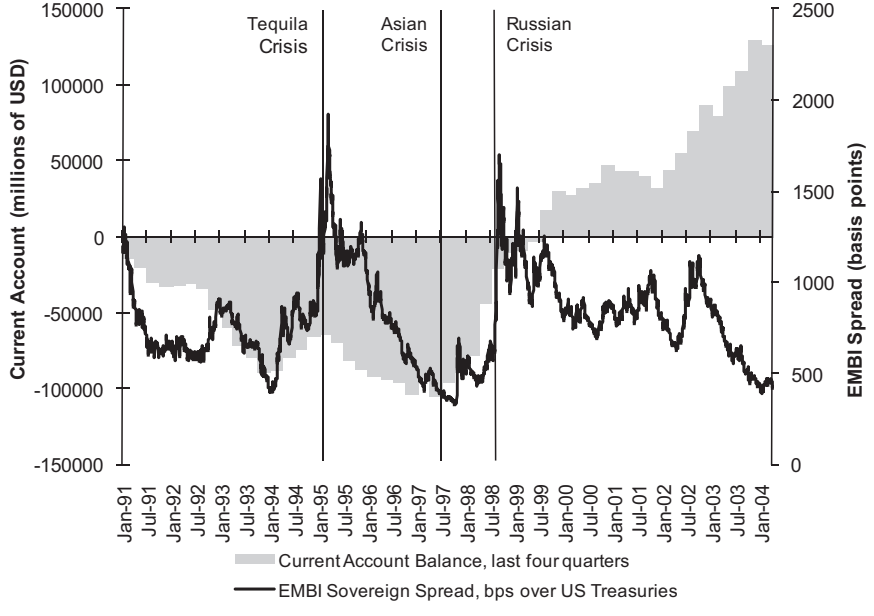

Figure 1. External financial conditions for EMs (EMBI sovereign spread & current account balance in EMs, millions of USD, last four quarters)
Note: Includes Argentina, Brazil, Chile, China, Colombia, Czech Republic, Egypt, Hungary, India, Indonesia, Israel, Korea, Malaysia, Mexico, Morocco, Pakistan, Peru, Philippines, Poland, Slovak Republic, South Africa, Thailand, Turkey and Venezuela.
Source: Own calculations based on official data.

current account balances of countries with emerging markets underwent a phenomenal adjustment from 1998, moving from large deficits to major surpluses, due mostly to the sharp turnaround of the current account in Asia. In addition, the problems were not confined to the financial sector. As Figures 2 and 3 show, investment plummeted in Latin America (LAC-7 stands for the seven largest countries in the region representing more than 95 percent of total output, namely Argentina, Brazil, Chile, Colombia, Mexico, Peru, and Venezuela), and for a long time GDP grew significantly less than in the first half of the 1990s when capital was flowing in.[3]

[3] The relevance of external factors has also been shown using standard econometric techniques. See, for example, Calvo, Leiderman and Reinhart (1993) and Izquierdo, Romero and Talvi (2007).

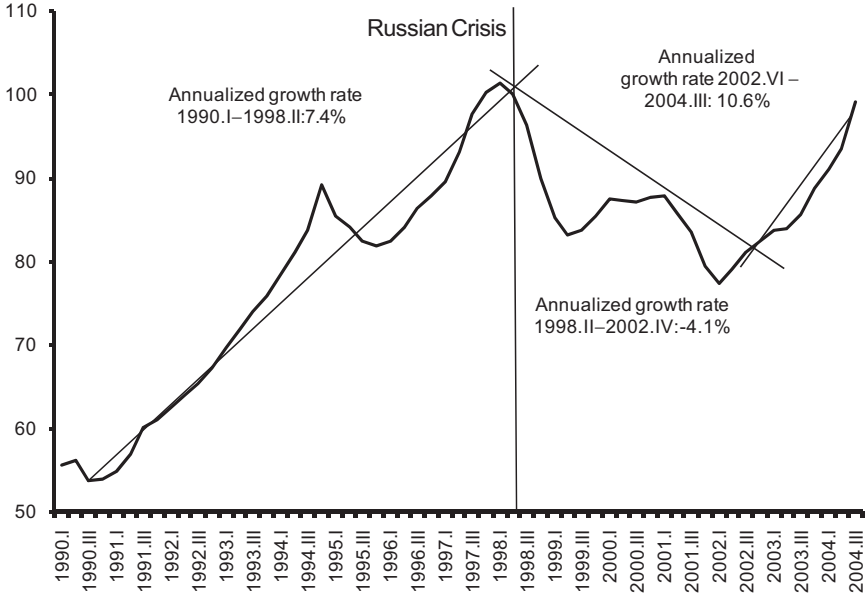

Figure 2. LAC-7 investment (LAC-7, s.a. investment, 1998.II = 100)
Source: Own calculations based on official data.

2.2 *Domestic factors are important, but not only those that were the center of attention before 1995*

In the traditional International Monetary Fund (IMF) model, fiscal deficit is a key variable. This is because in a world without capital mobility and with poorly developed national capital markets, fiscal deficits have to be monetized (unless a loan is obtained from the official sector in the rest of the world). There is therefore a very tight link between the fiscal deficit and inflation. The central bank may try to sever this umbilical cord by fixing the exchange rate, for example; but it will find that it starts to shed reserves; and, sooner or later, it will suffer a balance of payments crisis (a situation elegantly modeled by Krugman, 1979).[4] Alternatively, if exchange controls are put in place, a gap quickly opens up between the official exchange rate and the rate prevailing on the parallel (or black)

[4] It is worth noting, however, that Krugman (1979) is not an adequate model to explain the financial crises occurring after the 1980s. See Calvo (2005).

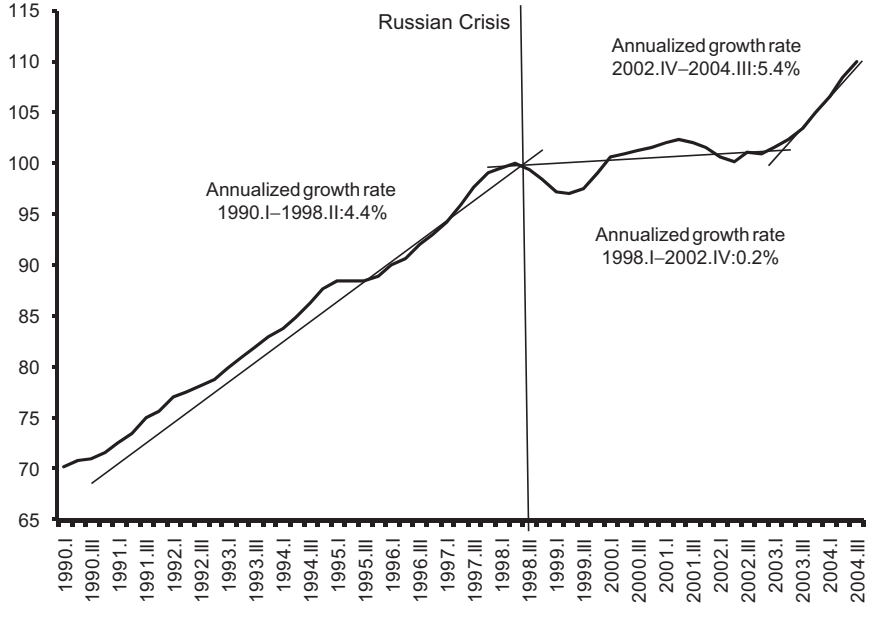

Figure 3. LAC-7 growth (LAC-7, s.a. GDP, 1998.II = 100)
Source: Own calculations based on official data.

market, giving rise to all kinds of distortions and, ultimately, a loss of control over macroeconomic variables.[5] For that reason, the fiscal deficit has been the focus of attention both in the Fund and among financial analysts. This was so, however, until crises started to appear in the 1990s in which the fiscal deficit was notable by its absence, an example being the crisis in Korea in 1997.

I will now discuss two variables that were ignored by analyses that preceded the 1990s crises, which help to explain crises after 1980: Liability Dollarization and the Current Account Deficit (as a proportion of expenditure on tradable goods).[6] By liability dollarization, I mean debts denominated in foreign currency. This is a common feature in many countries that have emerging markets (Eichengreen, Hausmann

[5] For an interesting discussion of policies of this type and their counterproductive effects, see Easterly (2002).

[6] To simplify the discussion, I will assume that there are just two categories of goods: tradable and nontradable. The first can be traded across borders at zero cost, whereas the second have to be used inside the country (although they can be owned by foreigners).

and Panizza, 2005, which documents the phenomenon and refers to it as "Original Sin").

In an econometric study that I conducted with Alejandro Izquierdo and Luis Fernando Mejía (2008), we studied episodes in which there was a very sharp and unanticipated reduction in international capital flows. These crises are called "Sudden Stops". The paper tries to characterize the likelihood of such crises, for which purpose we examine a large number of variables, although concentrating on those mentioned above, with one important difference: instead of the notion of "Original Sin", we focus on a narrower concept which we call "Domestic Liability Dollarization" (DLD). DLD is defined as the stock of foreign currency debt that residents have *vis-à-vis* the local banking system, measured as a proportion of GDP.

Why DLD? To gain an insight, consider the case of Argentina in 2002, in which the exchange rate rose from 1 peso to over 3 pesos per dollar when the exchange rate was set free. The banking system was virtually dollarized, which meant that practically all of its loans were denominated in dollars; and there was no escape clause because the government had for 10 years succeeded in maintaining peso–dollar parity, that is, the "Convertibility Plan". Many of those loans were used to finance consumption or working capital in nontradable sectors (which received their incomes in pesos). Accordingly, many loans became unpayable following the maxi-devaluation. This does not prove that high levels of DLD make crises more likely, but it does make it clear that in the case of devaluation, high levels of DLD could seriously complicate the local financial system. To be true, the currency denomination mismatch problem is not confined to DLD. It applies to all foreign currency denominated debt, since default on debt external to the domestic banking sector is likely to make it harder to obtain new external credit lines (although the evidence on this is not strong; see IDB, 2007, for a recent survey). But there is a major difference in the case of debt contracted with local banks: the latter can seriously interfere with the payments system, as shown by the Argentine *corralito* (literally "playpen", by which depositors were prevented from withdrawing their bank deposits). The payments system is at the heart of the productive process. If the former becomes paralyzed, the latter also will. Accordingly, the slightest suspicion that the authorities will be forced to devalue can produce a banking panic, which creates the conditions for the payment system to become paralyzed and leads to steep falls in output and employment. In the Argentine case, for example, from 1999 until the crisis hit bottom in 2002, GDP fell by over 20 percent.

The other key variable is current account deficit on current account as a proportion of expenditure on tradable goods and services. The larger the current account deficit, the greater the proportional contraction in expenditure associated with a sudden cut in external credit. Thus, it is to be expected that, given the real exchange rate, the larger is the current account deficit, the greater also will be the proportional fall in demand for nontradable goods and services in the event of a crisis.[7] Nontradables, by definition, cannot be exported; so a decrease in the demand for them causes their relative price to fall (that is, a real depreciation of the currency), or, equivalently, a rise in the real exchange rate.[8] A real devaluation, particularly if unexpected as in sudden-stop episodes, is never good news; but the larger the DLD the worse the situation, because it leads to widespread bankruptcy in the nontradable goods and services sector.

How do all these pieces fit together? Thus far I have argued that, if a sudden stop occurred, variables such as the current account deficit and DLD could help to throw the economy into deep crisis; but I have not offered a rationale for sudden stop. We do not answer this question in our empirical work. Instead, we ask what *domestic* variables would help to consolidate an incipient sudden stop, which, in principle, is transitory and stems from external financial factors — a phenomenon which, as I have tried to demonstrate in Subsection 2.1, cannot be ruled out for economies that participate in the international financial system. We answer that question by studying systemic crises (which we term "systemic sudden stop", or 3S). 3S are crises in which abrupt capital flow reversals are accompanied by a sudden increase in a global index of the cost of obtaining finance on emerging markets (a situation we define as an increase greater than two standard deviations with respect to the index's historical mean),[9] such as the global EMBI+ (a spreads index calculated by JP Morgan) shows a sudden increase. Thus, for 3S episodes, it is plausible to conjecture that the initial financial shock comes from abroad, which facilitates the econometric work of assessing the impact of the *domestic* factors on the likelihood that those episodes develop into a full-fledged sudden stop.

The external interest rate shock can be caused, for example, by default on the part of a country or sector, which causes a liquidity crunch in the

[7] This is exactly so if the utility function is homothetic.

[8] A more precise analysis of this relation can be found in Calvo, Izquierdo and Mejía (2008).

[9] Rises of this type can be seen in Figure 1 around the Tequila and Russian crises.

global financial system, pushing up interest rates on high-risk markets. The latter, in turn, generates a reduction in capital flows, which, as noted above, will have a greater impact on the real exchange rate the larger is the current account deficit (as a proportion of expenditure on tradable goods). Accordingly, given a significant rise in international interest rates, variables such as the current account deficit and DLD are risk factors: the higher their level, the greater is the likelihood of triggering a full-fledged sudden stop.[10] This is supported by a panel probit estimation that includes every country in the world for which it was possible to obtain DLD data for the period 1990–2004 (110 in total; see Calvo, Izquierdo and Mejía, 2008).

As a result of that research, two variables have been added that were not in the analysts' repertoire (at least in this form) before the 1990s crises. Clearly, DLD had been completely ignored. In fact, many people still believe that, while it may be an important variable for Latin America, it ought not to be so for Asia, where dollarization levels are much lower. This assessment is incorrect, however. In Asia, it is true that foreign currency deposits as a proportion of total deposits are much smaller than in Latin America; but the banking system in Asia is much larger in proportion to GDP. Thus, the volume of foreign currency credit from the national banking system, in relation to output, turns out to be very similar in the two regions (see Calvo, Izquierdo and Mejía, 2008).

With regard to the current account balance, differences from the conventional view are more a matter of focus than of emphasis. The current account deficit has always been at the center of discussion of these issues, as shown by the current debate on global imbalances. Nonetheless, the traditional view sees these deficits as worrying because they may be signaling that the country is borrowing at a rate that is not sustainable in the long-term. The unsustainability of deficits is not necessarily a problem, however. It is perfectly natural, for example, for some countries to borrow at an unsustainable rate when interest rates are low, simply because it is optimal to borrow now and stop doing so, or repay, later. This seems to have been the case for emerging markets in the first half of the 1990s. The worrying thing, as stressed in Calvo, Izquierdo and Talvi (2003) and other papers along the same lines, is not so much the lack of sustainability, but rather the possibility that a country may be forced to make an abrupt and

[10] For a more detailed explanation, see Calvo (2005, Chapters 5 and 12), and Calvo, Izquierdo and Mejía (2008).

unplanned adjustment to its current account balance (as a result of a sudden stop). This may give rise to financial problems of the type I have discussed above, with negative consequences extending far beyond the financial sector.

To summarize, and express the difference symbolically, if we call the current account deficit CAD, the conventional concern is about having a large CAD, whereas for the "sudden stop" literature, what is worrying is a sharp and unanticipated fall in CAD (more formally still, an unanticipated and highly negative ΔCAD, where Δ stands for the first difference operator). To be sure, the sudden stop literature also highlights the level of CAD, but only as a proxy for the potential contraction in CAD after an incipient sudden stop (see Calvo, Izquierdo and Mejía, 2008).[11]

2.3 *Phoenix miracles*

The Argentine crisis of 2001–2002 is comparable to the Great Depression of the 1930s in the United States, in terms of the GDP contraction that it involved. Both crises were accompanied by a sharp domestic credit crunch. In the Argentine case, there was also a steep fall in capital flows; and, as I indicated above, the currency suffered a devaluation of over 200 percent. To avert a major banking crisis, the Argentine authorities decided to "pesify" debts and bank deposits. Although the exchange rate rose from 1 to over 3 pesos per dollar, loans were pesified at a rate of 1 peso per dollar, whereas deposits were converted at a rate of 1.40 pesos. Apart from the fact that this meant a massive violation of contracts, the asymmetric way in which pesification was implemented caused a significant loss of capital for the banks, which the government attempted to alleviate by issuing a public bond that was placed in their treasuries. The details of this are discussed in Calvo, Izquierdo and Talvi (2006). The important point for this discussion is that the crisis was of major proportions, and involved a key role for the financial sector. Contrary to predictions made by the Fund and many other financial analysts, however, the Argentine economy managed to regain its precrisis

[11] This phenomenon is similar to what is known as a "hard landing", but it is not the same. A hard landing is a credit crunch that is costly to the economy. Sudden stop also assumes a credit slowdown, but the emphasis is placed on international credit. Moreover, systemic sudden stops do not require growth or output to decline. The latter is typically a result, but not part of the definition.

levels without domestic or international credit, and without a substantial recovery in investment.[12] Moreover, to the Fund's surprise, recovery occurred without its participation. Instead, in 2005, Argentina allowed itself the luxury of fully repaying its debts with the Fund, and in 2002–2005, its economy posted an impressive growth rate of 10 percent per year. What is the explanation for this? Is it an Argentine miracle?

Calvo, Izquierdo and Talvi (2006) study the economic recovery process in Argentina following crisis episodes of the systemic-sudden-stop type (defined above) on emerging markets for the period 1980–2004. The paper focuses on cases where output fell by over 4.4 percent (see the aforementioned paper for a justification of this criterion). One of the most interesting results is that the characteristics of the Argentine recovery are very similar to the average of the sample (which includes over 40 deep crises). This immediately raises the suspicion that the rebound of the Argentine economy has nothing to do with miracles. What happened?

This is ongoing research. Nonetheless, the most promising hypothesis that we could find (and for which we already have some statistical evidence at the micro level) is that when formal credit markets deteriorate sharply — which happens in most of these crises — it takes time to rebuild them. Recovery is therefore not accompanied by formal credit; but that does not mean firms cannot obtain other forms of financing. For instance, the fall in the investment rate itself releases funds to replace working capital which, before the crisis, was provided by banks. In addition, as nominal wages rise much more slowly than the price level, firms make larger profits (per unit of output, at least), which makes it easier for them to self-finance. These new forms of financing are not instantaneous, so recovery is not immediate but takes time. It is worth stressing, however, that although economies have the capacity to recover on their own, as it were, the crisis entails major economic and social losses, which might have been avoided with better management of financial instruments at both the local and international levels (for example, by reducing DLD or providing emerging economies with a global central bank). In addition, a conjecture that seems to be quite widely shared in the profession is that recovery does not guarantee that it will be possible to maintain the precrisis growth rate of total factor productivity (TFP), which could greatly increase

[12] It is interesting to note that the United States also recovered from the Great Depression without an equivalent rise in bank credit or investment. See Calvo, Izquierdo and Talvi (2006).

the cost of such upheavals. Accordingly, from that standpoint, the vigorous Argentine recovery seems more like a mirage than a miracle.

3. Sub-Prime Crisis and Latin America

The previous section shows that both the existence of crisis and its resolution is highly dependent on financial factors. The present *sub-prime* crisis has very important financial ramifications. Therefore, the likelihood that it will be transmitted to emerging market economies (EMs), cannot be discounted. It is interesting to note, however, that while the "North" has been enjoying a decline in volatility since the early 1980s (a feature called the *Great Moderation*), EMs have experienced a series of wild rollercoasters, starting with the Debt Crisis that started in August 1982, continuing with the Mexican Tequila crisis in 1994–1995, the East Asian crisis in 1997, the Russian crisis in 1998, and ending with the Turkey/Argentina crises in 2002. Thus, if anything, from the perspective of EMs those years should be called the period of Great *Immoderation*! The asymmetry between the North and EMs is quite striking, and it appears to hold even now. While the North is striving to keep its financial system in one piece, the EMs have hardly taken notice. For example, a key indicator like the EMBI+, that is, the EM spread relative to US Treasuries, has hardly moved in response to the sub-prime crisis. Actually, both the EMBI+ and the yield on those bonds are still significantly below their levels before the Southeast Asia 1997 crisis (see Figure 4).

Why is it that economies which were so prone to suffer from *contagion* from crises in other EMs, like in the Russian 1998 crisis episode, appear to shrug off a major crisis at the center of the financial system? Two conjectures come to mind. One conjecture is that EMs significantly shielded themselves from financial contagion by deactivating the two main triggers discussed in Section 2.2, namely, current account deficit and DLD. In Latin America, for example, Argentina forcibly "pesified" its economy in 2002, while Brazil and Mexico have succeeded in de-dollarizing their public debts. Moreover, the largest countries in the region exhibited a healthy current account surplus (although it should be noted that the current account surplus would quickly vanish if the terms of trade went back to their 2002 levels, see Figure 5[13]).

[13] In addition, Calvo and Talvi (2007) show that there may still be holes in their armors even if terms of trade do not deteriorate.

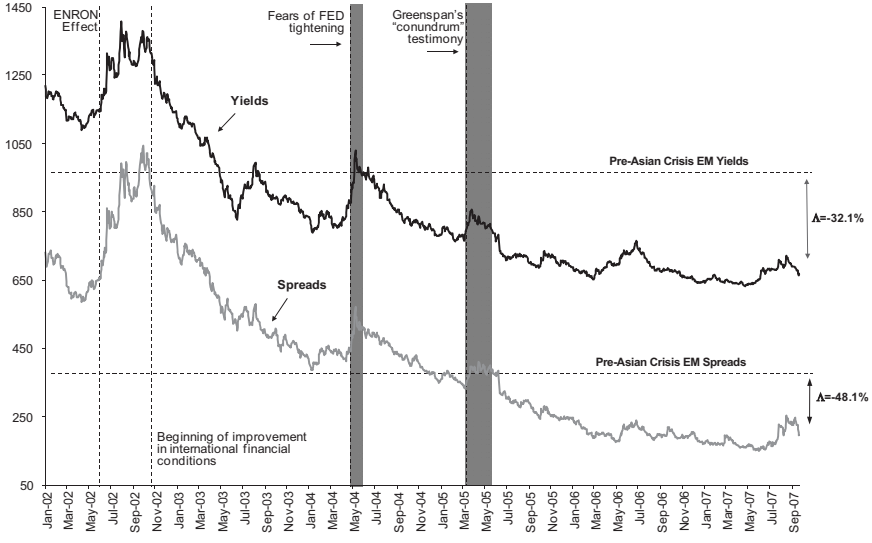

Figure 4. External financial conditions in EMs (EMBI+, bps)
Source: Bloomberg.

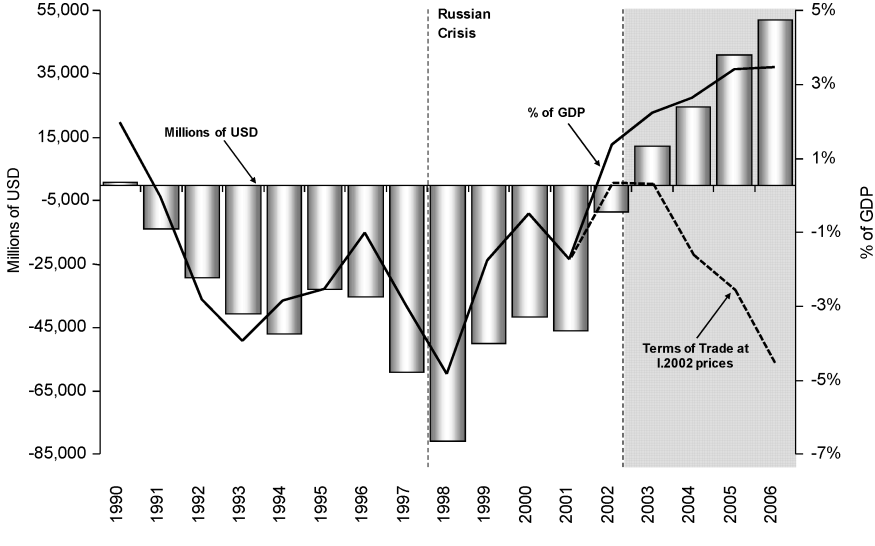

Figure 5. Latin America's adjusted current account balance*: Hidden deficits? (LAC-7, current account, in millions of USD and % of GDP)
* Calvo and Talvi (2007).

Another conjecture is that the crisis in the North was quickly met by a major liquidity infusion by North central banks. This is in sharp contrast with, for example, the Russian 1998 crisis in which case not only was there no global lender of last resort but, in addition, the Fund took the financial world by surprise by refusing to extend further credit to Russia, a country that was seen at the time as *too nuclear to fall*. North central banks could thus be seen as having contained the spread of the sub-prime crisis to EMs. I tend to favor this conjecture given that, as noted above, the current account surplus in Latin America is not very robust and that the decline in DLD may be transitory since there are several instances in which de-dollarization was quickly reverted in response to financial stress (for example, the switch from CETE to TESOBONO in Mexico 1994, prior to the Tequila crisis).

What about external factors? The situation in the North is in a state of flux, even if the sub-prime crisis subsides. Under the latter, more benign scenario, the Fed is likely to pay more attention to inflation, which may result in a sharp rise in interest rates and a quick mopping up of liquidity. The rise in international interest rates was never good news for the region (for recent evidence of this fact, see Izquierdo, Romero and Talvi, 2007). To be sure, Latin America exhibits current account surplus, but this does not imply that *every* sector is a net lender. Calvo and Talvi (2007), for example, argue that the terms of trade improvement that took place since 2002 is largely responsible for the current account surplus (see Figure 5). Thus, commodity-producing sectors may exhibit a large surplus. But this does not guarantee that the manufacturing sector, for example, has not been running deficits, taking advantage of low interest rates. Therefore, a rise in international interest rates may hit some key sectors despite the country as a whole showing a current account surplus.

Another complementary and perhaps more serious risk for Latin America and the other EMs is the possibility that we could be witnessing the end of the Great Moderation. The Fed may find itself between two fires: inflation and financial fragility. For example, the switch from international reserves to stocks and investment that is already taking place in some EMs (through Sovereign Wealth Funds) may provoke a surge in the rate of inflation and lead to Fed tightening. But Fed tightening may, in turn, reignite the mortgage crisis, pushing the rate back to lower territory. This policy zigzag would create uncertainty and make it difficult for EM central banks to use the interest rate as a policy instrument because they would have to be adjusting the domestic rates to the now more volatile

international interest rates. External factors are always hard to explain to the public and, as a result, responding to volatile international interest rates would likely make monetary policy less effective.

Finally, another risk factor that is worth highlighting is political response to financial stress in Latin America. The Chavez–Correa–Kirchner–Evo Morales axis has engineered a political backlash against the Washington Consensus and market-friendly reform, even under the extremely favorable economic circumstances that prevailed since 2002. Thus, one wonders what will happen if external conditions change for the worse. The 1980 debt crisis eventually led countries in the region to adopt market-friendly reform. Will that be repeated? I have serious doubts about it, given the breakdown of the Washington Consensus and the decline of the US standing as a world leader. Therefore, I would not be surprised if financial stress leads to further left-wing radicalization in the region, which, in turn, makes sudden stops more likely.

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Remarks on Systemic Risk and the International Lender of Last Resort

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After the calm of the past several years, the events since the summer of 2007 are a strong reminder that our increasingly globalized and sophisticated markets are still vulnerable to systemic risk. When we speak of systemic risk, we mean the risk of a sudden, usually unexpected, disruption of information flows in financial markets that prevents them from channeling funds to those who have the most productive profit opportunities. We have seen how systemic risk, when it becomes especially severe, can result in financial crises — the seizing up of financial markets — which can have potentially important economic consequences. We have also seen how governments, in their role as providers of emergency liquidity, can intervene to help put the financial system back on its feet and prevent a financial crisis from spinning out of control.[1]

In mature industrial economies, domestic central banks have the credibility and the resources to play this role. Around the world, central banks have injected liquidity and signaled that credit would be available to those institutions and markets that need it. At other times, as well, the Federal Reserve has acted successfully to prevent potentially devastating financial seizures: notably, after the stock market crash of October 19, 1987, and after the terrorist attacks of September 11, 2001.

Given the current focus on systemic risk, I would like to talk about an issue that I wrote about extensively before coming to the Board of Governors: financial instability in emerging-market countries. (Please note

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[1] I thank Joseph Gagnon, Steven Kamin, and Beth Anne Wilson for their assistance on this speech.

that my comments here reflect my own views and not necessarily those of the Board of Governors or the Federal Reserve System.) The need for emergency liquidity assistance in times of financial instability is just as strong, and arguably stronger, in emerging-market countries, in part because their less-developed financial markets, weaker institutions, and lack of easily available information often make these countries especially vulnerable to systemic risk. Such risk can be elevated and financial instability triggered by several factors: shocks related to weak domestic institutions and policies, swings in world commodity prices, contagion from other emerging markets, and turmoil originating in the industrial countries.[2]

Developing economies have made great strides over the past decade to improve economic fundamentals and policy-making, such as strengthening the independence and credibility of their central banks. Many of these countries have reaped the rewards of their labors during the most recent period of market turmoil, as volatility in their domestic financial markets was reasonably contained. However, room for improvement remains. As market participants have become more discriminating in recent years, emerging-market countries with weaker fundamentals and weaker institutions for the most part have been hit relatively harder. More broadly, these events should serve notice that no country is impervious to crises and that the need for a lender of last resort remains strong. To be clear, by lender of last resort, I mean short-term lending on good collateral to sound institutions, when financial markets temporarily seize up. I do not mean rescuing financial market participants from the consequences of their bad decisions by lending to unsound institutions with little capital, thereby postponing the recognition of insolvency.

Despite the need for a lender of last resort, central banks in emerging-market countries, unlike those in advanced countries, often cannot undertake this role. Many emerging-market countries have histories of high inflation and of large fiscal deficits that have generally been accommodated by the monetary authority. This legacy has led to a lack of confidence in the

[2] My views on the factors that produce systemic risk and financial instability are in Mishkin, Frederic S. (1997), "The causes and propagation of financial instability: Lessons for policymakers", in *Maintaining Financial Stability in a Global Economy*, pp. 55–96, Kansas City, MO, Federal Reserve Bank of Kansas City; and Mishkin, Frederic S. (2006), *The Next Great Globalization: How Disadvantaged Nations Can Harness Their Financial Systems to Get Rich*, Princeton, NJ, Princeton University Press. For a survey on contagion, see Kaminsky, Graciela L. *et al*. (2003), "The unholy trinity of financial contagion", *Journal of Economic Perspectives*, 17, pp. 51–74.

domestic currency, which makes emerging-market economies different from advanced economies in two ways. First, emerging-market economies often have much of their debt denominated in foreign currency. Second, the credibility of central banks in these countries to keep inflation under control is low. Accordingly, an injection of liquidity in the form of domestic currency can actually make the financial crisis worse by raising inflation fears and thus causing the domestic currency to depreciate. Given a debt structure characterized by liabilities denominated in foreign currency, this depreciation causes the domestic-currency value of the liabilities to rise, induces a deterioration of balance sheets, and thus causes a severe economic contraction. Moreover, a run on the domestic currency will likely be associated with a spike in nominal domestic-currency interest rates — just the opposite of what the injection of liquidity was intended to achieve — which will further damage economic prospects.

Therefore, if liquidity is to be provided during a financial crisis in an emerging-market economy, it generally should be in the form of foreign, not domestic, currency. But, if a domestic central bank lacks the foreign reserves to conduct emergency liquidity assistance in foreign currency to stop a financial crisis or promote a recovery when one occurs, can another institution come to the rescue? The answer is yes, and it is often best if the assistance comes not from within the country, but from without. Liquidity provided by foreign sources can help emerging-market countries cope with financial crises without many of the undesirable consequences that can result from the provision of domestic-currency liquidity by the domestic central bank. Properly managed, and in conjunction with steps to address the sources of the crisis, foreign liquidity assistance does not lead to increased inflation, higher interest rates, and an excessive depreciation of the domestic currency. Instead, it gives the government international reserves which can then be used to stabilize the value of the domestic currency and support domestic financial markets and institutions. Indeed, foreign liquidity assistance should also help lower interest rates (and thus improve firms' and households' cash flow). The resulting strengthening of domestic balance sheets helps undo the asymmetric information problems created by a financial crisis.

The need for providing liquidity has once again become the primary focus of governments around the world. Today, I would like to review the principles that should govern such lending and then examine some key issues concerning the activities of an international lender of last resort, including which institutions could play this role.

1. How Should a Lender of Last Resort Operate?

Our understanding of the sources of systemic risk immediately suggests three general principles for operating as an effective lender of last resort: (1) restore confidence in the financial system by quickly providing liquidity, (2) limit moral hazard by encouraging adequate prudential supervision, and (3) act as a lender of last resort infrequently.

1.1 *Restore confidence in the financial system by quickly providing liquidity*

When a systemic financial crisis occurs, the emergency lender's most crucial task is to restore confidence in the financial system. Without confidence, participants will pull out of financial markets, which will then be unable to channel funds to productive investment opportunities. Confidence is essential to an efficiently operating financial system, and it is also necessary for promoting recovery from, or forestalling, a financial crisis. Promoting and restoring confidence are easier said than done, however, and require several measures.

One such measure is to quickly provide ample liquidity so that markets can operate effectively. Speed is critical. Experience shows that the faster the lending, the lower the amount of lending necessary.[3]

To illustrate the benefits of acting quickly, I will use a canonical example, the Federal Reserve's operations in the aftermath of the stock market crash in October 1987. What is remarkable about this episode is that the Federal Reserve did not need to lend directly to the banks to encourage them to lend to the securities firms that needed funds to clear their customers' accounts. Because the Federal Reserve acted promptly (within a day) and reassured banks that the financial system would not seize up, banks knew that lending to securities firms would be profitable. They saw that making these loans immediately was in their interest, even if they did not borrow from the Federal Reserve. Banks thus began lending freely to securities firms, and, as a result, confidence was restored and the fear of crisis diminished almost immediately. The Federal Reserve did

[3] Mishkin, Frederic S. (1991), "Asymmetric information and financial crises: A historical perspective", in *Financial Markets and Financial Crises*, R. Glenn Hubbard (ed.), pp. 69–108, Chicago, University of Chicago Press.

not have to increase its lending to the banking system at all, and the actual amount of liquidity that it injected into the banking system through open-market operations in the immediate aftermath of the crash was around $12 billion, which at the time was notable but not exceptional. And the Federal Reserve was able to remove this liquidity almost immediately, within weeks of the crash.

The resolution of, and recovery from, a financial crisis require a restoration of the balance sheets of financial and nonfinancial firms. This restoration, in turn, requires several steps: the closing down of insolvent financial institutions, the injection of public funds so that healthy financial institutions can buy up the assets of insolvent institutions, and the establishment of a well-functioning bankruptcy law that enables the balance sheets of nonfinancial firms to be cleaned up quickly so that the firms can regain access to the credit markets.

Crucial to a country's successful resolution of a financial crisis is a commitment to necessary reforms and a refusal to go halfway. Allowing weak financial institutions or practices to continue may encourage excessive risk-taking because participants have little to lose. Because the continued presence of excessive risk diminishes confidence in the future health of the financial system, insolvent financial institutions must be shut down.

1.2 *Limit moral hazard by encouraging adequate prudential supervision*

The funds provided by lenders of last resort may be used indirectly to protect depositors and other creditors of banking institutions from losses. This safety net means that depositors and other creditors have little incentive to monitor these banking institutions and withdraw their deposits if the institutions are taking on too much risk. As a result, in the absence of a strong system of bank supervision, banking institutions are encouraged to take on exposures that heighten systemic risk.

To limit the moral hazard problem created by their acting as lenders of last resort, governments and institutions must make improved financial-sector supervision and regulation a high priority. The usual elements of a well-functioning prudential regulatory and supervisory system are adequate disclosure and capital requirements, limits on currency mismatch and connected lending, prompt corrective action, careful monitoring of

an institution's risk-management procedures, close supervision of financial institutions to enforce compliance with regulations, and sufficient resources and accountability for supervisors. Often, however, strong political forces resist putting these kinds of measures into place. This resistance has been a problem in industrialized countries (it was, for example, an important factor in the US savings and loan debacle of the 1980s),[4] but the problem is far worse in many emerging-market countries. The political will to adequately regulate and supervise financial institutions can be weak because powerful special interests have prevented such oversight and because the underlying legal and political framework has often been too frail to counteract the special interests.

Another important element of financial regulation is that the owners, if not also the managers, of insolvent institutions should suffer significant losses in the event of insolvency. In emerging-market countries (and sometimes in advanced countries, a prominent example of which is Japan during the 1990s), governments have often provided insolvent institutions with funds to keep them from failing and left the existing owners and managers in charge. Bailing out the owners and managers in this way worsens the moral hazard problem. Knowing that a bailout will occur, they have incentives to take on huge risks because they have so little to lose. Furthermore, in some cases, the owners and managers of these institutions have been able to take the rescue funds for their own personal gain and send them out of the country before the institutions fail.

1.3 *Act as a lender of last resort infrequently*

Besides encouraging and promoting the adoption of prudential regulatory and supervisory measures to limit moral hazard, governments and institutions should act as lenders of last resort only when absolutely necessary, as doing so involves a tradeoff between the benefit of preventing a financial crisis and the cost of the moral hazard it creates, which increases systemic risk. Recognizing that the decision to act as a lender of last resort is often very difficult, lenders should refrain from providing funds to markets or institutions not in crisis or to those that are truly

[4] For example, see Kane, Edward J. (1989), *The S&L Insurance Mess: How Did It Happen?*, Washington, DC, Urban Institute Press.

insolvent because of an unsustainable amount of debt.[5] Furthermore, once a crisis is over, the liquidity that has been injected into the financial system must be removed so that asset prices represent the appropriate market-determined value.

2. Current Challenges for an International Lender of Last Resort

As discussed earlier, for certain types of crises in emerging markets, an international lender of last resort is necessary. However, the dramatic improvement of the policy and financial environment around the world over the past several years has left many wondering whether such crises are things of the past. For emerging-market economies, the most prominent international institution to act as a lender of last resort has been the International Monetary Fund (IMF). However, demand for IMF lending has dropped more than 80 percent since 2005 as emergency lending has almost ceased and most borrowers have repaid their loans. Such developments have led some to speculate that an international lender of last resort is no longer needed.

However, it would be naïve to think that we will never again see situations where an international lender will be indispensable. The past few years have been unusual ones, providing ideal conditions for strong growth in emerging markets. In particular, growth in industrial countries has been solid, borrowing costs have been very low, and commodity prices have been high, not just for fuel but also for many of the primary metals and agricultural products that are produced in developing countries. Many countries have taken advantage of these developments to pay down debt and consolidate fiscal balances.

Nevertheless, concerns remain. Numerous economies are vulnerable to changes in commodity prices or slower world demand. This is particularly true for countries that have not improved their financial and regulatory infrastructure and that have adopted policies that stifle investment.

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[5] Goldstein, Morris (2005), "The international financial architecture", in *The United States and the World Economy: Foreign Economic Policy for the Next Decade*, C. Fred Bergston (ed.), pp. 373–407, Washington, DC, Institute for International Economics. Goldstein argues that surveillance by the International Monetary Fund needs to focus more on debt sustainability.

In some countries, corporate and household debt levels have increased greatly. For example, one troubling development in the past few years has been the sharp rise of home mortgage lending in foreign currencies, particularly in Eastern Europe. This development threatens to unwind the progress made in reducing currency mismatches by shifting the locus of the mismatch from the government or financial sector to the household sector, in which market participants are less well-equipped to understand the risks they are taking on.

And, more generally, we are increasingly realizing that globalization and the growth of markets have led to complex and occasionally surprising interconnections among markets and economies. Individual countries and regional institutions can track these developments to some extent, but the need to have institutions devoted to international monetary and financial stability on a *global* level has perhaps never been greater.

Given a need for lenders of last resort, the question remains: what institutions will best fill that role? The answer is that it is likely to be best filled by a combination of institutions. In some cases, as we have just seen, individual countries, particularly the large industrial countries, will be able to provide liquidity to markets that are domestically based but global in their linkages. To a much larger extent than in the recent past, countries are also working to insure themselves through the accumulation of foreign currency reserves. This past year, we have seen such reserves being used in the industrial and developing worlds to dampen volatility in exchange rates. Also, talk of regional arrangements such as the Chiang Mai Initiative for currency cooperation in Asia has been increasing. Finally, the IMF remains the premier institution overseeing international monetary and financial stability and crisis lending.

None of these options are perfect by themselves. Although central banks of large industrial countries have tremendous resources, their primary focus is domestic monetary policy and they have little mandate for involvement in crises without systemic implications for their countries. It is a positive development that countries with significant exposure to foreign currency risk are more and more able to insure themselves with reserves. However, there are costs associated with such reserve accumulation and there is also a danger that, under the guise of "insurance", countries will engage in activities — including intervention to keep their currencies weak — that are increasingly distorting global capital and trade

flows. In terms of regional arrangements, the trend toward rising international cooperation and coordination can have benefits. But regional institutions are typically small and untested, and so their actions may risk undermining more-global efforts. Moreover, their lending may violate the principles I discussed above. In many cases, the IMF is likely the best institution to provide liquidity — it has long experience in this role, significant expertise, and the ability to distribute funds quickly. However, IMF funds may be insufficient when the crisis countries, and associated capital markets, are large. In the mid-1990s, for example, the IMF worked in combination with other lenders in the cases of Korea and Mexico.

Regardless of the institution providing emergency liquidity, several challenges must be addressed if that function is to remain effective. One such challenge, which recalls principle number one for operating as a lender of last resort, is the growing need to respond quickly as financial crises evolve. As shown by the events of the past year, in a world of instantaneous communication and fully integrated financial markets, disruptions in such markets can materialize and spread very rapidly, thereby placing a premium on the ready analysis of developments and quick disbursement of funds. Moreover, an international lender of last resort will be challenged to substantively address liquidity problems in an environment in which gross international flows of capital are increasingly large and threaten to dwarf the resources that can be mustered by the international facility. In many cases, the IMF's funds will be sufficient — as of March 2008, the institution had almost $210 billion in resources available for new financial commitments in the coming year. But in cases involving the largest countries and capital markets, the IMF has played, and must continue to play, the role of coordinator of funds from a variety of sources or that of a catalyst to restore confidence (as in Brazil in 2002).

A second key challenge for an international lender of last resort remains the need to limit moral hazard by encouraging adequate prudential supervision — principle number two discussed earlier. To address this concern, the official international community has promoted such efforts as the establishment of the Financial Sector Assessment Program (FSAP), the preparation of Reports on the Observance of Standards and Codes (ROSCs), and the publication of Financial Soundness Indicators. In particular, the FSAP and ROSC initiatives, which are conducted jointly with the World Bank, consist of detailed public examinations of the financial sectors of member countries and of the countries' adherence to best

practices in data dissemination, policy transparency, legal systems, corporate governance, and in combating money laundering and terrorist financing. In combination with the FSAP, the ROSC program has greatly increased the pressure on emerging markets to adopt reforms to improve economic and financial stability and limit moral hazard. This surveillance should enhance the effectiveness of lending, regardless of which institution provides the emergency liquidity.

A third important challenge, reflecting principle number three for operating as an international lender of last resort, is to bolster the ability to say no to countries and, in cases of insolvency, to facilitate the involvement of governments and the private sector. Several years ago, the IMF adopted criteria that countries must meet to receive sizable loans. These criteria included rigorous analysis indicating that a country's financial difficulties reflected a crisis of liquidity rather than of solvency, a high likelihood of a quick return to borrowing from private markets, and a strong probability that the stabilization program would be successful. It is less clear what safeguards regional institutions are adopting to enable them to say no to members when the lending is not justified. Moreover, in countries where reserves are plentiful, it may tempting to lend to insolvent institutions and to avoid the difficult reforms necessary to address the underlying weaknesses.

Distinguishing between illiquidity and insolvency, though critical to being an effective lender of last resort, is exceedingly difficult. The difference hinges on many assumptions about future economic conditions, including global and domestic demand, interest rates, commodity prices, exchange rates, and so on, as well as the behavior of market participants, policy-makers, and consumers. Moreover the determination is not a static one. Institutions and markets that are initially illiquid can quickly become insolvent without the appropriate funds. The distinction may be even trickier in the case of sovereign insolvency. One could argue that governments have at their disposal an even greater range of possible policy responses to crises than do firms or markets, and so they face a greater range of potential outcomes.

Around the world, central bankers, market participants, academics, and the media have been wrestling with the question of what it means to be an effective lender of last resort. Appropriately providing liquidity while limiting the risk of moral hazard has always been a challenge. Within their own countries, policy-makers worldwide must wrestle with

the best way to design institutions and, in times of crisis, support the stability of financial systems, in both the short and long runs. This approach must also be taken internationally. We have been fortunate that global economic conditions have been strong. However, it would be a grave mistake to assume that the world no longer needs a lender of last resort. In addition to promoting vigilance and crisis prevention, we should continue to strengthen our international institutions to enable them to provide liquidity quickly, appropriately, and in a way that encourages reform and good policy-making.

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The Crisis of 2007: The Same Old Story, Only the Players Have Changed

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1. The Crisis

Recent financial instability triggered by the collapse of the US sub-prime mortgage market has many features with great resonance from financial history. The crisis occurred following two years of rising policy interest rates. Its causes include lax oversight and a relaxation of normal standards of prudent lending and a period of abnormally low interest rates. The default on a significant fraction of sub-prime mortgages has produced spillover effects around the world via the securitized mortgage derivatives into which these mortgages were bundled, to the balance sheets of hedge funds, investment banks and conduits (which are bank-owned but off their balance sheets) which intermediate between mortgage and other asset-backed commercial paper and long-term securities. The uncertainty about the value of the securities collateralized by these mortgages spread uncertainty about the value of commercial paper collateral, and uncertainty about the soundness of loans for leveraged buyouts. All this led to the freezing up of the interbank lending market in August 2007 and substantial liquidity injections by the ECB and the Federal Reserve.

1.1 *A historical perspective*

Many of the financial institutions and instruments caught up in the crisis are part of the centuries-old phenomenon of financial innovation. The new

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instruments often devised to avoid regulation, are then proved to be successful or not by the test of financial stress such as we have been recently encountering.

The rise and fall of financial institutions and instruments occurs as part of a longstanding pattern of booms and busts in the markets for equities, land, commodities, foreign exchange, and other assets. The cycle is financed by credit. Lending booms and busts and the credit cycle are also intimately connected to the business cycle.

A tradition in monetary economics which goes back to the 19th century, and in the 20th century was fostered by Wesley Mitchell (1913), Irving Fisher (1933), Hyman Minsky (1977), Charles Kindleberger (1978) and others, tells the tale of a business cycle upswing driven by what Fisher called a displacement (an exogenous event that provides new profitable opportunities for investment) leading to an investment boom financed by bank money (and accommodative monetary policy) and by new credit instruments — financial innovation.

The boom leads to a state of euphoria where investors have difficulty distinguishing sound from unsound prospects and where fraud can be rampant. It also can lead to a bubble characterized by asset prices rising independently from their fundamentals. The boom inevitably leads to a state of over-indebtedness, when agents have insufficient cash flow to service their liabilities. In such a situation, a crisis can be triggered by errors in judgment by debtors and creditors in an environment changing from monetary ease to monetary tightening. The crisis can lead to fire sales of assets, declining net worths, bankruptcies, bank failures, and an ensuing recession. A key dynamic in the crisis stressed by Mishkin (1997) is information asymmetry manifest in the spread between risky and safe securities, the consequences of which (adverse selection and moral hazard) are ignored in the boom and come into play with a vengeance in the bust.

Banks played a key role in the traditional story because bank credit in large part financed the boom, and the bust was often accompanied by bank failures and banking panics — events which inevitably made the downturn worse. This led to the traditional case for the monetary authority to act as a lender of last resort and provide liquidity at penalty rates to the money market and/or discount window lending to solvent but illiquid banks.

Countercyclical monetary policy is also an integral part of the boom–bust credit cycle. My research with David Wheelock of the St. Louis Fed, covering a century of US data for the US and nine other countries

(Bordo and Wheelock, 2007a,b), shows that stock market booms occur in environments of low inflation, rising real gross domestic product (GDP) growth, and low real policy interest rates. As the boom progresses and inflationary pressure builds up, central banks (before World War II, driven by the gold convertibility constraint) inevitably tighten their policy rates, helping to trigger the ensuing crash. The story is similar for housing booms and busts, but they follow a different cycle because of long gestation lags in construction and in the adjustment of prices to a collapse in demand (Leamer, 2007).

Stock market crashes can be serious events leading to a decline in wealth and in consumption and also a scramble for liquidity, in turn contributing to incipient banking crises. Housing busts also have serious consequences for the banking system via defaults on mortgages, and on the real economy via declining wealth on consumption expenditure, the collapse of residential investment, and a financial accelerator effect as net worths decline. The recent housing boom in the US likely was largely triggered by a long period of abnormally low interest rates, likely attributed to loose monetary policy from 2001 to 2004 in reaction to earlier financial turbulence and then fear of deflation and to a global savings glut (Bernanke, 2007). The bust was likely induced by a rise in rates in reaction to the inevitable inflationary pressure.

2. Descriptive Evidence: The Credit Cycle

Figure 1, based on ongoing research that I am doing with Joseph Haubrich of the Cleveland Fed, provides some background evidence for the US over the past century. The upper panel plots from 1953 to the present, the monthly spreads between the Baa corporate bond rate and the ten-year Treasury constant maturity bond rate. The spread, *inter alia*, represents a measure of the financial market's assessment of credit risk and also a measure of financial instability reflecting asymmetric information (Mishkin, 1991). Figure 2 takes a longer view and shows the data from 1921 to the present. Also displayed in both figures are National Bureau of Economic Research (NBER) recession dates and major financial market events including stock market crashes, financial crises, and some major political events that affected financial markets. The lower panels of Figures 1 and 2 show policy interest rates for the US — the federal funds rate since 1953 and the discount rate for the longer 20th century.

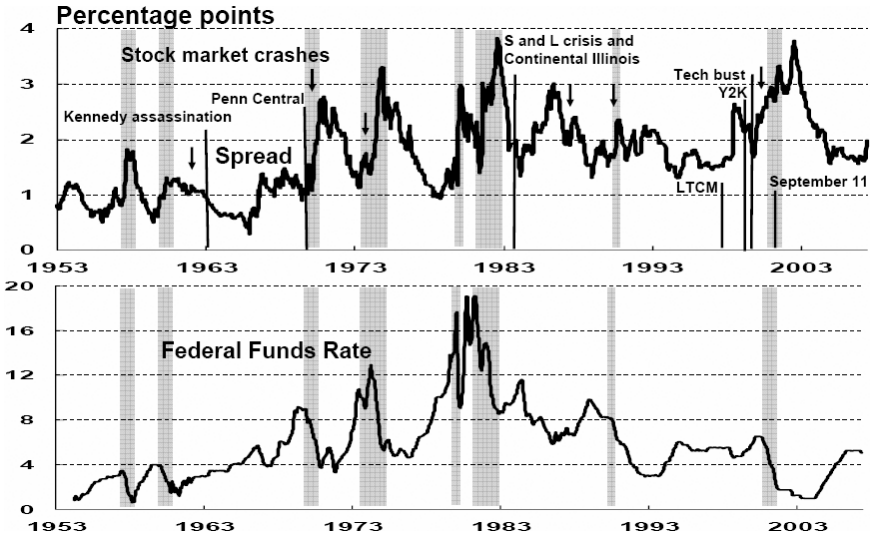

Figure 1. Federal funds rate and baa and 10-year TCM spread
Source: Federal Reserve Board and NBER.

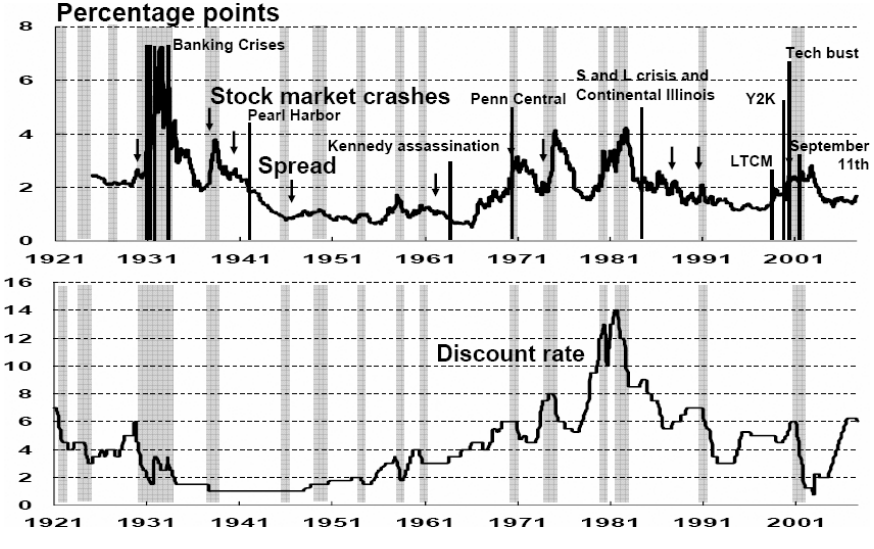

Figure 2. Discount rate and baa and composite treasury over 10 years spread
Source: Federal Reserve Board and NBER.

As can be seen, the peaks in the credit cycle (proxied by the spreads) are often lined up with the upper turning points in the NBER reference cycles. Also, many of the events, especially the stock market crashes and the banking crises of the 1930s, occur close to the peaks. Moreover, the lower panel often shows the policy rate peaking very close to or before the peaks of the credit cycle. Its movements roughly reflect the tightening of policy before the bust and loosening in reaction to the oncoming recession afterwards.

3. Descriptive Evidence: The Housing Market

We next focus more closely on the housing market, which is at the center of the current crisis and provides some evidence on the relationship between monetary policy, housing booms and busts and the business cycle. Figure 3 plots the Case–Shiller National Housing Price Index over the cycle and against the discount rate. The pattern suggests that housing prices tend to be procyclical and on occasion peak before the downturn, but, as argued by Leamer (2007), house prices react much more sluggishly in a bust than the stock of houses, as households are reluctant to cut prices. However, there is somewhat of a pattern linking a tightening of monetary

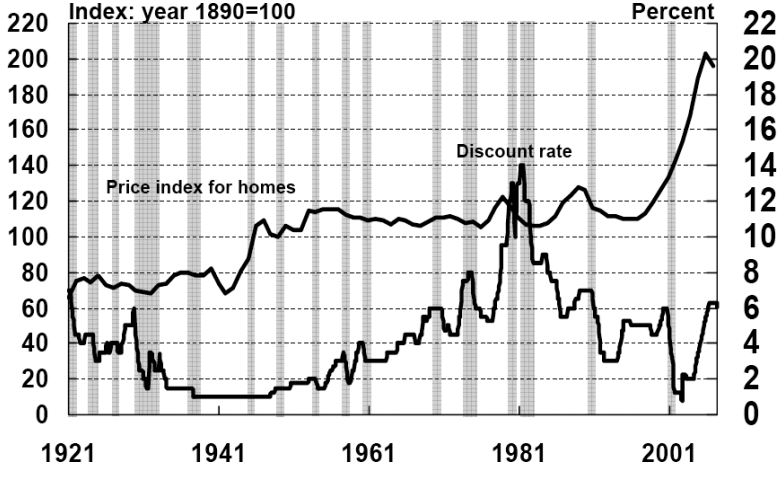

Figure 3. Real price index for homes
Source(s): *Irrational Exuberance*, Federal Reserve Board and NBER.

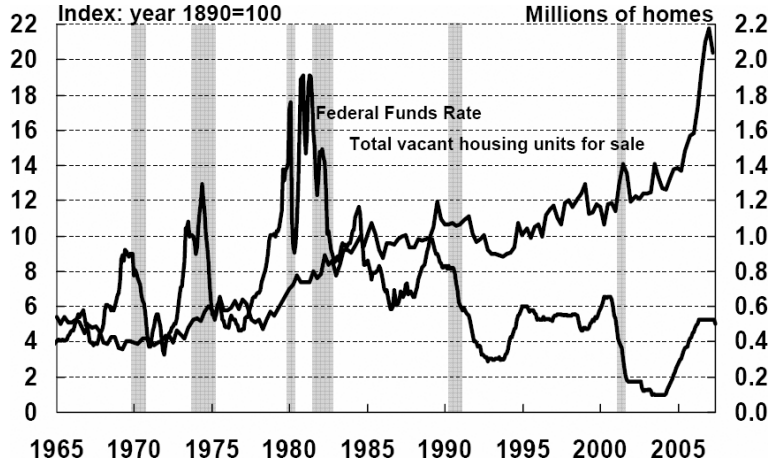

Figure 4. Total vacant housing units
Source(s): Bureau of the Census, NBER, and Federal Reserve Board.

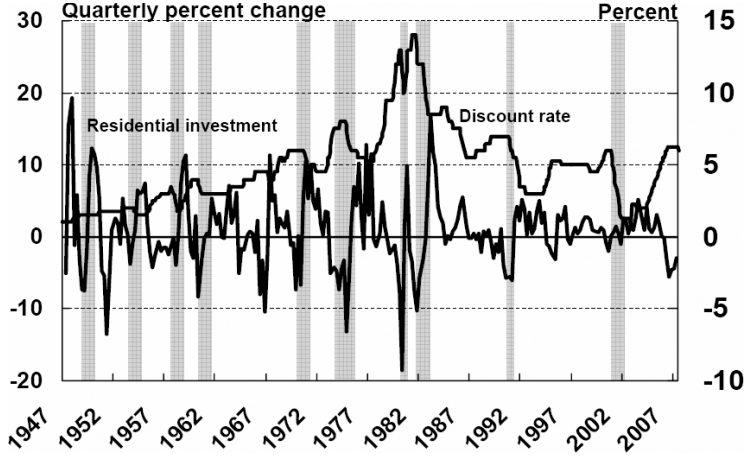

Figure 5. Residential investment
Source(s): Bureau of Economic Analysis, Federal Reserve Board.

policy to reversals in house prices. Figure 4, which plots total vacant housing units for sale and the federal funds rate from 1965, shows both a positive correlation between vacancies and recessions and an inverse relationship between vacancies and the funds rate. Finally, Figure 5, which

plots residential investment since 1947, shows a close correlation with the business cycle. Its cycle is also preceded by movements in the policy rate.

4. The Nonbank Financial Sector, Financial Innovation, and Financial Crises

The traditional financial crisis story depicts a shock to a major financial or nonfinancial firm, leading to a banking panic as depositors attempt to convert their deposits into currency. More recently, especially since the advent of deposit insurance, the source of the pressure has come from the asset side rather than the liability side of the bank's balance sheet. Examples include the Penn Central episode in 1970 when the collapse of the railroad led to a panic in the commercial paper market which, in turn, led, like today, to concern by the Fed that it would spill over into the banking system. This led the New York Fed to open the discount window to the money center banks to assist them to freely discount to nonfinancial firms based on the collateral of sound commercial paper; the Latin American debt default of 1982, when many money center banks became close to insolvent until a massive rescue was engineered between the Fed and the International Monetary Fund; and the collapse of the hedge fund Long-Term Capital Management (LTCM) in 1998, which also was perceived to be a threat to the banking system. LTCM was rescued by a lifeboat operation by the New York banks orchestrated by the New York Fed. A historical precedent was a crisis in 1763 in the market for bills of exchange that spread from Amsterdam to Hamburg and which, like LTCM, led to a liquidity crisis but in which, unlike LTCM, the crisis led to the failure of the principal player and many others (Schnabel and Shin, 2001). In each case, the crisis broke in the nonbank financial sector but spilled over or threatened to spill over onto the banks who were the ultimate creditors.

Many of the financial crises of the past involved financial innovation which increased leverage. The 1763 crisis was centered on the market for bills of exchange, Penn Central on the newly revived (in the 1960s) commercial paper market, the savings and loan crisis of the early 1980s on the junk bond market, and LTCM on derivatives and hedge funds.

In the current episode, the financial innovation derived from the securitization of sub-prime mortgages and other loans has shifted risk away from the originating bank onto mortgage and other asset-backed securities which bundle the risk of less stellar borrowers with more creditworthy

ones and which were certified by the credit rating agencies as prime. These have been absorbed by hedge funds in the US and abroad, by offshore banks, and in the asset-backed commercial paper of the commercial and investment banks. As Rajan (2005) argued, shifting the risk away from banks, which have incentives to monitor their borrowers, to hedge funds and other institutions, which do not, rather than reducing overall systemic risk increased it by raising the risk of a much more widespread meltdown in the event of a tail event, as we are currently witnessing.

As the recent crisis has demonstrated, the decline in the value of subprime mortgage paper in the US, in addition to drastically reducing the value of some hedge funds, has also put pressure on the banking system, which has been revealed as the ultimate creditor of the nonbank financial sector.

5. International Spillovers

Financial crises have always had an international dimension as Morgenstern (1959), Kindleberger (1978), and Bordo (1986) have shown. Contagion spreads quickly through asset markets, through international banking, and through the monetary standard. Stock market crashes and banking panics often have occurred in many countries within a few months of the original shock. A classic example is the Baring crisis of 1890 which started in Argentina and affected the rest of Latin America and other emerging countries of the time. It was triggered by central bank tightening in England, France, and Germany. This led to a series of sudden stops and current account reversals (Bordo, 2006) in the emerging countries and a number of banking crises and debt defaults. These events were echoed in the late 1990s (see Calvo and Talvi, 2005).

The current crisis has been contained, so far, to the advanced countries among which contagion has been spread by the holding of opaque sub-prime mortgage derivatives in diverse banks in Europe and in other countries, and by the seizing up of the asset-backed (mortgage) commercial paper market. The emerging countries have so far avoided the crisis, perhaps because of the precautionary measures many have taken in reaction to their meltdowns in the Asian crisis of 1997 (for example, the build-up of large foreign exchange reserves and reduced exposure to foreign borrowing). If the credit crunch continues and the housing bust plays out into recession in the US, then the mergers that are exposed to foreign

capital will be affected as well as countries relying for their growth on exports to the US.

6. Policy Lessons

A number of lessons can be drawn from this historical perspective. First are the implications for crisis management and the role of the lender of last resort. The distinction made by Schwartz (1986) between real and pseudo financial crises, and its extension by Bordo, Mizrach and Schwartz (1995) to systemic risk, has resonance for the recent crisis events. Schwartz argued that a real financial crisis involves a scramble for high-powered money by the public fearful for the safety of their bank deposits, that is, a banking panic or a threat to the payments system. Pseudo crises encompass "a decline in asset prices of equity stocks, real estate, commodities; depreciation of the exchange value of a national currency; financial distress of a large nonfinancial firm, a large municipality, a financial industry, or sovereign debtors …" Schwartz (1986, p. 12). In the case of a real crisis, the monetary authority should act as a lender of last resort and provide whatever liquidity is required to allay the public's fears. In the case of a pseudo crisis, there is no need for action.

In this framework, the recent events of a collapse in the US housing market, and its consequences for wealth holders directly or indirectly exposed by derivatives, represents a pseudo crisis which should not be the object of central bank intervention. However, the spillovers of the subprime crisis into the interbank loan market and the freezing up of liquidity to the banking system in Europe and America did pose the threat of a real financial crisis and should have been dealt with by following the strictures of Thornton (1802) and Bagehot (1873) to lend freely but at a penalty rate. Bagehot placed primary emphasis on the Bank of England lending without hesitation on the basis of collateral that would be sound in the absence of a crisis. The penalty rate was to prevent moral hazard.

The actions of the European Central Bank of flooding the money market with liquidity and the Fed of following similar actions and also reducing the discount rate by 50 basis points in August 2007 suggest that they heeded the first part of Bagehot's lesson to lend freely on the basis of proffered collateral, but not quite on the second part of lending at a penalty rate. The Bank of England until mid-September 2007 followed a strict interpretation of Bagehot by keeping its discount window open to all

comers but at a penalty rate (although the run on Northern Rock on September 14, which led to a large infusion of central bank liquidity and the announcement of a complete guarantee of all UK bank deposits, very likely reflect not the failure of the Bank's lender of last resort policy but perceived inadequacies in the UK's provision of deposit insurance, the ill-thought-out separation of financial supervision and regulation from the central bank and political pressure).

The second lesson concerns the role of monetary policy in housing and other asset busts. The traditional view of monetary policy suggests that if the safety of the banking system is actually threatened by the consequences of a housing bust, then the Fed should depart from its perceived mandate of maintaining price stability (targeting inflation) and providing liquidity to the financial system (Bernanke and Gertler, 2001). Moreover, if the collapse of housing could precipitate or exacerbate a recession, then according to this view, the policy to follow is countercyclical easing. This seems to be the policy which the Fed, by cutting the federal funds rate by 50 basis points on September 18, 2007, is pursuing.

A third lesson concerns whether the Fed should follow the reactive policy to asset booms that it now does or follow a preemptive policy. The traditional view of monetary policy argues that central banks should act reactively and deal with the consequences for the financial system of an asset price boom after it has burst (Bernanke and Gertler, 2001). An alternative view argues that if an asset bubble (for example, housing) is on the horizon, then the Fed should act preemptively to defuse it (Cecchetti, 2000). Bordo and Jeanne (2002) consider a circumstance in which the use of preemptive policy against the occurrence of a low probability event, which can have catastrophic consequences, such as a national housing bust, can be welfare-improving.

Finally, we speculate on whether the recent financial crisis could have been avoided if the Fed had not provided as much liquidity as it did from 2001 to 2004. After the year 2000 (Y2K) when no financial crisis occurred, it promptly withdrew the massive infusion of liquidity it had provided. By contrast, thereafter it foresaw a series of shocks to the economy that might lead to financial crisis, for example, the tech bust of 2001 and the events of September 11, 2001. In each case it injected liquidity, but when no financial crisis occurred, it permitted the additional funds it had provided to remain in the money market. In addition, it overreacted to the threat of deflation in 2003–2004, which may have been of the good (productivity-driven) variety rather than of the bad (recessionary) variety (Bordo and Filardo, 2005).

If consequent upon these events the markets had not been infused with liquidity as much as they were and for so long, then interest rates would not have been as low in recent years as they were and the housing boom which has just bust may not have expanded as much as it did. Evidence for this perspective by Taylor (2007) suggests that interest rates in this period were on average considerably lower than would be the case based on his famous rule.

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II. CURRENT STATE OF FINANCIAL GLOBALIZATION

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Financial Globalization and Stability

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1. Introduction

Globalization has profound implications for the economies of most countries around the world. International financial integration or financial globalization is a particularly important part of the process for at least two reasons. First, globalization of financial activities tends to proceed even faster than the case for most other economic activities. Second, financial globalization affects the efficiency and stability of financial sectors, which exert significant influences on general economic performance.

Cross-border financial activities have increased tremendously over the last decades. External assets and liabilities of industrial countries (as a percentage of GDP), for example, are nowadays about six times larger than the case in the 1970s. This development has fostered debates in policy and research circles on a number of issues. First, does international financial integration contribute to financial instability and crises? Second, can

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it disturb macroeconomic management, such as monetary, exchange rate and fiscal policies? Third, has it measurable benefits in terms of productivity and growth for the countries that open their borders? Fourth, should capital account liberalization be a statutory objective of the International Monetary Fund (IMF)? This paper addresses some of these issues, with a particular focus on financial stability.

This paper documents and discusses the process and current state of financial globalization and analyzes the impact it has on financial stability. The second section extensively documents and discusses some main features of the current state and process of financial integration. It includes discussions about various indicators of financial integration, differences between industrial and developing countries, asset return correlations as well as the direction and composition of capital flows. Section 3 addresses a major economic implication of this process, namely its effects on financial stability. The first subsection discusses the stabilizing implications of financial integration. In particular, it points out the improved risk-sharing capacities provided by improved cross-border investment opportunities. The second subsection discusses the risk of contagion and how it is affected by financial globalization. These subsections include a review of the main theoretical arguments and of the empirical literature as well as a regression analysis about how the costs of banking crises relate to the financial openness of countries. Section 4 concludes.

2. Current State of Financial Globalization

In the last three decades, the global financial system has undergone a remarkable integration process. In relation to GDP, the sum of foreign assets and liabilities has more than tripled in advanced economies, as the black solid line in Figure 1 indicates. While the financial systems of the developed countries became more internationally integrated since the early 1970s, financial globalization gained substantially in momentum in the late 1990s.

This tendency does not only reflect the fact that the overall openness of the major industrial countries in general improved. As the light grey line in Figure 1 indicates, the speed of financial integration is almost similarly pronounced if one relates it to real economic integration, that is, if one looks at the ratio of the sum of foreign assets and liabilities to the sum of exports and imports of those countries. Thus, the accelerated financial

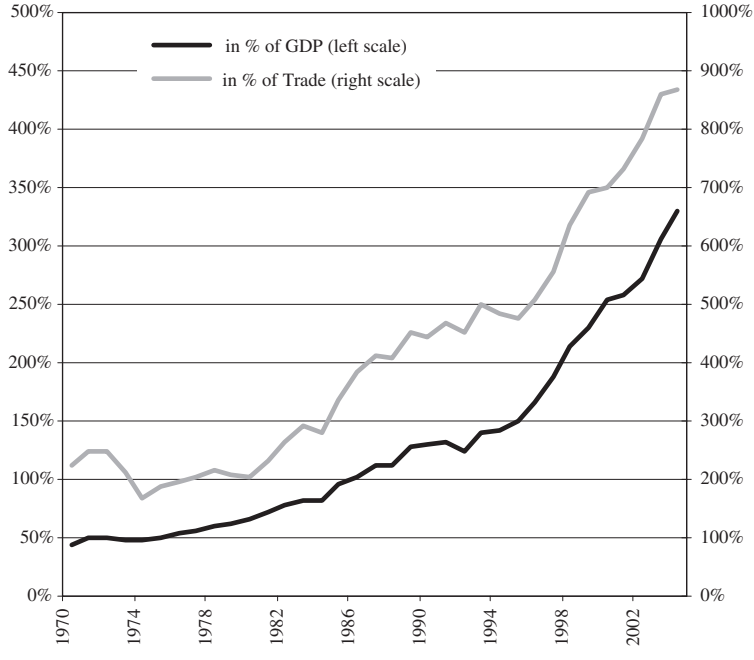

Figure 1. Total external position of advanced countries
Source: Reproduced from Lane and Milesi-Ferretti (2007, p. 13).

integration in those countries is not only a mere reflection of an increased international trade.

However, as Figures 1 and 2 also point out, financial integration of emerging and developing countries could not keep up with the pace of financial integration in advanced economies. Nevertheless, those countries' financial systems are nowadays also more integrated into the global financial system than at the beginning of the 1980s. But the dynamics of the financial integration process in emerging and developing countries does not exceed the real integration process, as reflected by good trade.

Fostered financial integration as indicated by these measures does not point to an increased importance of capital imports and/or capital exports. Especially in Organization for Economic Cooperation and Development (OECD) countries, financial integration has been characterized by a two-way asset trade. Thus, countries have accumulated assets *and* liabilities *vis-à-vis* other countries as a means to diversify internationally. The net external capital account position relative to gross domestic product (GDP)

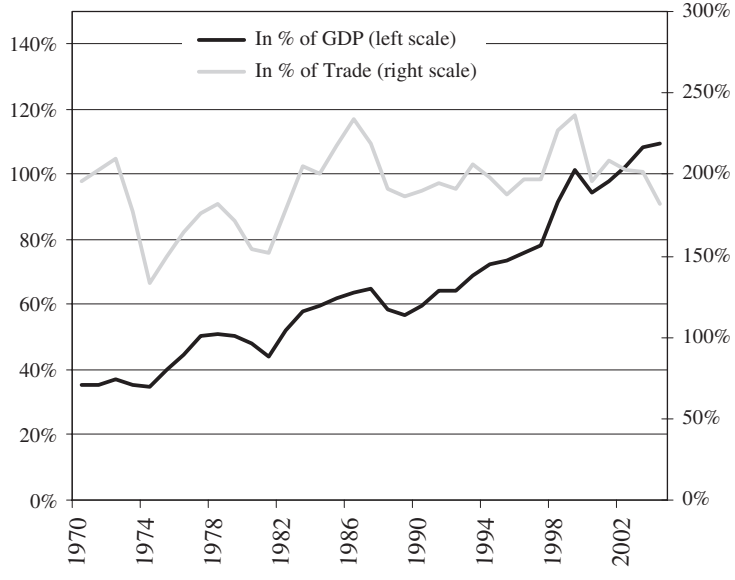

Figure 2. Total external position of emerging and developing countries
Source: Reproduced from Lane and Milesi-Ferretti (2007, p. 14).

was in 2004 comparatively small in advanced economies. For middle- and low-income countries, capital imports have been more important relative to international portfolio diversification than in advanced economies. As Table 1 shows, in those countries the net external liabilities are substantially larger relative to GDP and account for a larger fraction of the gross assets and liabilities. However, emerging markets and developing economies have substantially reduced their net foreign liabilities since the Asian crisis in the late 1990s and became net exporters of capital, while at the same time the US increased substantially its capital imports leading to an aggregate net foreign liability position of OECD countries.

Furthermore, Table 1 also reports the Gruber–Loyd Index (GLI), which sets the net external asset position in perspective to the sum of gross external assets and liabilities. A GLI close to 100 indicates that financial integration did not lead to an import or export of capital but rather contributed to a larger diversification in the form of two-way asset trades. Thus, for OECD countries this index suggests that financial integration was almost entirely driven by diversification motives, whereas in other countries also net capital flows contributed to financial globalization.

Table 1.

	External Position		GLI
	Gross	**Net**	
High Income	531.5	44.7	92
OECD	462.1	–13.5	97
Non-OECD	664.5	156.4	76
Middle Income	151.3	–45.8	70
Low Income	119.3	–49.3	59

Source: Reproduced from IMF (2007a, p. 9).
Note: Unweighted averages for each subgroup. A country's gross external position is defined as the sum of external assets (A) and liabilities (L) relative to GDP; the net external position is defined as (A-L)/GDP. The Grubel–Loyd Index (GLI), which indicates the fraction of a country's gross external assets and liabilities that constitutes two-way (Obstfeld, 2004), is defined as 1-|A-L|/(A+L).

A major reason for why two-way asset trades or portfolio diversification motives are less important in emerging market and developing economies and why financial integration has proceeded slower in these countries is the less developed financial system of these economies. Demirgüc-Kunt and Levine (2001) find that banks' assets as well as claims of other financial institutions on the private sector significantly increase with the per-capita GDP in a cross-country comparison. Indeed, bank assets relative the GDP are on average about twice as large in OECD countries than in those emerging markets that are covered in their Financial Structure database.

The fact that indeed financial intermediaries were the main drivers of financial integration can be seen from the Bank for International Settlements (BIS) "locational" banking statistic. The black line in Figure 3 gives the development of the banks' external assets and liabilities in the countries reporting to this statistic, which are predominantly OECD countries. The development indicates that banks indeed had a major stake in the financial integration process. Since the late 1990s, banks' external position increased by an average annual growth rate of more than 10 percent. As Figure 3 also shows, banks' accelerated cross-border activity was mainly focused in cross-border interbank relations. The increase in banks' external interbank assets and liabilities contributed substantially to the financial integration of banks. In particular, interbank debt was used for investments

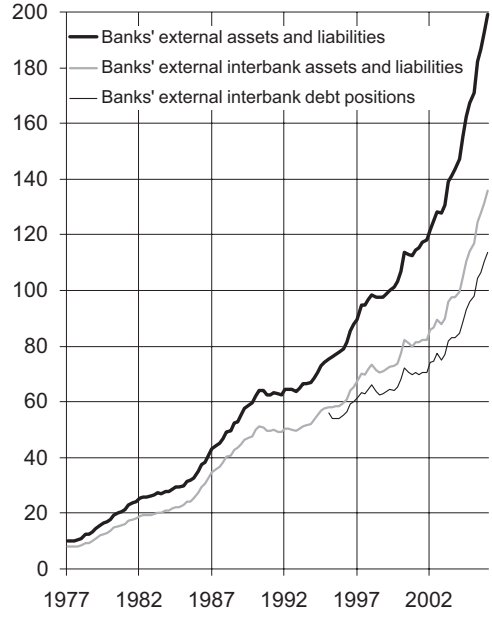

Figure 3.

abroad. All in all, this suggests that financial integration was driven by an extension of intermediation chains across borders.

However, the relative importance of interbank debt and interbank claims in general for banks' cross-border activity has declined. The light line in Figure 4 represents the fraction of external interbank debt in the total cross-border interbank position. It continuously declined since the mid-1990s. Similarly, the fraction of external interbank position in banks' total external position decreased since the early 1990s. This suggests that banks increasingly invested directly abroad or used other financial intermediaries for their cross-border activities.

But more importantly, at the same time also the ratio of banks' external assets and liabilities to the respective countries' overall external position declined, which can be seen from the dotted line in Figure 4. Thus, either investors increasingly held foreign securities directly or other intermediaries gained importance in the financial integration process.

In sum, financial globalization seems to be also a reflection of the extension of intermediations chains in the global financial systems.

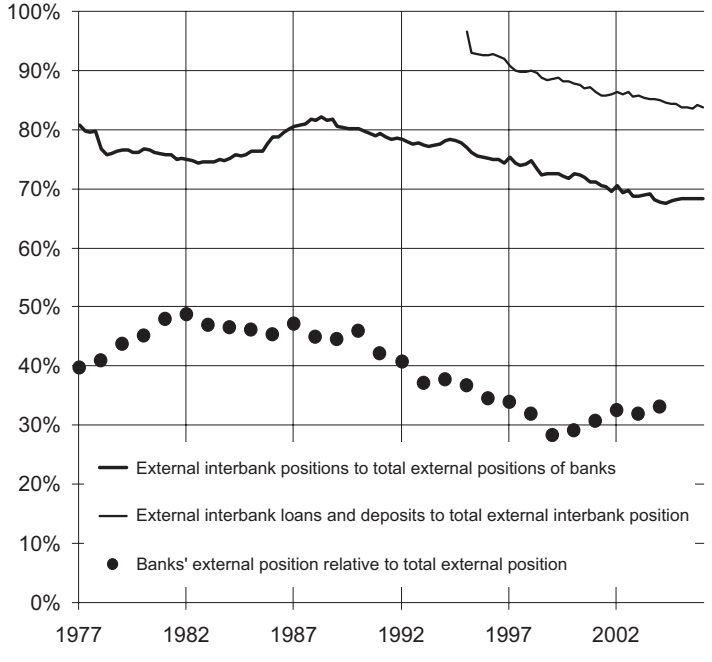

Figure 4.

The increase in banks' external positions and particularly the cross-border interbank claims has substantially contributed to financial globalization. Thus, banks and in particular interbank relations have played a key role in financial globalization, at least in advanced economies. But nevertheless, banks' overall fraction in the external position and in particular those of external interbank positions has steadily declined in advanced economies.

Assessing the current state of financial globalization with quantity-based measures, however, requires a word of caution. Given that financial integration fosters cross-border capital flows, these flows should lead to stronger international co-movement of asset prices. Factors affecting domestic savings and thus domestic capital supply should have less impact on prices in national asset market. Furthermore, domestic financial markets become deeper, reducing the impact of idiosyncratic fire-sales in domestic asset markets. However, a greater co-movement of asset prices reduces the benefits in terms of risk-sharing from an internationally diversified portfolio, diminishing the incentives to hold external assets from an

individual country's perspective. Thus, financial integration does not necessarily need to be associated with larger holdings of gross external assets and liabilities. At the same time, though, large stocks of external assets and liabilities reflect large past gross capital flows across borders, indicating a relatively integrated international financial system. Consequently, while a speedy growth of external assets and liabilities to GDP holdings provides evidence for proceeding financial globalization, a sluggish development of these quantity-based measures is not necessarily indicating an absence of financial integration. In other words, quantity-based measures can only provide evidence *for* financial globalization; they cannot indicate a lack of it. Hence, when assessing the progress in global financial integration, one should also take other than quantity-based measures into account.

An alternative approach to assess the degree of financial integration uses price-based measures. The idea is that assets that generate the same contingent cash flow should be traded at the same price, irrespective of the residence of the issuer and of the holder of the asset. The problem with this approach is to find assets that have the same cash flow and risk characteristics and are traded in a range of countries, or alternatively, to control for the impact of different risks on the pricing of similar assets. This is particularly true if one wants to assess the state of financial globalization and therefore has to cover very different countries with very different financial systems and very different exchange rate regimes.

A recent study by Bekaert, Hodrick and Zhang (2005) examines in a factor model the co-movement of international stock returns. Their analysis is restricted to OECD countries only plus Hong Kong and Singapore. Figure 5 shows the development of the return correlation of different country portfolios. Specifically, return correlations between countries are reported for portfolios of specific industries and of specific styles, that is, firm characteristics (size and book-to-market ratio). As can be seen from the figure, the co-movement of stock returns has generally not increased significantly from January 1980 to December 2003.

However, for European stock markets, they report an upward trend in return correlations in this period. This view is also supported by the ECB (2007). In its report on Financial Integration in Europe, the European Central Bank (ECB) shows that the return variance in the equity markets of the different European Monetary Union (EMU) countries can be more and more explained by a Euro area-wide factor (see Figure 6). However,

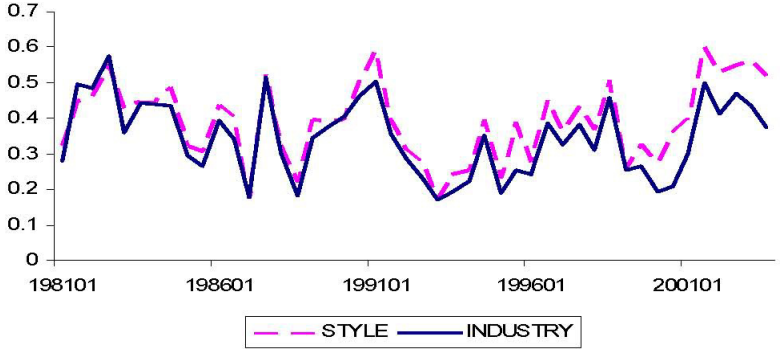

Figure 5.
Source: Reproduced from Bekaert *et al.* (2005).

Figure 6.
Source: Thomson Financial Datastream and ECB calculations. [Reproduced from ECB (2007).]
Note: The first column shows the unweighted average of the relative importance of US equity market fluctuations for the variance of Euro area equity market returns. For each period, the second column shows the unweighted average of the relative importance of Euro area-wide factors, other than US equity market fluctuations, in the variance of individual Euro area countries' equity market returns ("variance ratio").

the ECB also finds that the explanatory power of US equity market fluctuations for EMU countries' equity return has modestly increased, suggesting that not only European financial integration has proceeded but that the integration of EMU and US equity markets also increased.

Furthermore, for emerging markets, Bekaert and Harvey (2000) find in a cross-sectional time-series model a moderate increase in the correlation of emerging markets and world stock market returns.

In general, co-movements of asset prices also have to be interpreted with caution when assessing financial integration as this increase in correlations can also result from greater correlations of cash flows, for example, due to greater economic integration. Moreover, given the difficulties in controlling for differences in risk characteristics, price-based indicators may be more valuable for measuring trends in financial integration. They probably cannot indicate whether financial systems are fully integrated or not. Similarly, quantity-based indicators may not allow us to assess the absolute level of financial integration. Thus, in order to assess whether there are political factors still restricting international financial integration or whether all legal restrictions to the capital account are abandoned by one country, it is possible to also look at *de jure* measures of financial integration.

Figure 7 shows for different groups of countries the development of a *de jure* index of capital account restrictiveness, which summarizes the legal restrictions on cross-border capital transactions using different financial products. An index value of 1 indicates no legal restrictions on any cross-border financial transactions, and 0 is reported if all cross-border capital movements are prohibited. Apparently, formal capital account restrictions are by now widely abandoned in advanced economies. Here, remaining capital controls were removed in the first half of the 1990s. In contrast, for emerging markets, this *de jure* indicator suggests that formal capital controls are still kept in place and are more or less still as restrictive as they were in the 1970s. For other developing countries, this measure only indicates a moderate opening of capital accounts at the end of the 1990s.

Consequently, while the *de facto* measure (the sum of external asset and liabilities over GDP) indicates that also emerging and developing countries at least to some extent participated in the trend towards financial globalization, the *de jure* measure does not give the same picture. This suggests that although legally still present, available capital account controls were or could no longer be enforced in the late 1990s.[1] However, to the extent that they still "bite", at least in the short run, they are at the disposal of local governments imposing a political risk that might affect international capital inflows.[2]

[1] See Reinhart and Rogoff (2004) for a broad discussion of these issues.

[2] Stulz (2005) presents a model that is related to this argument.

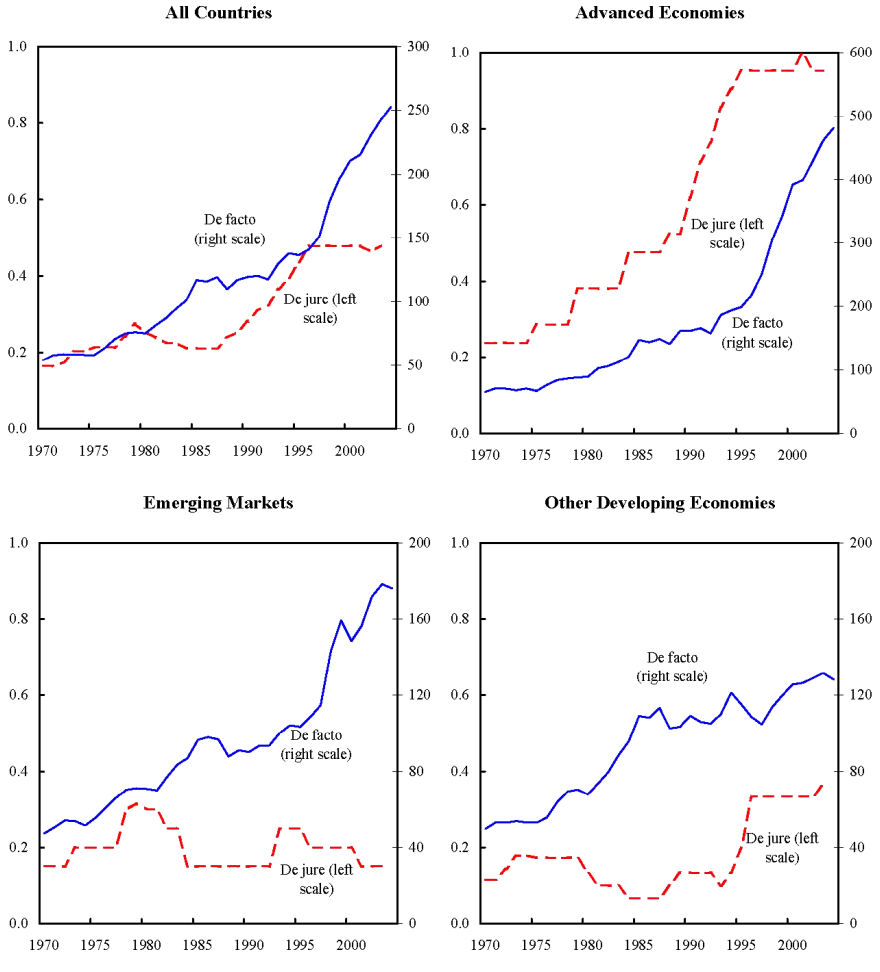

Figure 7.

Source: Reproduced from Kose *et al*. (2006, p. 77).

Note: This figure shows unweighted cross-country averages, within each group, of two measures of capital account openness. The *de jure* measure is based on the IMF 0-1 capital account restrictiveness classification, with 1 representing countries that have open capital accounts. The *de facto* measure is based on the ratio of gross stocks of foreign and liabilities to GDP, with the raw data taken from Lane and Milesi-Ferretti (2007).

3. Implications for Financial Stability

The merits of having capital flow freely across borders have for many years been subject to an active and sometimes polemical debate. At one extreme, it is argued that the free flow of capital helps countries to insure against macroeconomic fluctuations, to transfer technologies and to finance economic development (see, for example, Fischer, 1998; Summers, 2000). At the other extreme, some maintain that the free flow of capital exposes countries to financial crises and causes polarization where developed countries grow and developing countries become even poorer (see, for example, Bhagwati, 1998; Rodrik, 1998; Stiglitz, 2000).

In theory, the implications of financial integration for the resilience of domestic financial system are ambiguous. On the one hand, the improved risk-sharing options due to financial integration contribute to a more resilient financial sector. In an integrated financial system, investors have a larger variety of assets to invest at their disposal. They can better diversify and reduce their exposure to individual regional risks. The stake each individual investor has to bear in the overall costs of an adverse regional shock declines, making it more likely that regional shocks can be sustained without inducing the failure of any major market participants. At the same time, financial integration also contributes to deeper financial markets, diminishing the price impact of fire-sales of a given size. Furthermore, this should lead to greater liquidity, improved information acquisition and stronger competition between market participants, contributing to a more efficient pricing of financial instruments. Thus, from this perspective, adverse shocks to prices in individual financial markets should abate as financial integration proceeds, and the impact of these shocks on the stability of financial institutions should also decline.

On the other hand, increased financial integration may also bring about that adverse shocks abroad have stronger effects on the domestic financial system. For example, the price impact of fire-sales is limited in a foreign financial market because funds are withdrawn from the domestic financial market and invested abroad. This reduces the demand for domestic assets, leading to a correlated price decline in the domestic and foreign financial market. Similarly, domestic financial institutions that incurred a loss abroad are likely to reduce their risk exposure at home as well as abroad, contributing to a greater co-movement of the risk premium in both financial markets.

3.1 *Stabilizing effects from improved risk-sharing*

The main channel through which financial liberalization and integration could provide welfare benefits and improve the resilience of the global financial systems is risk-sharing. From a macroeconomic perspective, the issue is whether better integrated countries exhibit less volatile and more aligned consumption growth patterns (consumption risk-sharing) or less volatile and more aligned GDP growth (income risk-sharing). Theoretically, the effect of international financial integration on GDP growth volatility or correlations is ambiguous, as it could lead to diversification in the production structures of very small developed countries or to more specialization of production for advanced countries. When it leads to risk-sharing, however, consumption growth volatility and correlations should really decrease, and so should the ratio of consumption growth volatility over output growth volatility.

Kose, Prasad and Terrones (2006) have argued that the latter is only the case for countries above a certain threshold of financial openness (roughly emerging market economies and industrial countries). Bekaert, Harvey and Lundblad (2006) find with their measures of equity market liberalization and capital account openness that, on average, both consumption growth volatility and the ratio of consumption growth volatility over output growth volatility decline, even for a wider set of countries. Similarly, Sorensen, Wu, Yosha and Zhu (2007) estimate that increases of foreign asset holdings or reductions in equity home biases go hand-in-hand with some greater consumption risk-sharing, although the effect is weaker than for income risk-sharing. Whereas Buch, Doepke and Pierdzioch (2005) find the relationship between financial openness and output volatility to be time-varying and dependent on the nature of shocks, Sorensen *et al*. (2007) estimate a strong reductionary effect of greater financial openness and smaller home bias on their measure of income risk-sharing based on the differences between GDP and gross national product (GNP). Morgan, Rime and Strahan (2004) estimate that banking integration across US states reduced and aligned state-level business cycles, as measured by gross state product, employment and personal income growth. Overall, the risk-sharing literature also tends increasingly to point towards beneficial effects of financial globalization, in particular higher income countries and countries whose financial opening is already at an advanced stage.

Summing up, financial integration allows for better income and consumption risk-sharing, so that consumers can smooth their consumption

better over time. Industrial countries tend to reap those benefits from *de facto* financial integration and openness of capital accounts. The same tends to be true for emerging markets with sound macroeconomic policies, advanced domestic financial development and good economic institutions, high human capital and already quite open capital accounts. For countries, however, which are below relatively high thresholds for those variables, that is, many or most emerging markets and developing countries, the situation is not clear-cut. Many of them may not benefit from financial integration in these ways, as they are characterized by information problems and domestic political distortions (Eichengreen *et al*., 1998). For emerging market economies and developing countries, the opening and liberalization process should be subject to a number of conditions with respect to their level of financial and economic development and the soundness of their macroeconomic policy set-up. In other words, in these countries, the sequencing of different policy actions is of the essence. A discussion of the criteria for the right sequencing, however, is beyond the scope of the present paper. But what about the direct financial stability effects of financial globalization, which are related to but distinct from the implications for macroeconomic aggregates discussed above?

Taking a micro perspective, the International Monetary Fund (IMF, 2007b, Chapter III) in its recent *Global Financial Stability Report* studies the diversification benefits of large, internationally active banks. For a sample of large Asian, European and US banks, the study assesses the effect of international diversification on banks' riskiness and profitability. In detail, as a market-based measure of banks' profitability, the risk-adjusted return on equity is used. Furthermore, as an accounting-based measure of the banks' riskiness, the *z*-score sets the equity ratio plus the return on asset in relation to the standard deviation of the return on assets. As a measure for the default risk, the study uses the distance to default, the standard deviations that the value of the assets at maturity deviates from the repayment obligations on the liability. In addition, the difference between the Tobin's Q for the international bank as a whole and the Tobin's Q for the different national entities of the bank is incorporated. The study then regresses these measures of banks' individual risk and performance separately on the international diversification of the banks' loan portfolio and of the banks' returns, respectively. The degree of international diversification is measured with the Herfindahl index of the international loan portfolio and of the international returns with a low index indicating a high level of diversification. Figure 8, which is based on work done by IMF staff Andrea Maechler, gives the plots of the different regressions and

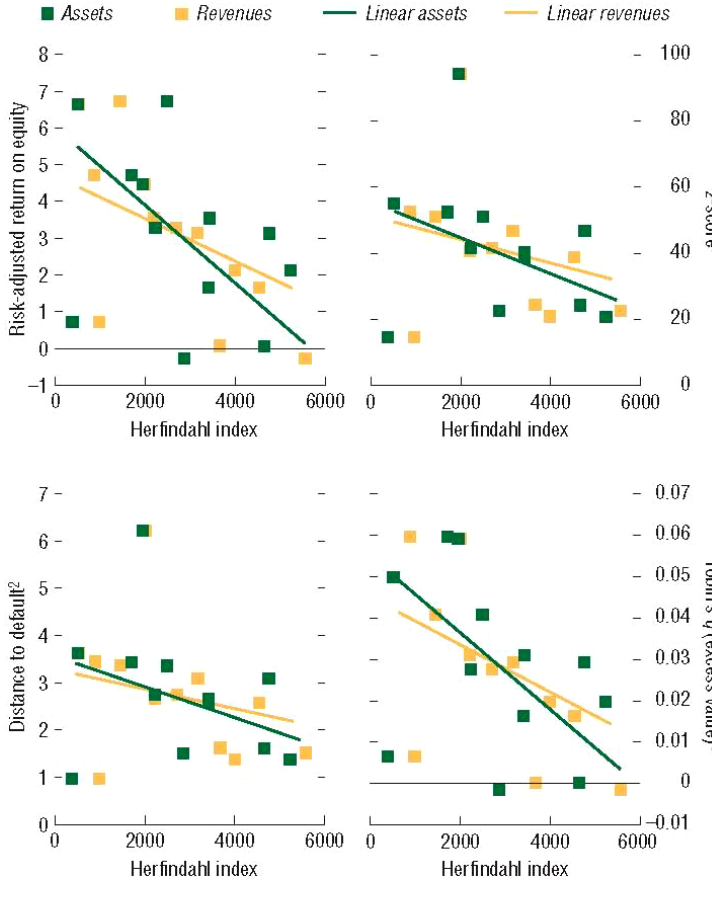

Figure 8.

Source: © 2003 Bureau van Dijk Electronic Publishing-Bankscope; Thompson ONE Banker; and IMF staff calculations. [Reproduced from IMF (2007a).]

Note: Herfindahl index calculated as the sum of the squared shares of a bank's assets or revenues across selected countries — the lower the index, the more cross-border diversified the bank.

[1] The *z*-score is defined as $z = (k + \mu)/\sigma$, where k is equity capital as percent of assets, μ is return as percent on assets, and σ is standard deviation of return on assets as a proxy for return volatility.

[2] The distance to default is defined as the difference between the expected value of the assets at maturity and the default threshold, which is a function of the value of the liabilities.

[3] The "excess value" is defined in line with the "conglomerization discount" literature (e.g., Laeven and Levine, 2007) as a difference between actual Tobin's q and a weighted average of estimated Tobin's q for the constituent entities.

shows that, in fact, all measures of risk and performance are positively affected by an increase in international diversification of large banks. Thus, virtually all these regressions, which are all significant at least at the 10 percent level, suggest that greater cross-border diversification improves the soundness of the banking system by making individual banking failures less likely.

The question whether cross-border bank mergers are more or less risky than domestic mergers has been addressed by others before. Amihud *et al*. (2002) examine bank stock returns from many countries. They find no systematic effects of these mergers on individual or systematic stock price risk, which is consistent with the hypothesis that diversification benefits and information costs of foreign lending offset each other.[3] Choi *et al*. (2006) analyze this issue with merger announcement effects on bank bond yield spreads. They estimate that bondholders perceive cross-border bank mergers and acquisitions (M&As) as risk-increasing activities, with a 4 basis point yield increase at the announcement. Moreover, they detect that more moral-hazard-prone deposit insurance arrangements further increase this effect, whereas better investor protection reduces it. Finally, tougher or more transparent banking regulation and supervision do not seem to affect the riskiness of cross-border bank M&As. Choi *et al*.'s results for cross-border bank M&As are therefore in stark contrast to the results of Penas and Unal (2004), who find that US bank bond spreads decline after domestic merger announcements. Thus, the available evidence on the risk effects of cross-border bank mergers is somewhat mixed at present. The ongoing financial consolidation process with an increasing cross-border component calls for further thinking about how supervisory structures and regulatory approaches can keep pace with these developments.

Fecht *et al*. (2007a) try to assess the benefits from diversifying the risk of delayed loan repayments through cross-border banking. Based on Bankscope data for individual banks located in 25 European countries and in the US, the average volume of nonperforming loans are calculated for each country for each year between 1997 and 2007. The coverage of banks varies largely between 75 banks for the US and one bank for Greece and the Czech Republic. Nonperforming loans are broadly measured comprising overdue loans, restructured loans and other nonperforming loans.

[3] Hanson *et al*. (2005) show the substantial scope for diversification in international credit portfolios.

Thus, in contrast to shocks to the loan loss provisions, fluctuations of nonperforming loans measure a liquidity risk rather than a risk of capital losses. The development of the nonperforming loans at "representative" banks in the different countries allows calculating the variation coefficient of nonperforming loans for different groups of countries. One can then assess to what extent a bank can diversify shocks to the fraction of nonperforming loans by holding the representative loan portfolio in various countries.

Figure 9 shows the development of the variation coefficient for increasing numbers of countries. The dotted lines report the average variation coefficient of nonperforming loans based on the total sample of countries. It shows how a bank that expands its loan business at random to additional countries can on average diversify shocks to the fraction of nonperforming loans in its portfolio. The dotted grey line is the variation coefficient of the unweighted fluctuations of the countries' nonperforming loans. It therefore measures the scope for diversification based on the assumption that the portfolio fraction a bank holds in the various countries is always the same. The dotted black line, in contrast, gives the variation

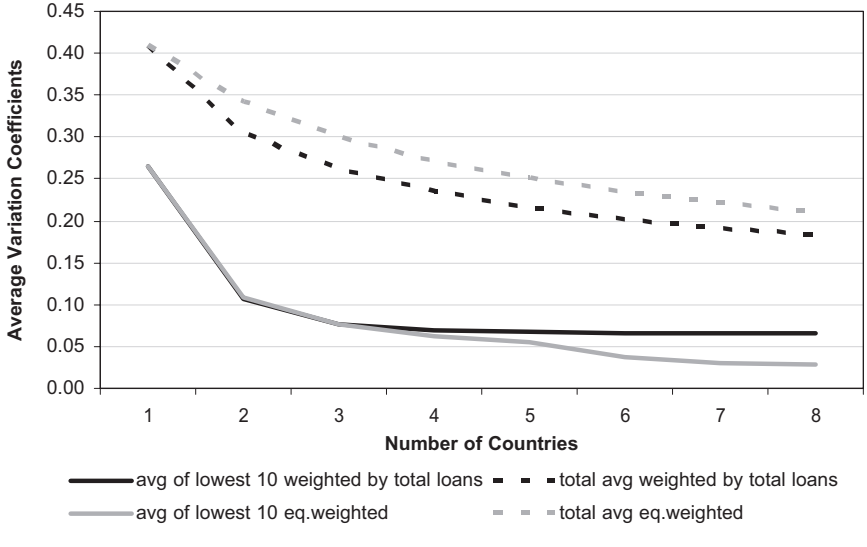

Figure 9. Variation coefficients on nonperforming loans for different groups of countries
Source: Reproduced from Fecht *et al*. (2007a).

coefficient of the weighted national nonperforming loans. It gives the diversification benefits assuming that an international bank always holds a constant fraction of the countries' respective loan portfolio.

As these two lines indicate, the diversification benefits are fairly large for a bank when extending its scope to one or a few other countries. However, the marginal benefits from cross-border lending vanish quickly and the diversification effect from lending to the private sector in seven instead of six countries seems already negligible. Looking at the solid curves, these results are even more pronounced. The solid lines give the average variation coefficient for those ten groups of countries that allow for the maximum diversification. That is, they report for each number of countries the variation coefficient for those ten groups of countries that have the lowest variation coefficient. Thus, the solid lines show the benefits from diversification given that banks always choose to expand their business to economies that provide maximum diversification benefits.[4]

3.2 *Destabilizing effects from financial contagion*

Increased financial integration also brings about that adverse shocks abroad affect the domestic financial system by more than otherwise the case. The price impact of fire-sales is limited in a foreign financial market because funds are withdrawn from the domestic financial market and invested abroad. This reduces the demand for domestic assets, leading to a correlated price decline in the domestic and foreign financial market. Similarly, domestic financial institutions that incurred a loss abroad are likely to reduce their risk exposure at home as well as abroad, contributing to a greater co-movement of the risk premium in both financial

[4] Interestingly, these findings are very much in line with the results reported by Imbs and Mauro (2007). They also find that the diversification potential of cross-border financial integration is rather quickly exhausted, as the group of integrated countries increases. Quite surprisingly, using the variance and covariance of countries' output developments, their results also suggest that large risk-sharing benefits can be realized among two or three countries, but that beyond seven countries the diversification potential is insignificant. The available data on actual financial integration (see IMF, 2007, for details) instead clearly indicate that financial integration is strongly and positively linked to geographical proximity. Moreover, cultural and historical factors, such as a common language or a common colonial history, are strongly significant in explaining the bilateral financial exposure of countries.

markets. But obviously, this greater co-movement of asset prices is just the downside of improved risk-sharing.

However, even financial contagion in the sense that the default of a foreign borrower causes unsustainable losses to domestic financial institutions can ultimately be part of an efficient risk-sharing arrangement in a second-best world. For example, to overcome enforcement problems, it might be *ex ante* optimal to use short-term debt from multiple investors. Using this source of finance, borrowers can increase their credibility when committing to repay and thereby raise more funds. However, if the borrower cannot repay, an orderly and efficient bankruptcy resolution might be impossible and an inefficient liquidation of the assets unavoidable, which causes severe losses to the investors.[5] Generally, in order to overcome financial market frictions like enforcement and asymmetric information problems, optimal financial contracts might involve huge efficiency losses in some adverse states of the world.[6] These financial markets' frictions seem to be particularly severe in cross-country financial relations. Here, information asymmetries as well as enforcement problems are likely to be more of a concern than in domestic financial markets. Furthermore, as for instance Tirole (2003) and Stulz (2005) point out in cross-border financial relations, governments tend to use discretionary policies at the detriment of foreign borrowers and thereby aggravate the enforcement problem. Thus, in particular cross-border financial contracts are likely to embed huge risks in order to overcome severe financial market frictions.

Because these financial arrangements impose large losses on investors in case the borrower faces an adverse return shock, these financial arrangements can trigger cross-border domino effects, that is, the default of a large foreign borrower can lead to the failure of a domestic financial institution. However, as long as contracting parties bear these losses, the net welfare effect of the option to financially integrate cannot be negative.

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[5] See Calomiris and Kahn (1991) and Diamond and Rajan (2001) for formal models of this argument.

[6] Other examples of financial market frictions are asymmetric information problems. Given that returns of certain projects are unobservable to outside investors, the contracting parties might agree on signing a debt contract that involves an inefficient change in the ownership of the project if contractual repayments are not met. Similarly, an efficient insurance against unobservable liquidity shocks can require banks to offer the unconditional option to withdraw deposits. In case of a severe adverse return shock to the bank, this can lead to a run, the inefficient liquidation of assets and huge losses to the depositors.

Given that contracting parties were *ex ante* — when entering the financial arrangement — aware of their potentially large losses leading to contagion, this indicates that expected benefits from the cross-border financial arrangement overcompensated these expected losses. Consequently, financial stability and contagion concerns can only affect the welfare implications of financial integration if financial instabilities create, in a broad sense, negative externalities.

However, financial crises in general and banking crises in particular can cause huge social costs. Hoggarth *et al*. (2002) estimate the average output loss of a banking crisis to amount to 15 percent to 20 percent of GDP. Boyd *et al*. (2005) assess the cumulative output loss to be as high as 63 percent to 302 percent of pre-crisis GDP. These extraordinary welfare losses are usually perceived as evidence that banking failures must incur large externalities in a broad sense. In the literature, several kinds of externalities of a banking failure have been identified. First and foremost, banking crises impose negative externalities on bank-dependent firms. An individual bank's crisis affects opaque borrowers of the bank that are locked into the banking relation. Due to informational asymmetries, those firms face substantially (or even prohibitively) larger borrowing costs when they have to find new sources of finance.[7] In a widespread banking crisis, all borrowers, whose access to finance relies on banks' screening and monitoring, might face a substantial tightening of borrowing conditions in the credit market. Several recent empirical studies by Dell'Ariccia *et al*. (2005), Kroszner *et al*. (2006), and Raddatz (2006) confirm this effect by showing that, indeed, sectors that are more dependent on external finance and that tend to be more information-sensitive suffer the most during banking crisis. However, while Kroszner *et al*. (2006) find that this effect is the more severe the more developed the financial system is, Raddatz's (2006) results suggest that opaque firms' liquidity provision is more endangered during banking crises in less developed financial systems.

In addition, the opacity of banks' business might give rise to some risk-shifting between different stakeholders in the bank. Bank managers as well as bank equity owners can have an incentive for excessive risk-taking because they mainly participate in the upside chances of risky investments while, for instance, depositors carry the downside risk. If small depositors cannot observe and prevent this risk-shifting, it imposes

[7] This argument goes back to Sharpe (1990). Empirically this point is confirmed, for instance, by Slovin *et al*. (1993).

large externalities on them. Furthermore, the opacity of banks' business, together with the liquidity transformation provided by banks, gives rise to informational contagion. Depositors observing a crisis at some other bank might fear a failure at their own bank, withdraw their deposits on a large scale, and thereby trigger a self-fulfilling spread of the crisis.[8] Similarly, the fire-sales of troubled banks can cause asset price declines that lead to a liquidity crisis at other banks.[9] A deposit insurance, often seen as a measure to contain these externalities on depositors, is likely to increase the risk-shifting, increasing the social costs of banking crisis even further.[10]

This in turn suggests that decisions of banks and other financial market participants do not reflect all expected social costs of cross-border engagements. In particular, it does not incorporate all expected costs of financial contagion. Thus, enlarging their investment and financing scope through financial integration might be beneficial for the market participants themselves, but must not necessarily be welfare-improving from a social perspective. For instance, to improve the efficiency of cross-border transactions can provide the bank managers with greater risk-shifting options. This increases their own expected profits at the expense of the bank's borrowers or other stakeholders in financial institutions. Consequently, whether financial integration is welfare-improving from a financial stability perspective depends on its impact on the size of these negative externalities and thus on the overall social costs of banking crises.

However, improved transparency, better economic institutions, and advanced financial system should help overcome asymmetric information and enforcement problems in cross-border transactions. This should first tend to reduce the inherent fragility of cross-border financial arrangements needed to overcome frictions in cross-border relations. Second, it should diminish the negative externalities of cross-border financial contagion as the risk-shifting options decline, bank dependence might decrease, and incentives to follow a herding behavior weaken.

To get a first idea of how financial integration affects the social costs of financial instabilities, Ferguson *et al*. (2007, Chapter 6) estimate the effects of levels of and changes in foreign liabilities on measures of the severity of systemic banking crises. They find that greater financial

[8] See Chen (1999) for a formal model of this argument.

[9] Fecht (2004) models this argument formally.

[10] Keeley (1990) finds that, in fact, deposit insurance exacerbates risk-shifting.

openness in this sense has either no effect on crisis severity or a reductionary effect. We further extend this analysis by relating the sum of external assets and liabilities from Lane and Milesi-Ferretti (2007) as an indicator of financial openness to various measures of the severity of banking crises. So our primary focus — as in Ferguson *et al*. — is on the impact of *de facto* financial integration rather than a *de jure* measure of capital controls. Furthermore, in using a broad measure for financial openness, we do not follow approaches that assess the vulnerability of banking systems to sudden stops, that is, stops or reversals of cross-border capital flows. We then collect the following measures of the severity of banking crises from the World Bank "Banking Crises Database" for all crises between 1980 and 2004 that are covered in this database.[11] In particular, we use the fiscal costs of restructuring the banking sector as a share of GDP as a narrow measure for the social costs of banking crises. As indicators for the severity of the shock to the domestic banking sector, we also study the impact of financial integration on the ratio of nonperforming loans to total loans and of assets of defaulted banks as a share of total banking assets in our cross-country regression analyses.

Figures 10 to 12 show scatter plots of these measures against the sum of foreign assets and liabilities during the last two full years before the crisis as explanatory variable. Each point represents a banking crisis over a certain stretch of time, as dated by the World Bank. To have an idea of the correlations, the figures also show the fitted regression lines of simple univariate regressions with a constant. To check robustness, we derived the regressions for (1) all banking crises in the dataset, (2) all crises indicated as systemic crises in the dataset, (3) all crisis with particularly reliable data, and (4) all systemic crisis with high quality data.[12] Table 2 displays the complete regression results.

By and large, this illustrative analysis does not yield any systematic relationship between the sum of external assets and liabilities and the costs of banking crises. We also used different measures for financial

[11] The database has been established by Caprio and Klingebiel and is developed and maintained by Laeven and Noguera. See http://www1.worldbank.org/finance/html/database_sfd.html, and Caprio and Klingebiel (1999).

[12] In total, there are 17 crises for which a precise starting year is not specified. Those crises are not included in the High Quality data, however they are used in the regressions when considering all crises (1) and systemic crises only (2). A starting year has been assigned to these crises according to the information contained in the crisis database. Additional information is available on request.

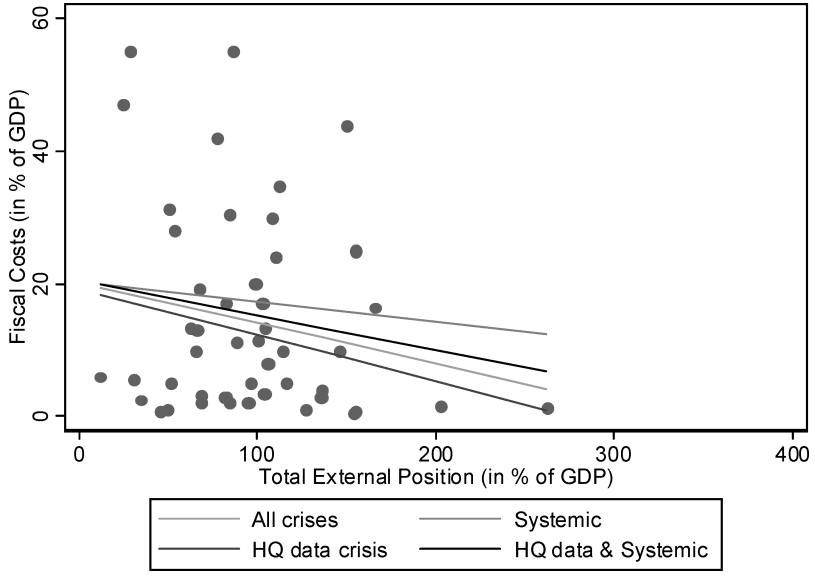

Figure 10.

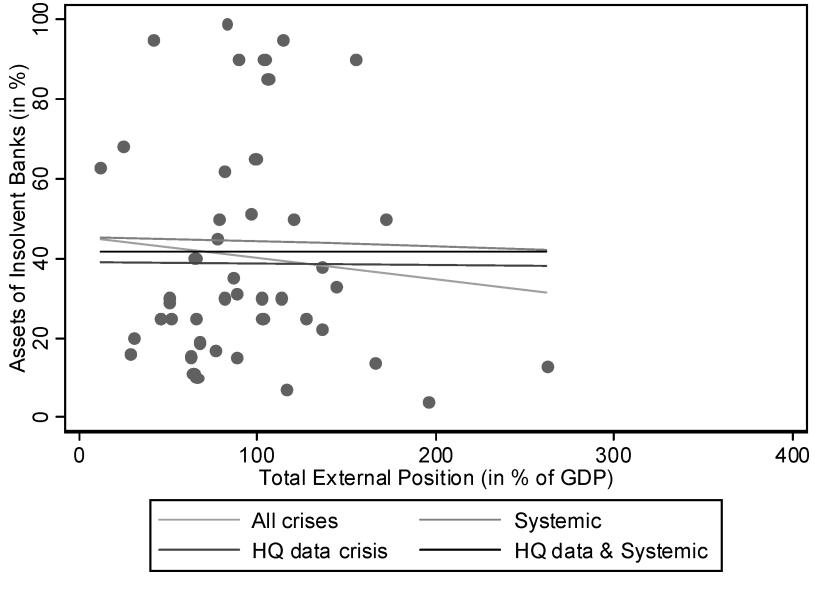

Figure 11.

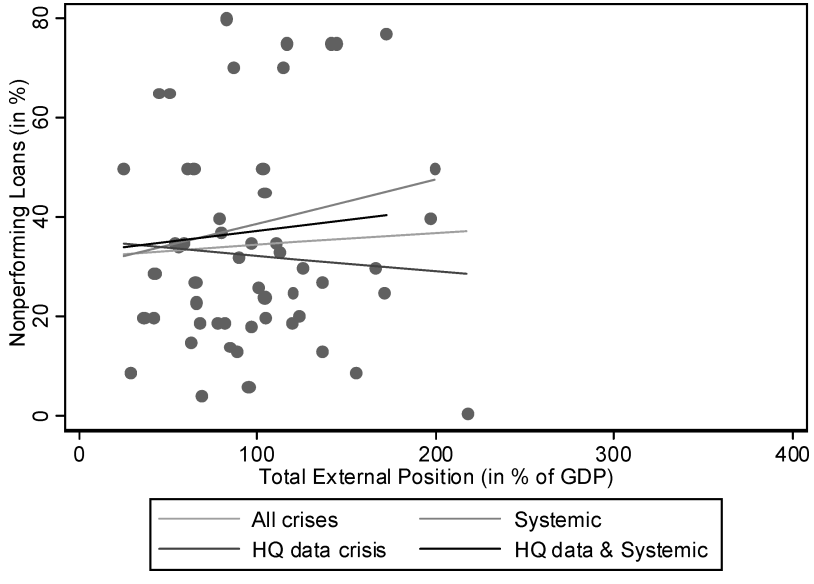

Figure 12.

openness. We pursued the same analysis with the change in the sum of external assets and liabilities, the net external asset position and the change in the net external asset position. Overall, we also did not find any significant relation when using these measures. In any case, there is hardly any evidence for financial openness to increase the severity of banking crises.

Of course, this analysis should not be seen as a full-fledged econometric study of the relation between financial openness and the costs of banking crises. We do not control for a host of variables that could also influence the severity of banking crises, such as domestic business cycles, the quality of economic institutions and banking supervision, etc., nor do we account for a variety of econometric issues. However, in line with some results by Ferguson *et al.* (2007), more sophisticated econometric studies also suggest that, if anything, financial openness reduces the costs of banking crises. For instance, in a dynamic panel analysis of 90 countries from 1975 to 1999, Bonfiglioli and Mendicino (2004) study the impact of different *de jure* measures of financial openness on output losses due to banking crises. They find that financial liberalization itself does not spur growth. But taking the effect of financial liberalization on

Table 2. Regression results

Dependent variable		All crises (1)	Systemic only (2)	High Quality (HQ) data only (3)	Systemic and HQ data only (4)
Nonperforming Loans in % of Total Loans	Coefficient	0.0247	0.0878	–0.0324	0.0421
	Std Error	*0.0661*	*0.0716*	*0.0784*	*0.0928*
	p-value	*0.7100*	*0.2270*	*0.6820*	*0.6530*
	Adj. R-squared	–0.0168	0.0113	–0.0212	–0.0247
	N. Obs	53	45	41	34
Assets of Insolvent Banks in % of Total Banking Assets	Coefficient	–0.0535	–0.0113	–0.0042	–0.0007
	Std Error	*0.0877*	*0.0960*	*0.0911*	*0.0957*
	p-value	*0.5450*	*0.9070*	*0.9640*	*0.9940*
	Adj. R-squared	–0.0148	–0.0274	–0.0293	–0.0345
	N. Obs	44	38	36	31
Fiscal Cost in % of GDP	Coefficient	–0.0603	–0.0300	–0.0694	–0.0515
	Std Error	*0.0456*	*0.0560*	*0.0457*	*0.0543*
	p-value	*0.1930*	*0.5960*	*0.1370*	*0.3510*
	Adj. R-squared	0.0153	–0.0197	0.0309	–0.0033
	N. Obs	49	38	42	32

(*Continued*)

Table 2. (*Continued*)

Dependent variable		All crises (1)	Systemic only (2)	High Quality (HQ) data only (3)	Systemic and HQ data only (4)
Output Loss	Coefficient	0.0171	0.0428*	0.0173	0.0432
	Std Error	*0.0135*	*0.0247*	*0.0141*	*0.0261*
	p-value	*0.2080*	*0.0880*	*0.2220*	*0.1030*
	Adj. R-squared	0.0056	0.0267	0.0052	0.0265
	N. Obs	109	74	98	65

Note: The explanatory variable is the average total external position (sum of external assets and liabilities) in percentage of GDP in the two years preceding the crisis. Crisis definitions and data according to the database on financial crises established by Caprio and Klingebiel and developed and maintained by Laeven and Noguera (see the World Bank's website, and Caprio and Klingebiel (1999). All regressions have been estimated including the constant; the estimates of the constant are not reported in the table. Columns (1) to (4) report the results using different crises samples: (1) considers all the crises in the database; (2) only the crises that are defined "systemic" according to Caprio *et al.*; (3) only crises for which a precise starting year is specified (High Quality data); (4) only systemic crises with High Quality data. * indicates statistical significance of coefficients at the 10% level.

the occurrence of banking crises into account by including the presence of a banking crisis as a separate indicator, they show that financial integration fosters growth and at the same time limits the costs of a banking crisis. Systemic banking crises are more associated with rather closed financial systems. Improved economic institutions and a more developed financial system seem to be the factors driving this result.

However, so far our analysis only focused on the costs of banking crises. But financial integration could also lead to more frequent banking crises, leaving the overall costs of these crises unaffected. Bonfiglioli and Mendicino (2004) find evidence that the frequency of banking crises is about the same in countries with capital controls and restrictions on equity transactions as it is in countries without such controls and restrictions. In contrast, the IMF (2007b) provides evidence that financial integration indeed affects the propensity for financial crisis differently in countries with more or less developed financial systems and/or poor or well-developed economic institutions.[13]

Overall, there seems to be no or only very little hard evidence supporting the view that more financially open countries are, on average, more frequently or more severely affected by financial crises than less open countries. This suggests that the negative externalities of financial crises in countries do not increase with financial globalization. Thus, on average, there seem to be no extra costs of financial integration imposed by the threat of greater financial fragility. Still, single countries may face instability as a consequence of too fast or ill-sequenced financial opening. Williamson and Mahar (1998) discuss cases in which short-term capital inflows seem to have contributed to financial instability. As indicated in the previous subsection, the benefits of financial integration for financial stability may not be very extensive either.

However, this latter assessment does not take the likely endogeneity of the risk-sharing potential into account. As Kalemli-Ozcan, Sorensen and Yosha (2003) show, risk-sharing can promote industrial specialization. This raises the question what the stability effects of banking integration are when the enhanced risk-sharing leads to such specialization (Fecht *et al*., 2007b). Specific sectors have a comparative advantage in certain economies, and the domestic banking sector has an advantage in

[13] When the sample is split according to the World Bank's definitions of systemic and non-systemic banking crises, the latter are more frequent for financially integrated countries and the former less frequent.

lending to the domestic firms. Then, banks will only find it optimal to specialize in lending to the more productive sector in their home region if they can diversify their sector-specific exposure through an international financial market. Thus, financial integration will allow banks to insure against sector-specific shocks, fostering domestic banks' incentives to specialize. This in turn contributes to more specialized economies leading to more asynchronous development of the different economies, which endogenously increases the risk-sharing opportunities.

4. Conclusions

In this paper, we documented the global financial integration process and discussed its implications for financial stability. The financial integration process has very much accelerated in the last two decades, particularly among industrial countries which share risks through two-way asset trade. We identified banks as a driving force behind the integration process, although their role has declined over time. Asia has emerged as a major capital exporter, whereas emerging economies in Eastern Europe and Latin America tend to remain capital importers. The beneficial effects of integration for efficiency, growth and risk-sharing have now been well-documented for industrial countries. Emerging market economies and developing countries below certain levels of economic and financial development may, however, not be able to reap those benefits. The greatest advantages seem to be related to the opening for equity and foreign direct investments.

The relationship between financial integration and financial stability is theoretically ambiguous. The simple regression analysis presented in the paper shows no systematic link between the sum of external assets and liabilities of a country and the costs of a banking crisis. More generally, the available econometric evidence in the literature as a whole suggests either no systematic relationship between financial integration and stability, or a positive relationship, that is, that more financially open countries are also more stable. Even in the light of some case studies that point to a contributing role of capital flows to financial crises, the policy direction should therefore be to generally allow the financial integration process to advance and to adjust the speed and sequencing of any necessary liberalizations in countries that possess vulnerabilities in a way that limits remaining risks.

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Does Financial Integration Improve Countries' Growth Opportunities?

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1. Introduction and Summary

Few studies have explored the implications of worldwide and regional financial integration for the efficiency of capital allocation.[1] Assessing whether financial integration produces the beneficial *real* effects predicted by theory is perhaps what ultimately matters most for people and public policy. This is the focus of a recent paper of mine, jointly written with Iryna Ivaschenko (De Nicolò and Ivaschenko, 2008, DNI henceforth). I summarize some of the results here.

In a perfectly financially integrated region, capital should be invested where it is expected to earn the highest expected risk-adjusted return. The cost of equity capital within the region should be equalized, as firms and investors would face the same investment opportunities and the same pricing of risk. Therefore, in an imperfectly integrated region witnessing advances in financial integration, we should observe convergence in the cost of equity capital across countries. Furthermore, the degree of convergence in the cost of capital of each country should also have a positive impact on a country's risk-adjusted growth opportunities owing to a more efficient allocation of capital within firms and sectors brought about by integration. In DNI, I aim at assessing these predictions of theory.

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[1] Recent work by Bekaert, Harvey and Lundblad (2005, 2007) has focused on the growth effects of integration globally, but not on integration *within* regions. Adjaouté and Danthine (2004) have assessed financial integration within developed European countries, but have not examined the implications of integration for growth.

I first document advances in measures of financial integration for major developed and emerging market economies.[2] As in Bekaert, Harvey and Lundblad (2007, BHL henceforth), I focus on equity markets and construct proxy measures of the cost of equity capital. Following Adjaouté and Danthine (2004), advances in integration are assessed by testing cross-country convergence of equity premia, as equity premia are fundamental determinants of the cost of equity that capital firms face.

To examine the real effects of financial integration, I construct a measure of risk-adjusted growth opportunities for each country, document its evolution, and assess whether a measure speed of integration, given by the distance of a country's equity premium from the group average, predicts its risk-adjusted growth opportunities. Doing this aims at establishing whether a country that experiences increased integration in the form of a *reduction* in the distance of its equity premium from the group average also witnesses a subsequent increase in its risk-adjusted growth opportunities. The finding of a *negative* relationship between the country-specific measure of speed of integration and future risk-adjusted growth opportunities would thus suggest that such opportunities indeed improve with the speed of integration. In addition, I also assess the converse, that is, whether improvements in risk-adjusted growth opportunities predict advances in financial integration in the form of a future reduction in the distance measure defined above. Doing this sheds light on the extent to which the dynamics of financial integration and risk-adjusted growth opportunities reinforce each other.

Two results obtain. First, there is evidence of a declining trend in the cross-country dispersion of equity premia worldwide and such declines have been more pronounced in emerging market countries. Moreover, regional integration has proceeded faster in Europe, with emerging European

[2] Several recent studies have focused on European financial integration, documenting increased convergence in prices of money and bond markets (Barros *et al*., 2005; Baele *et al*., 2004; and Adam *et al*., 2002) in subsets of Euro area countries, and convergence of pricing in equity markets (Adjaouté and Danthine, 2004; De Nicolò and Tieman, 2008) in sets of Western European economies. Few studies have focused on emerging European countries, either considered individually or as a group. This study also contributes to this literature by presenting evidence on a large set of Western European and emerging European economies.

countries playing an important role. Second, measures of the speed of integration indeed predict subsequent increases in a country's risk-adjusted growth opportunities, while better risk-adjusted growth opportunities predict future advances in integration. These results suggest that the benefits of a more efficient allocation of capital prompted by financial integration are significant, and that countries whose speed of integration is faster may benefit from a virtuous dynamic pattern in which financial integration and improved real prospects are mutually reinforcing. Europe is the region which appears to have benefited most from this virtuous dynamic pattern.

2. Measuring and Assessing Advances in Financial Integration

In DNI, advances in financial integration are gauged by assessing whether there is a significant decline in the cross-country dispersion of a proxy measure of equity premia. Following De Nicolò and Tieman (2008), the dynamics of the cross-country dispersion of equity premia is assumed to follow an autoregressive, one-factor model with time-varying conditional variance, i.e., a GARCH(1,1) model with a common factor in the mean equation.

Under standard assumptions on the cross-sectional distribution of the relevant coefficients, a statistical model for the dispersion of equity premia is given by:

$$\bar{\sigma}_X^2(t) = A_0 + A_1 t + A_2 (E_{t-1} F_t)^2 + A_3 \bar{\sigma}_X^2 (t-1) + H_t \eta_t, \quad (1)$$

$$H_t^2 = B_0 + B_1 \eta_{t-1}^2 + B_2 H_{t-1}^2, \quad (2)$$

where $\bar{\sigma}_X^2(t)$ denotes the cross-sectional variance of equity excess returns, which proxy equity premiums, $(E_{t-1}F_t)^2$ is the square of the expectations of the common factor, proxied by the square of the world stock market return, and H_t^2 is the conditional variance of $\sigma^2{}_X(t)$ Convergence in the cross-country dispersion of equity premia occurs if A_1 is negative.

I use monthly equity market data for the period January 1994 to May 2007 for 52 countries, including developed countries and emerging market countries in Europe, Asia and America, taken from Datastream and

Standard & Poors.[3] The risk-free rate is the yield on government securities at maturities ranging from one month to three months, depending on data availability.

By estimating Equations 1 and 2 including all countries, I test world convergence in equity premia. Estimates of Equations 1 and 2 are also carried out for two different types of country subsamples. The first type of subsample *excludes* from the whole sample countries that belong to a particular region. In this case, a comparison of the estimated coefficient obtained when all countries are included with that obtained by excluding a subsample gauges the relative contribution of that subsample to worldwide equity premia convergence. Specifically, I compare estimates of the trend coefficient A_1 when $\overline{\sigma}_X^2(t)$ is computed by including all countries in the sample, with estimates of the trend coefficient when $\overline{\sigma}_X^2(t)$ is computed *excluding* all countries in a given subsample. The second type of subsample *includes only* countries in a particular region. Thus, estimates of the trend coefficient A_1 provide a gauge of equity premia convergence *within* a region, that is, a measure of regional financial integration.

Table 1 reports estimates of the trend coefficient in Model 1–2. As shown in the estimates obtained including all countries (Equation 1 of the table), the trend coefficient is negative and significant, indicating strong world convergence in equity premia. As shown in Equation 2 of the table, world convergence is importantly driven by convergence in emerging market countries, as the trend coefficient is *lower* in absolute value than that obtained when all countries are included.

Looking at the contribution of regions to world convergence, I find that Asian countries, when treated as a bloc, *do not* contribute significantly to world convergence, since the trend coefficient in Equation 3 of the table is *larger* in absolute value than that in Equation 1. By contrast,

[3] Each regional sample includes developed and emerging countries. *Developed America* includes the United States and Canada. *Emerging America* includes the following six countries: Mexico, Argentina, Brazil, Chile, Colombia and Peru. *Developed Asia* includes Hong Kong, Republic of Korea, Singapore, Japan, Australia and New Zealand. *Emerging Asia* includes the following eight countries: China, India, Indonesia, Malaysia, Pakistan, Philippines, Taiwan Republic of China and Thailand. *Developed Europe* includes the following 16 countries: Austria, Belgium, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and the United Kingdom. *Emerging Europe* includes the following 13 countries: Czech Republic, Hungary, Poland, Romania, Russia, Bulgaria, Croatia, Estonia, Latvia, Lithuania, Slovakia, Slovenia and Ukraine.

Table 1. GARCH estimates for cross-country variances of equity premia: Trend coefficients

Mean Equation: $\bar{\sigma}_X^2(t) = A_0 + A_1 t + A_2(E_{t-1}F_t)^2 + A_3\bar{\sigma}_X^2(t-1) + A_4 CO_t + H_t \eta t$.

Variance Equation: $H_t^2 = B_0 + B_1\eta_{t-1}^2 + B_2 H_{t-1}^2$.

Equation	Coeff.	Std. Error	T-Stat	Signif.
		A. WORLD INTEGRATION		
(1) All countries				
A1	–0.11776645	0.04426999	–2.66019	0.00780973
(2) All countries ex Emerging Market countries				
A1	–0.00247392	0.00007649	–32.34451	0.00000000
(3) All countries ex Asia				
A1	–0.17787246	0.01466913	–12.12563	0.00000000
(4) All countries ex Latin America + Mexico				
A1	–0.12123633	0.01012353	–11.97569	0.00000000
(5) All countries ex Europe				
A1	–0.06860428	0.02518799	–2.72369	0.00645571
		B. REGIONAL INTEGRATION		
(6) Asia				
A1	0.00333638	0.00850288	0.39238	0.69477550
(7) Latin America				
A1	–0.09144475	0.00060950	–5.03307	0.00000000
(8) Europe				
A1	–0.11905965	0.04040136	–2.94692	0.00320954
(9) Europe ex Emerging Europe				
A1	–0.005799712	0.001508582	–3.84448	0.00012081

Note: CO_t is the number of countries in the cross-section at date t.

the Latin American and European regions have contributed significantly to world integration, as witnessed by an absolute value of the trend coefficients in the relevant equations (Equations 4 and 5 of the table) lower than that in Equation 1. Importantly, the drop of the trend coefficient

in these estimates relative to the world estimate is largest for Europe. This indicates that European financial integration has proceeded at the fastest pace.

With regard to regional integration, estimates for the Asian region yield a trend coefficient not significantly differing from zero (Equation 6 of the table). The results for Latin America and Europe are strikingly different: these exhibit strong regional financial integration (Equations 7 and 8 of the table), as the trend coefficient in the relevant equations is negative and significant. With regard to European financial integration, the estimates of the trend coefficient obtained with Equation 8 is significantly larger, in absolute value, than that estimated when emerging European countries are excluded (Equation 9 of the table). Thus, countries in emerging Europe have experienced a convergence faster than the group of other countries, thereby significantly contributing to convergence *within* the region.

In sum, world financial integration as convergence in equity premia has progressed significantly. It has been primarily driven by advances in emerging market countries, and by countries in Latin America and Europe. European integration has progressed faster than in the other regions, driven by the fast pace of integration of emerging European countries.[4]

3. Risk-Adjusted Growth Opportunities and Financial Integration

A standard forward-looking measure of growth opportunities is given by the evolution of the price-to-earnings ratio. Similarly to BHL, in DNI, I assess progress in financial integration by constructing country measures of growth opportunities based on measures of total equity market price-to-earnings ratios. Differently from BHL, however, I adjust these measures for risk, since price-to-earnings ratios exhibit significant fluctuations, possibly reflecting both market uncertainty regarding future growth of the economy as well as the temporary appearance of "bubble" components in some equity market prices.

[4] These results are also consistent with those reported by Garcia-Herrero and Wooldridge (2007), who find evidence of a decreasing correlation between domestic investment and savings, which is an implication of increased financial integration.

To account for cross-country differences in industry representation and composition of each country's price-to-earnings ratio, I standardize these ratios by the world price-to-earnings ratio. As discussed in BHL, doing this is akin to evaluating country growth opportunities relative to a proxy measure of global growth opportunities. Thus, our measure of risk-adjusted growth opportunities for country *j* in month *t*, called *RAGO*, is given by:

$$RAGO_{jt} = \frac{(P/E)_{jt} / (P/i)_{wt}}{\sigma_{jt}}, \tag{3}$$

where $(P/E)_{jt}$ denotes the country *j*'s total market price-to-earnings ratio, $(P/E)_{wt}$ is the world price-to-earnings ratio, and σ_{jt} is a rolling standard deviation of the ratio $(P/E)_{jt}/(P/E)_{wt}$ computed in each month using data of the preceding 12 months.

The evolution of *RAGO* exhibits several interesting patterns. In Europe, all countries exhibit a nondeclining trend, with the exception of Norway, and the trend is significantly upward in many countries, especially in emerging Europe. In the Americas, *RAGO* is upward-sloping in the US, Mexico, Brazil and Chile, while it declines in the other countries of the group. In Asia, an upward trend in *RAGO* is exhibited by China, India, Pakistan, Hong Kong, Republic of Korea and Singapore. Interestingly, in all regions, a combination of developed and emerging market economies exhibit an upward trend in *RAGO*.

Next, I construct simple measures of *speed* of integration within a given set of countries. A simple proxy measure of speed of integration is given by a measure of the distance of the equity premium of a country from a measure of central tendency of the cross-country distribution of equity premia in the entire sample considered. Specifically, for country *j* in year *t*, this measure, called *ISPEED*, is given by:

$$ISPEED_{jt} = abs(X_{jt} - \hat{X}_t), \tag{4}$$

where $abs(X_{jt} - \hat{X}_t)$ denotes the absolute value of $X_{jt} - \hat{X}_t$, X_{jt} is the equity premium, and $\hat{X}_t$ is the mean of equity premia across countries. This measure records the position of the equity premium of a country relative to the group within the cross-country distribution. The faster is financial integration in a country, the smaller is the distance of its equity premium from the group mean. Note that a desirable feature of this measure is that it

accounts for time variation of both the equity premium of a country and the group it belongs to.

We model the dynamics of *RAGO* and *ISPEED* as simple autoregressive processes conditioned on their own past values in a VAR-type fashion. The coefficient associated with past values of the speed of integration in the *RAGO* equation yields an estimate of the impact of this speed on future country's risk-adjusted growth opportunities, while the coefficient associated with past values of *RAGO* in the equation of integration speed yields an estimate of the impact of *RAGO* on future integration speed. Thus, the impact of the speed of integration (risk-adjusted growth opportunities) on future risk-adjusted growth opportunities (future speed of integration) is assessed by positing the following statistical panel data models for *RAGO* and *ISPEED*:

$$\Delta RAGO_{jt} = \alpha_{1j} + \beta_1 ISPEED_{jt-1} + (\gamma_1 - 1) RAGO_{jt-1} + \delta_{11} A\,RAGO_{t-1} + \delta_{12} A\,\Delta RAGO_{t-1} + \varepsilon_{1jt}, \quad (5)$$

$$\Delta ISPEED_{jt} = \alpha_{2j} + \beta_2 RAGO_{jt-1} + (\gamma_2 - 1) ISPEED_{jt-1} + \delta_{12} A\,ISPEED_{jt-1} + \delta_{22} A\,\Delta ISPEED_{jt-1} + \varepsilon_{2jt}, \quad (6)$$

where Δ denotes first differences, and α_{1j} and α_{2j} are country-specific effects. In Equation 5, $ARAGO_{t-1} = N^{-1}\sum_{j=1}^{N} RAGO_{jt-1}$ and $A\Delta RAGO_{t-1} = N^{-1}\sum_{j=1}^{N}\Delta RAGO_{jt-1}$ are the cross-sectional averages of lagged values of *RAGO* and its first difference respectively. In Equation 6, $AISPEED_{t-1} = N^{-1}\sum_{j=1}^{N} ISPEED_{jt-1}$ and $A\Delta ISPEED_{t-1} = N^{-1}\sum_{j=1}^{N}\Delta ISPEED_{jt-1}$ are the cross-sectional averages of lagged values of *ISPEED* and its first difference respectively. This specification is borrowed from Pesaran (2007) to take into account the potential existence of unit roots. Specifically, the (panel) unit root hypothesis is rejected if $\gamma_i - 1 < 0$, $i = 1,2$. The main objective is to estimate the coefficients β_1 and β_2, and test whether their values are negative and significantly different from zero.

Table 2 reports the results of these fixed effects specification for the entire sample and for Europe, Asia and Latin America.[5] In the world sample

[5] In all estimates, the unit roots hypothesis is rejected with high confidence, since the robust *t*-statistics associated with $\gamma_i - 1 < 0$, $i = 1,2$ are well below the cross-sectionally augmented Dickey–Fuller critical values obtained in Pesaran (2007) at 1 percent confidence levels.

Table 2. Panel regressions: Coefficients of RAGO and ISPEED

$$\Delta RAGO_{jt} = \alpha_{1j} + \beta_1 ISPEED_{jt-1} + (\gamma_1 - 1)RAGO_{jt-1} + \delta_{11} ARAGO_{t-1} + \delta_{12} A\Delta RAGO_{t-1} + \varepsilon_{1jt.}$$

$$\Delta ISPEED_{jt} = \alpha_{2j} + \beta_2 RAGO_{jt-1} + (\gamma_2 - 1)\, ISPEED_{jt-1} + \delta_{12} AISPEED_{jt-1} + \delta_{22} ISPEED_{jt-1}\, \varepsilon_{2jt}.$$

Equation	Coeff.	Std. Error	T-Stat	Signif.
(1) World				
Beta(1)	–0.0078577	0.0040932	–1.92	0.055
Beta(2)	–0.0063543	0.0021149	–3.00	0.003
(2) Europe				
Beta(1)	–0.0143973	0.004765	–3.02	0.003
Beta(2)	–0.0071381	0.003876	–1.84	0.066
(3) Asia				
Beta(1)	0.0062916	0.0141887	0.44	0.658
Beta(2)	–0.0016708	0.0022979	–0.73	0.467
(4) Latin America				
Beta(1)	–0.0148078	0.0169446	–0.87	0.383
Beta(2)	–0.0304753	0.0148776	–2.05	0.041

(Equation 1), *both* the coefficients β_1 and β_2 are negative and significant at conventional significance levels. This finding suggests the existence and economic relevance of a virtuous dynamic, whereby a more efficient allocation of capital spurred by financial integration improves future risk-adjusted growth opportunities and, in turn, improved risk-adjusted growth opportunities speed up financial integration.

When one looks at the same relationships in the context of *regional* integration, as opposed to world integration, the results are consistent with the results on convergence in equity premia described previously. The European sample exhibits the same pattern of the world sample: both the coefficients β_1 and β_2 are negative and significant (Equation 2), indicating that the virtuous dynamic between financial integration and risk-adjusted growth opportunities holds at regional level as well. By contrast, such a dynamic does not show up in the data for the Asian sample (Equation 3), confirming the degree of heterogeneity of the Asian countries in their financial integration

process. Lastly, in the Latin American sample (Equation 4), both the coefficients β_1 and β_2 are negative, but only the coefficient β_2 is significant, indicating that the positive impact of improved growth opportunities on financial integration dominates the reverse impact.

4. Conclusion

In conclusion, a country-specific measure of integration *predicts* a measure of a country's risk-adjusted growth opportunities. Thus, increased financial integration has overall improved the efficiency of capital allocation worldwide, and particularly that of countries that are integrating most rapidly. Regional financial integration appears to have played a significant growth-enhancing role in Europe. Conversely, better risk-adjusted growth opportunities foster future advances in integration. These results suggest that the world, and particularly Europe, has witnessed a virtuous dynamic in the past decade: increased financial integration has improved the efficiency of capital allocation, and countries that have improved their risk-adjusted growth opportunities have witnessed an acceleration of their financial integration.

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Financial Globalization in the Asian Region

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I would like to thank the organizers for the invitation to be part of this panel on the Current State of Financial Globalization. The timing of the conference is impeccable. As we all know, global financial events have been on the front page of every major newspaper around the world over the past month or so. These events have reminded us of just how interconnected the various pieces of the global financial system have become. Because of these interconnections, when sub-prime borrowers in the United States have trouble paying their mortgages, it is major news in Brisbane, Beijing and Berlin and almost every city and town in between!

In my remarks this morning, I would like to talk about these interconnections and particularly about the globalization of financial systems in the Asian region, including Australia. This is a challenging task, partly because the experience amongst these countries is so varied, and partly because the financial systems are at very different stages of development. Yet there are some common themes, and the varied experiences point to some possible lessons.

My remarks are in two parts. First, I would like to review the various indicators of financial globalization and what they tell us about Asian integration into the world financial system. And then second, I would like to touch on a few issues that, in my opinion, will both assist further integration and help ensure that the benefits of this integration are fully realized.

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1. The Current State of Financial Globalization in Asia

There is no single measure of financial globalization. Yet, there are at least four indicators that are commonly discussed. These are:

(1) The scale of cross-border capital flows;
(2) The correlation of saving and investment within a country;
(3) The correlation of asset price movements across countries; and
(4) The extent of foreign direct investment in the banking system.

I would like to say a few words about each of these, although I will focus mainly on the first two. Overall, these indicators suggest that the past decade has seen a marked increase in the integration of Asian financial systems into the global financial system, although, compared to other areas of the world, there is a considerable way to go.

1.1 *Capital flows and saving–investment correlations*

The most commonly cited measure of financial globalization is the degree of cross-border capital flows. One way of looking at this is to add up all inflows of capital into every country in the world and to scale the result by world gross domestic product (GDP) as shown in Figure 1. Here the picture is pretty clear: there has been a sharp increase in the movement of capital around the world since the mid-1990s. Between 1980 and 1995, aggregate capital flows averaged the equivalent of 5 percent of global GDP. In 2006, the figure was more than three times this.

Around this rising trend, there are clear cycles, with capital flows tending to rise during periods of strong global growth, and receding when growth is slower. There has also been a marked increase in the share of capital flows accounted for by debt and interbank lending, and a corresponding decline in the shares accounted for by portfolio equity flows and foreign direct investment.

This increase in the flow of capital has meant that the ratios of gross foreign assets and gross foreign liabilities to GDP have increased for most countries. In Australia's case, for example, the ratio of the sum of foreign assets and liabilities to GDP has increased from around 125 percent in the mid-1990s, to around 240 percent currently.

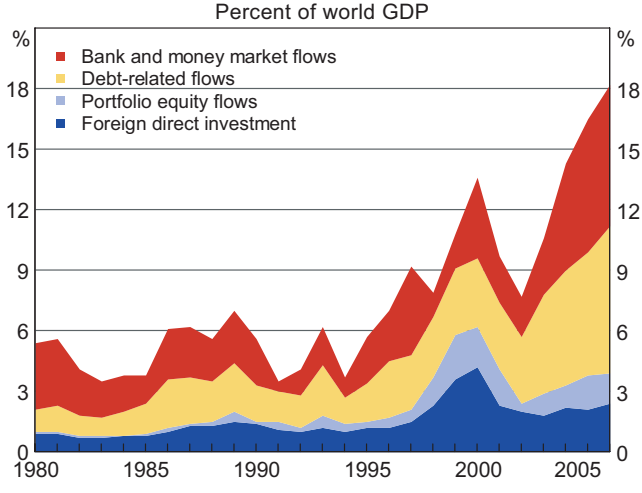

Figure 1. Gross international capital movements
Sources: IMF; RBA estimates.

The overall picture in Asia is broadly similar. This can be seen in the sharp increase in the ratio of gross *asset* outflows to Asian GDP (Figure 2). In 2006, this ratio stood at just over 12 percent, almost four times the average for the 1990s.[1] Despite this increase, capital flows to and from Asia, relative to GDP, remain smaller than they are in most other regions of the world. As a consequence, the ratios of gross foreign assets and gross foreign liabilities to GDP are, for the most part, lower in Asian countries than for countries in Europe and North America (the main exceptions here are Hong Kong and Singapore). In terms of capital inflow, there has been a tendency for the share of equity liabilities in total financial liabilities to increase in contrast to the experience of the world as a whole. With these broad figures as background, there are four aspects of Asian capital flows that I would like to draw attention to.

The first is that most of the flows are to and from countries *outside* the region, rather than between countries within the region. One way of seeing this is to look at intra-regional portfolio flows (Figure 3). In 2005, Asian investors allocated only 5 percent of their international portfolio

[1] The rise in the ratio of gross capital *inflows* to GDP is less marked, given that a number of countries have had capital account surpluses over recent years.

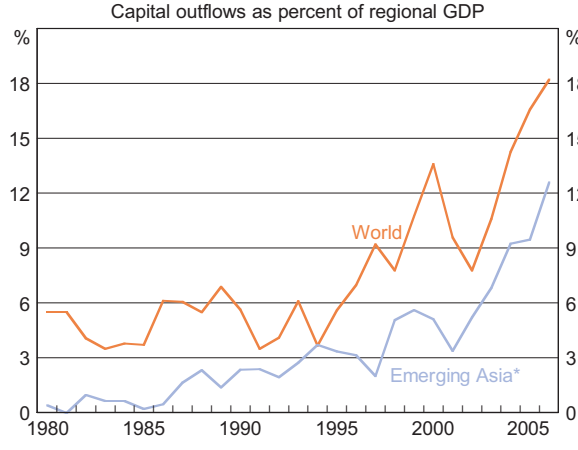

Figure 2. Gross international capital movements
* China, Indonesia, Korea, Malaysia, Philippines, Thailand.
Sources: IMF; RBA estimates.

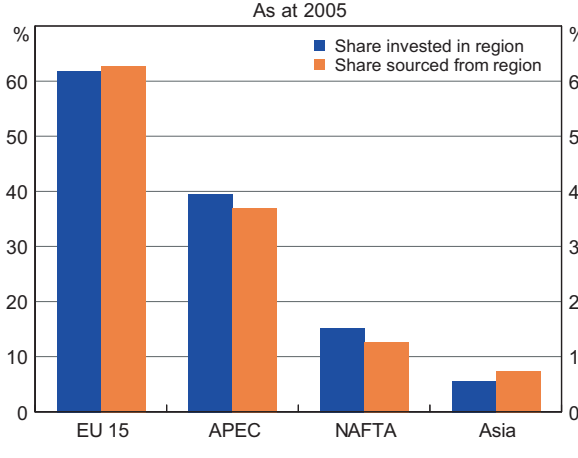

Figure 3. Share of cross-border portfolio investment that is intra-regional
Source: IMF.

investments to other Asian countries; in contrast, within Europe, over 60 percent of total portfolio flows are intra-European. While there are clearly a variety of factors that explain this outcome, one of these is the relative lack of development of financial markets in some Asian countries.

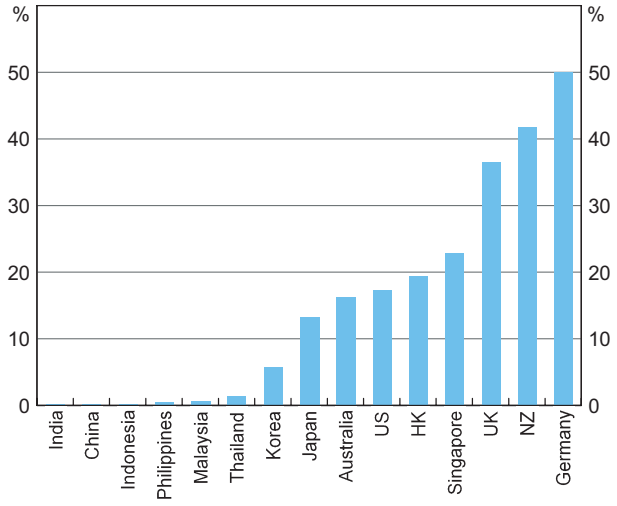

Figure 4. Foreign share in equity portfolio*

* 2006 except 2005 for India, Indonesia, Malaysia, Philippines, Singapore, Thailand, and US.

Sources: IMF; RBA; World Federation of Exchange.

Another is that many of the countries are net exporters of capital, with the developed countries, including the United States and Australia, being the recipients of this capital.

The second is that investors in many countries in the region still exhibit a very strong home bias (Figure 4). Investors in almost all Asian countries have less than 20 percent of their equity portfolios invested outside their own country, and in most cases the figure is considerably less than 10 percent. One factor limiting international portfolio diversification in some countries is the existence of capital account controls, with these controls still being more prevalent in Asia than in many other parts of the world.

The third is that most foreign borrowing is in nonlocal currencies. While it is difficult to obtain comprehensive data, the data that are available suggest that in a number of countries, at least three-quarters of the outstanding debt owed to banks offshore is denominated in nonlocal currencies. Many foreign lenders remain unwilling to incur liabilities in local currencies, partly as a consequence of the relative lack of liquid and deep financial markets in which to hedge the currency risk.

And fourth, and perhaps most significantly, is the important role that the public sector is playing in shaping how some financial systems are being integrated into the world financial system. To understand why they are playing such an important role, it is useful to first look at the basic facts about saving and investment.

The correlation between these two variables is often taken as a measure of financial globalization. In a country that is well-integrated into the world financial system, the level of domestic investment is no longer determined by the level of domestic saving, and so the two variables are likely to have a relatively low correlation with one another.

Australia is a very good example of this. Following the liberalization of the Australian capital account in the 1970s and 1980s, the correlation of saving and investment fell significantly, particularly from the early 1990s onward (Figure 5). Over the past two decades, the level of investment has continuously exceeded domestic saving, and as a result, the capital account has been in continuous surplus (or equivalently the current account in deficit), averaging around 4.5 percent of GDP. Also, over this period there have been notable swings in the size of this surplus as domestic saving and investment have moved quite differently on occasion: the capital account surplus has

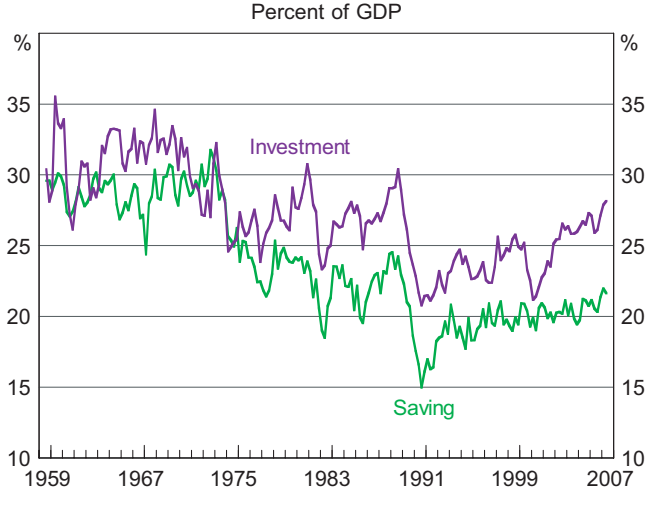

Figure 5. Saving and investment — Australia

Source: ABS.

fluctuated within a range of 2 percent to 6.5 percent of GDP over the past 20 years.

Most studies find that saving–investment correlations have also declined in Asia, although these correlations remain higher than in many developed economies. Perhaps the most interesting thing about the decline is that it has occurred as a result of the sharp fall in investment in many countries, following the financial problems of the mid- to late 1990s. For the emerging countries of Asia (excluding China), investment as a share of GDP averaged around 34 percent between 1990 and 1997, but then fell significantly to average a much lower 27 percent between 1998 and 2006 (Figure 6). In contrast, the saving rate has shown considerably less variation. As a result, the current account for the region as a whole has been in surplus since 1998, with the surplus averaging around 4 percent of GDP; this is in sharp contrast to the experience of the preceding years.

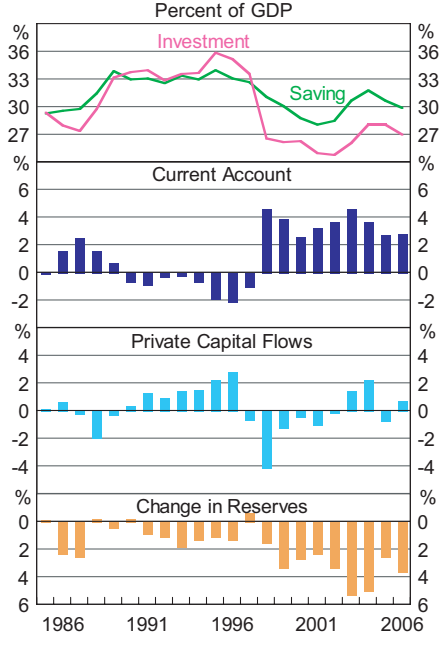

Figure 6. Emerging Asia* — External balance

* IMF definition of Newly Industrialized and Developing economies in Asia; excluding China.

Sources: IMF; RBA calculations.

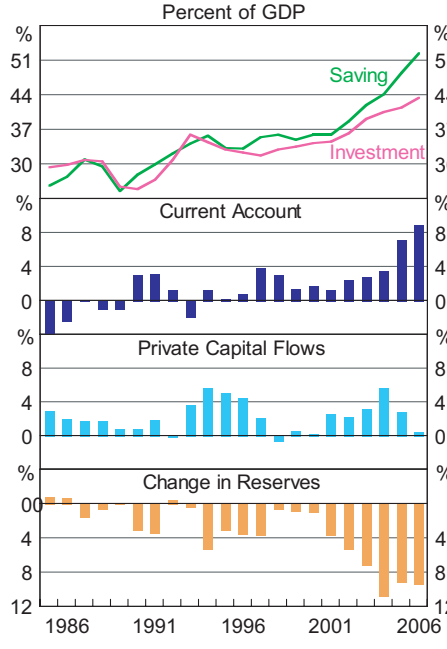

Figure 7. China — External balance
Sources: IMF; RBA calculations.

The picture for China is a little different, with investment having been very strong, although China too has run large current account surpluses for a number of years (Figure 7).

When a country has a floating exchange rate and the central bank does not intervene in the market, the counterpart of current account surpluses is an outflow of private capital. However, for the Asian region as a whole — including China — this has not been the case. Instead, Asia has been a net exporter of goods and services and a net importer of private capital; it has had both current and capital account surpluses.

The counterpart of these dual surpluses is, of course, a build-up in foreign reserves by the central bank. While the experience varies across countries, the scale of these official asset purchases has been very large in some countries. For the emerging Asian countries as a whole (excluding China), the accumulation of foreign reserves has averaged around 3 percent of GDP per year since late last decade, and in some years it has been the equivalent of 5 percent of GDP. In China, the purchases

have been larger still, averaging around 10 percent of GDP over the past three years.

This brings me back to my fourth observation about Asian financial globalization, namely the role of the public sector. In effect, global financial integration has allowed a number of countries in Asia to have saving higher than investment, with the excess saving being channeled through the public sector to the developed countries. This is quite a different model of globalization to that evident in most of the rest of the world. It has implications for both the development of financial markets and the returns that these countries might expect to earn on their foreign investments. It also raises potential foreign policy issues, particularly as central banks and sovereign wealth funds come to hold larger investment positions in other countries. At some point, the model of financial integration is likely to need to evolve to one in which the private sector takes a greater role, although predicting the exact timing and transition path is very difficult.

1.2 *Asset price correlations and foreign direct investment*

The third indicator of financial globalization is the extent to which asset price movements are correlated across countries. Here, the various studies reach a variety of conclusions, but, on balance, they tend to support the idea that correlations have increased over time, particularly for the stock market (Figure 8).

Perhaps the more interesting observation is that correlations tend to jump globally when major financial disturbances occur. This is because these disturbances are typically caused, or at least associated with, sudden shifts in either risk perceptions or risk preferences by investors across the world. When global risk perceptions or preferences change, domestic factors become, at least temporarily, less important.

The stock market crash in 1987, and the Asian financial crisis a decade later, are good examples of this. So are the recent strains in financial systems around the world. The problems in the US sub-prime housing market have been the catalyst for a global repricing of risk, and this has affected asset prices in many countries. This is most clearly seen in interbank funding costs, which increased markedly around the world in August and early September, as credit risk was repriced and concerns about liquidity intensified (Figure 9).

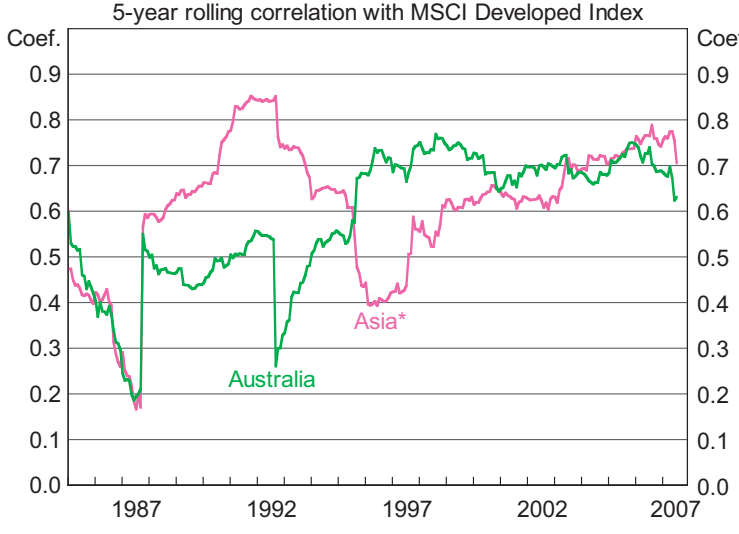

Figure 8. Stock market correlation

* Includes Korea, Malaysia, Thailand, Hong Kong.

Sources: Bloomberg; CEIC; RBA calculations.

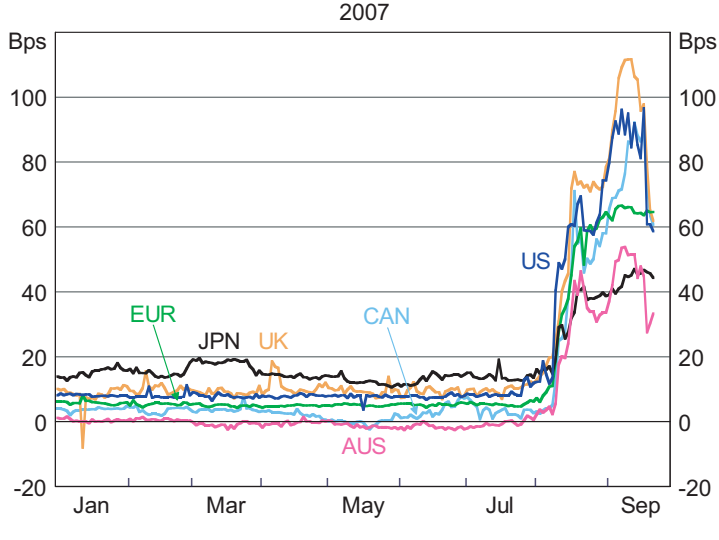

Figure 9. 3-month LIBOR to swap spread

Sources: Bloomberg; Reulers; Tuilett (Australia) Pty Ltd.

Interestingly, the effects have not been as evident in credit markets in many Asian countries, hinting at a lower level of integration than in some other parts of the world. In part, this reflects the fact that Asian banks have recently not relied particularly heavily on international capital markets for their funding, and that structured finance is a less prominent part of the financial landscape in Asia than it is in other parts of the world.

Asian markets, however, have not been unaffected. Credit spreads have increased and Asian stock markets fell significantly in July and the first half of August, before subsequently recovering (Figure 10). Many regional currencies also depreciated sharply over this period, as global risk aversion increased (Figure 11). The Australian dollar was one of these, with the increase in risk aversion triggering an unwinding of carry trades. More recently, most regional currencies have strengthened against the US dollar.

A fourth indicator of financial globalization is the extent of foreign direct investment in the financial sector. Like most areas of the world, many Asian countries have experienced a significant increase in cross-border

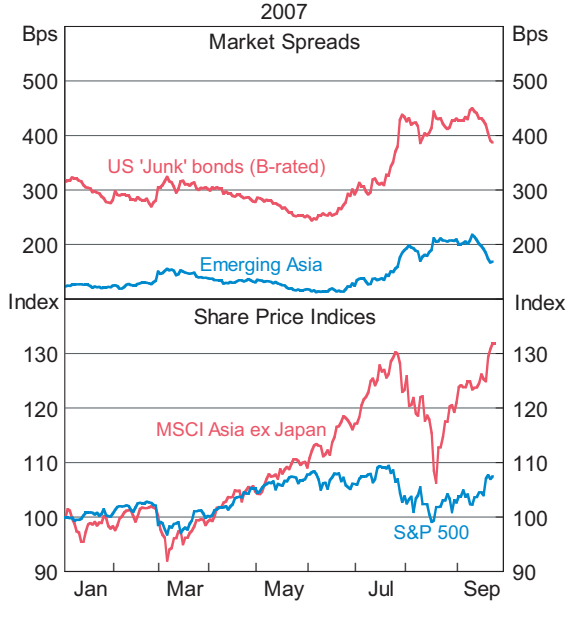

Figure 10. Financial markets
Sources: Bloomberg; Merrill Lynch; RBA; Thomson Financial.

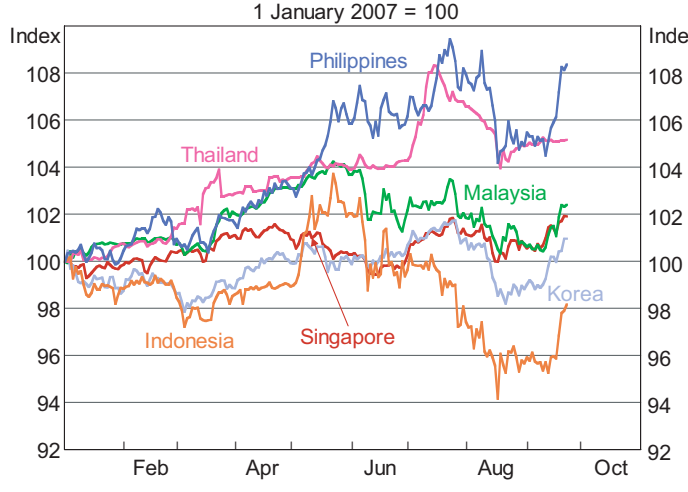

Figure 11. Selected Asian currencies against US$
Source: Bloomberg.

mergers and acquisitions in the financial sector, although foreign ownership remains less extensive than in Latin America or Eastern Europe. Over recent years, foreign banks have established significant presences in a number of countries, including Indonesia, Korea and Thailand. This process has gone the furthest in New Zealand, where foreign banks account for over 98 percent of the country's banking system assets.

One indicator of the extent of foreign involvement in the domestic banking systems is provided by the Bank for International Settlements' (BIS) *International Banking Statistics*. For emerging Asian countries, the value of local claims in local currency of BIS reporting banks has more than doubled over the past three years, with these claims accounting for around 40 percent of total foreign claims (Figure 12). While this ratio has increased significantly over the past decade, it remains lower than in many other areas of the world.

To summarize these various indictors, it is fair to say that the financial systems in many Asian countries have become more integrated into the global system over recent years, although on a number of measures, they appear to be less integrated than those of many other countries. Perhaps the most distinguishing feature of this integration is the role that the public sector has played in channeling the region's savings that

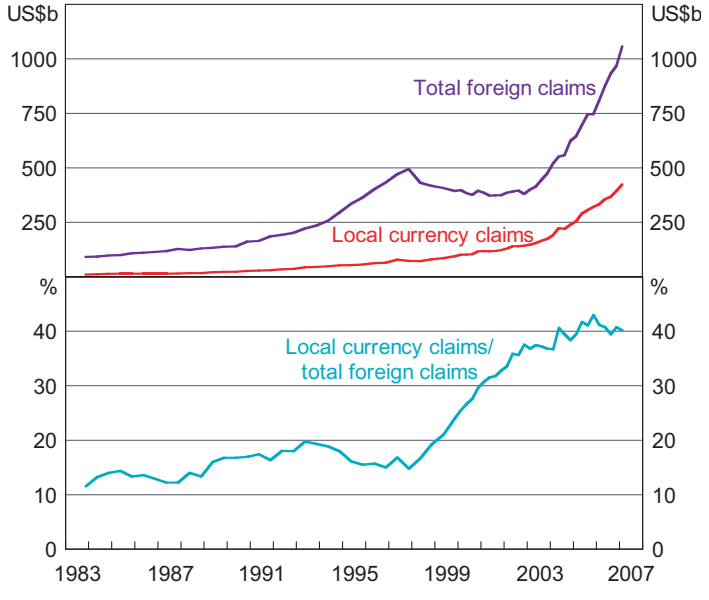

Figure 12. BIS reporting bank claims on developing Asia
Source: BIS.

are not used for domestic investment to borrowers in the developed world.

2. Further Progress

I would now like to touch briefly on three areas where I think further evolution is important if the region is to successfully travel down the path of increasing financial globalization. In raising these areas, it is important to recognize that different countries are at different stages of development, so that the same arrangements are not applicable in every case. But the direction in which we should be heading is pretty clear.

The first of these three areas is the ability of a country to borrow in the international capital markets in its own currency.

Here, the Australian experience is instructive. Australia is one of those many countries that has embraced financial globalization. It has a flexible exchange rate, an open capital account, relatively deep securities markets,

and has made extensive use of the pool of global savings to finance domestic investment. Overall, this integration has served the country well, with few people wishing to see a return to earlier times.

One of the key elements that has allowed financial globalization to be viewed so positively is the ability of Australian borrowers to borrow offshore in Australian dollars. Historically, many people have tended to think about financial globalization in terms of the willingness of citizens in one country to own assets in, or to lend to, another — indeed, this way of thinking is encouraged by the way that the national financial accounts are put together. But this is only half the story. Equally important is the willingness of citizens in one country to take on assets and liabilities denominated in another country's currency. An unwillingness by investors to lend to a country in its own currency significantly complicates the full integration of that country into the world financial system.

In Australia's case, much of the borrowing from the rest of the world is intermediated through the banking sector, with the banks borrowing in a range of markets; as at June 2007, around three-quarters of Australia's gross foreign debt was owed by financial intermediaries (Figure 13). Some of this borrowing is done directly in Australian dollars, but most of it is denominated in foreign currency. But where it is denominated in

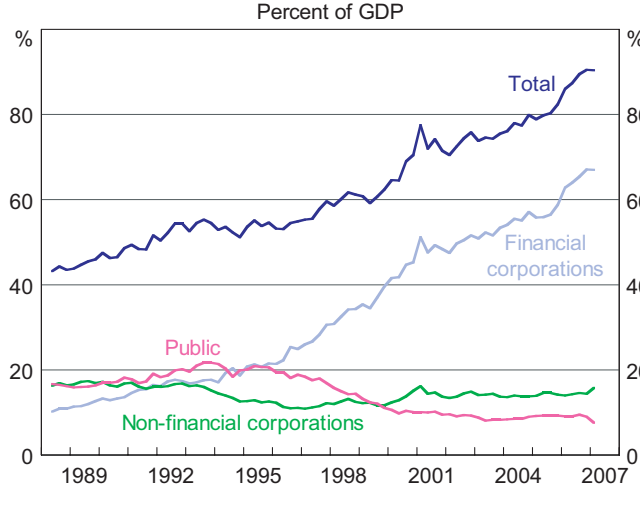

Figure 13. Gross foreign debt — Australia

Source: ABS.

foreign currency, the existence of deep and liquid derivatives markets means that the Australian banks are able to swap these loans back into Australian dollars. The result is that they run little, if any, foreign exchange risk. The banks are able to do this because there is a group of investors in the global economy that is prepared to take on Australian dollar foreign exchange risk.

Getting to this position took a number of years. I expect that many countries in Asia will also one day get to this position, although considerable progress still needs to be made. How best to travel the path is a difficult question. Having a sound macroeconomic framework and developing confidence in public institutions are important. So too are developing a local currency yield curve and allowing some fluctuations in the exchange rate. Without these fluctuations, the deep and liquid markets that are required for hedging and managing risks have difficulty developing. And without these markets, foreign investors are likely to remain reluctant to take on local currency exchange rate risk. Having the public sector play such an important role in the capital account is not particularly conducive to this development.

This brings me to my second area — and that is exchange rate flexibility. Having an exchange rate that moves around is clearly important in creating the right incentives for the necessary markets to develop. But it is also important in allowing a country to cope with swings in the international investment community's appetite for local assets and the local currency.

Again, to draw on the Australian experience, during the high-tech boom of the late 1990s, Australia was terribly unfashionable with global investors — we were seen as an old-fashioned economy, a user rather than a producer of technology-intensive goods. The result was a marked fall in the inflow of capital. In response, the exchange rate depreciated significantly. While this was uncomfortable at the time, it greatly cushioned the economy from the marked decline in investment in this "unfashionable" economy. Since then, the resources boom has come along, Australia's terms of trade have risen significantly, and Australian assets and the Australian dollar are back in favor. As a result, the exchange rate has appreciated considerably, and this has again been helpful in terms of macroeconomic management. This exchange rate flexibility has been a key element in Australia's uninterrupted economic expansion over the past 16 years.

Again, it took Australia a long time to get to this position. We tried almost every type of exchange rate regime (except a currency board!)

before we finally got there in 1983. Now that we are there, we see it as a crucial element in living successfully in this globalized financial world.

The third and final issue — and one that is particularly relevant to this conference — is cross-border crisis management. We are moving inexorably to a world of *global* financial institutions that are operating in *global* markets, yet crisis management largely remains essentially *local*. To date, this tension has not caused great difficulties, but then again the current arrangements have not been put under any real pressure. This is an area where changes in the global financial system have clearly run ahead of the supporting regulatory framework.

This lack of progress does not reflect a lack of work or goodwill of those involved. Rather, cross-border crisis management is fundamentally difficult! There are complex technical and legal issues involved. But there are also political, and even foreign policy, issues at stake. Who pays for any bailout? Can you trust the other jurisdiction not to grab all the assets? What happens if multiple jurisdictions can't agree to a common solution?

At least from my experience, discussions on these questions are often stymied by an understandable suspicion that the other country will, in a crisis, act in its own, rather than the common, interest. In principle, one way of getting around this suspicion is for both sides to make a credible commitment to a particular approach. However, doing this is far from straightforward, and at least for the foreseeable future, probably impossible in most cases.

This, however, does not mean that progress is impossible. In the case of Australia and New Zealand, both countries have recently changed their banking acts to explicitly state that each country's prudential supervisor must take account of financial stability in the other country in its decision-making. This change in legislation represents a high-level political recognition in both countries that there are common interests. In particular, it sends an important message that both governments expect the common interest to be taken into account. It is clearly not a panacea for all the problems that can arise in cross-border crisis management, but it represents a significant step forward.

Thank you.

The Current State of Financial Globalization — Good News, and Bad

Gerard Caprio, Jr.*
Williams College

Were financial globalization a stock, its price would have displayed remarkable volatility in recent months, for reasons to which I shall turn below. The papers in this session by Gianni De Nicolò and Philip Lowe remind us of the upside of financial globalization, for which we shall be thankful. I did not have the opportunity to see the paper by Falko Fecht, Hans-Peter Grüner, Philipp Hartmann and Marco Lo Duca, in part as a result of the "dark side" of financial globalization, namely the recent turbulence in financial markets. This provides an opening for me to discuss those events here, even though it has received less attention in most of the papers.

De Nicolò reminds us of textbook reasons for why so many favor financial globalization, starting with the ability to have savings and investment diverge more. This should contribute to higher welfare levels worldwide. Moreover, the increase in the efficiency of capital allocation promises greater growth in the future. De Nicolò finds a reduction in the dispersion of equity premia around the world and argues that the increased speed of financial integration in Europe offers the prospect of greater benefits in the future, and that it is worthy of emulation in lagging regions. I find little to quibble with here.

Lowe notes four indicators of financial globalization: the scale of cross-border flows, the correlation of savings and investment, the correlation of asset price movements, and the extent of foreign direct investment in the banking system. I would add another, namely the usage of financial intermediaries and financial services without regard to the domicile or nationality of the provider. If financial globalization continues at its

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current pace, and given the advances in Internet banking, we could see a world in which people around the globe could walk into a store and make a payment in their currency and their intermediary of choice, from anywhere in the world. One aspect of this: foreign currency usage is significant in many countries around the world, according to the World Bank database on bank regulation and supervision, which Jim Barth, Ross Levine and I have just updated for the Bank and is posted on its website. Lowe points to factors such as the liberalization of the capital account that permit certain aspects of financial globalization to proceed. Foreign ownership of financial intermediaries also has played a role (Figure 1). This aspect of integration advanced rapidly in some countries, notably Mexico.

How has this happened? Certainly financial crises have played a part, as countries that previously tried to keep foreign banks out finally acknowledged that they would rather have foreigner entities with deep pockets bear the burden of future losses, and perhaps even run the banking system better. There is evidence in World Bank research that the upside of this increased entry has been greater competition and a move to increase the penetration of the formal financial sector in the economy. This has been beneficial, especially where not crowded out by government borrowing — preliminary evidence, yes, but promising nonetheless. Another facilitating factor that allowed this to occur was the retrenchment of the state as an

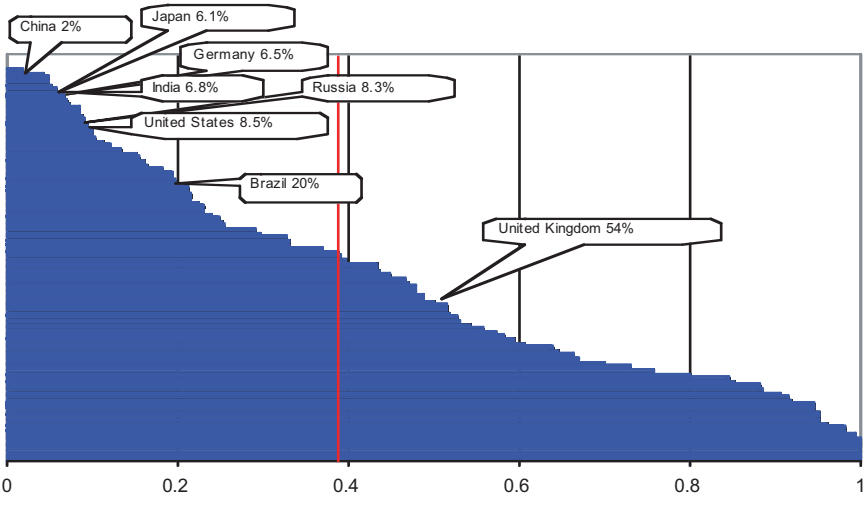

Figure 1. Share of total assets in foreign-owned banks as of year-end 2005

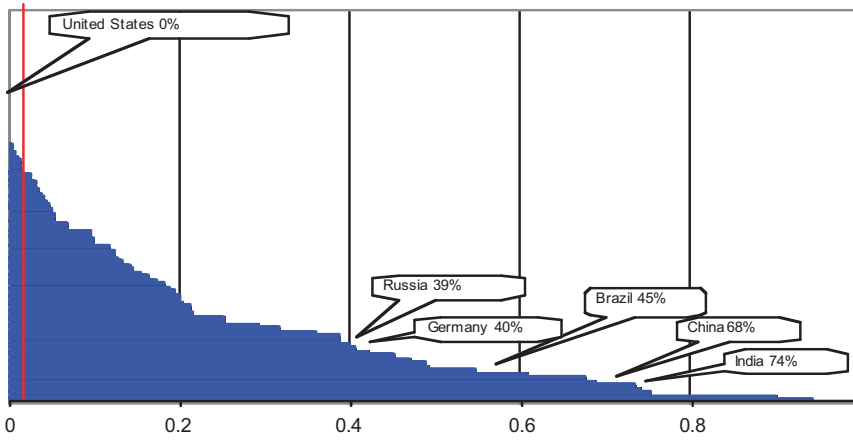

Figure 2. Share of total assets in government-owned banks as of year-end 2005

owner in the banking sector. Figure 2 shows how far we have come — that Russia now has a bit less state ownership than Germany (though I bet that the latest "turbulence" will lead to further declines there), and that China has now reduced its state ownership by about a third, so that only two-thirds of its assets are in government banks, is remarkable.

So, there is much to celebrate, as both papers describe. But now, about that dark side. Globalization is popular when the shocks being transmitted are benign, but not in the opposite case. As we saw in recent months, the combination of securitization and globalization has an unhappy implication for some European (and other) financial intermediaries, as they were left holding the bag when the sub-prime market finally met the end that so many saw coming. Portfolio shocks are even more dangerous when innovation leads to a reduction in transparency, so that in times of trouble, credit lines get cut to good and bad intermediaries, exacerbating systemic risk.

We have also seen that bad ideas get transmitted quickly in the financial sector, as, for example, deposit insurance has now spread to about 80 countries. Research shows that adopting deposit insurance in a weak institutional environment can lead to costly crises. While some of the recent adopters might be able to hold down the risks, are Russia, Tajikistan and Zimbabwe — the most recent adopters — up to the task, or will the increased ability of banks to gamble with insured deposits make risk-taking and outright theft easier?

Worse might be in store. While the advice has been to keep the guarantee limited in countries with weak institutions, UK authorities were so quick to extend deposit insurance in the case of Northern Rock that blanket coverage could easily become the norm. My assumption that countries will copy bad practice such as deposit insurance (and Basel II, but that is a longer story on which I am already on record), and not good practice such as FIDICIA or a mandatory subordinated debt proposal, is not merely a perverse view of human nature, but rather the view that politicians respond to incentives, and when presented with the quick, easy and (for themselves) cheap way to respond to problems, they jump at it. What is most regrettable about the rush to full guarantees in the Northern Rock episode is that it did not have to occur. Northern Rock's deposit base was only 25 percent of its liabilities, and so the Bank of England could have accepted its paper at a high penalty rate and/or with a deep haircut and still have provided the resources to stop the retail depositor run, letting large creditors with deeper pockets take the hit. Discounting any paper as if it were riskless surely would create a moral hazard — recent op-ed pieces by Raghu Rajan and Charles Goodhart each are correct in this respect — but when haircuts are possible, central banks can still ensure that sufficient pain accompanies the experience so that subsequent risky practice will be held in check. Of course, outsiders do not know if Northern Rock was solvent at the time of its first approach to the Bank of England, but if it were not, it should have been closed down earlier. Were there coordination problems or differences of opinion between the BoE and the FSA?

Still more concern about financial globalization: that it has far outrun our ability to coordinate regulatory policies. Europe has not resolved its muddied situation on the lender of last resort (LOLR) in a crisis, as noted at last year's conference, and that this crisis was sufficiently large to unlock billions in liquidity but not unblock intransigent positions on the LOLR issue surely is cause for concern. Easy liquidity is not a substitute for an LOLR policy.

In sum, the world keeps advancing toward greater globalization in finance, and some believe that globalization only will advance. But recall the last time, about a century ago, when Keynes told us that attitude was also deeply entrenched, as he later described the pre-WWI years:

> "The inhabitant of London could order by telephone, sipping his morning tea in bed, the various products of the whole earth, in such quantity as he might see fit, and reasonably expect their early delivery upon his

> doorstep; he could at the same moment and by the same means adventure his wealth in the natural resources and new enterprises of any quarter of the world and share, without exertion or even trouble, in their prospective fruits and advantages; or he could decide to couple the security of his fortunes with the good faith of the townspeople of any substantial municipality in any continent that fancy or information might recommend. He could secure, forthwith, if he wished it, cheap and comfortable means of transit to any country or climate without passport or other formality. He could dispatch his servant to the neighboring office of a bank for such supply of the precious metals as might seem convenient, and could then proceed abroad to foreign quarters, without knowledge of their religion, language, or customs, bearing coined wealth upon his person, and would consider himself greatly aggrieved and much surprised at the least interference. … but, most important of all, he regarded this state of affairs as normal, certain, and permanent, except in the direction of further improvement, and any deviation from it as aberrant, scandalous, and avoidable" (1919).

Are we on a similar trajectory? In addition to the tremors in credit markets, concerns about inequality and protectionist tendencies are two added reasons for thinking that globalization is not a one-way street. While the pace of globalization in many sector advances, a sense of foreboding continues. Last year, I proposed that each conference should have a movie to illustrate its theme, and the movie I proposed for the theme then was the 1940s classic, *A Wing and A Prayer*. For that was about all that I concluded we had to avoid a crisis from cross-border finance — much hope, but not much else. This year, my nominee is the movie *Jaws*. First, there are the parallels between the plot and current events — the movie begins after many sunny days and a boring summer, the danger is denied by authorities for some time, etc. However, even more I would choose this movie as appropriate as a movie for the conference for its soundtrack. Throughout the movie, the music suggests a hidden menace, occasionally reaching a minor crescendo, but then subsiding for a while, before bursting on the audience. Who will be the victims? We do not yet know. I recommend that this music should be playing in central banks and supervisory agencies around the world — the music that lets them know that the beast is out there, and is hungry.

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III. GLOBALIZATION AND SYSTEMIC RISK — THEORY

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Incentive Conflict in Central Bank Responses to Sectoral Turmoil in Financial Hub Countries

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Political concern for the safety of a particular enterprise or economic sector increases both with its clout and with the extent to which its failure might generate negative externalities that harm voters and so-called innocent parties that cannot directly influence the tradeoffs its managers make. Implicitly or explicitly, most governments maintain a safety net for banks and selected other firms. This net combines measures that restrict the risky positions that protected institutions assume in the first place with measures that limit the damage that customers, employees, creditors and stockholders suffer when and if disaster ensues. Managers of protected institutions may be likened to a team of high-wire artists. They deliberately throw themselves into risky positions and, when things turn out badly, a messy multiparty disaster can ensue.

The first section of the paper identifies the conceptual components of a national safety net and describes the incomplete ways that the nets of financial-center countries are joined today. The second section introduces the idea that national regulatory cultures exist and embrace conflicting norms. The third section develops the hypothesis that financial turmoil alters the preference ordering that regulatory cultures assign to conflicting regulatory norms. In times of turmoil, the incentive force exercised by norms that foster truth-telling and accountability for efficient and distributionally defensible loss control declines sharply, while the influence of competing nationalistic and blame-minimization norms intensifies. For the leaders of the hegemonic global regulatory community (especially the Fed and the European Central Bank), the absence of an established

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procedure for sharing losses that might be imbedded in the accounts of large multinational institutions increases the depth of their exposure to a personal and bureaucratic reputational disaster. To reduce this exposure, policy-makers in these countries can use central bank lending to shift some of the worrisome losses to national taxpayers by directly and indirectly subsidizing troubled financial markets and institutions that lie within their purview whenever it appears that financial-institution insolvencies may be widespread. Officials' reputational concerns and limited policy options combine to create a disposition to overreact to multinational financial stress (such as that observed during the 2007–2008 subprime turmoil). In the US, this disposition implies that having a corporate subsidiary with primary-dealer status opens a channel through which a few deeply troubled foreign conglomerates and domestic nonbanks can plan to extract substantial subsidies by engaging in repurchase agreements with the Fed.

Current market turmoil may be attributed to the market's simultaneous reassessment and repricing of the downside risks inherent in securitization vehicles that outsourced the due-diligence phase of the underwriting process to credit-scoring models and credit-rating organizations. For example, trading in the riskiest slice of the ABX index of bonds backed by home loans made in the second half of 2006 slid to a new low of 18 cents by late October, while the TABX index (which proxies the assets underlying collateralized debt obligations) has also continued to slide.

Risk reassessment and repricing clogged the pipeline of unfinished securitizations, particularly for institutions and conduits that originated or packaged the riskiest loans or securitization structures. In addition, the repricing undermined the solvency of highly leveraged institutions (such as structured investment vehicles) that had routinely short-funded a risky portfolio.

Although using central bank resources to relieve insolvency-driven shortages of liquidity at troubled institutions keeps markets running more smoothly in the short run, it generates adverse long-run consequences by allowing institutions to reap rewards in proportion to the imprudence they showed in originating, pricing and securitizing poorly underwritten loans. Accommodating their needs threatens to exacerbate the depth, breadth and duration of future instances of financial-institution insolvency by encouraging these and other institutions to underinvest in due diligence in the future. The fourth section explains that, to offset short-run pressure on central banks to give troubled institutions a break, it is

important to require officials to follow market-mimicking procedures in curing so-called liquidity shortages and to justify and account explicitly for the value and distribution of the subsidies their last resort lending generates.

1. Understanding National Safety Nets and How Weakly They are Linked

Financial stability is often defined by contraposition: as the absence of widespread liquidity and solvency crises. An enterprise experiences a liquidity crisis when it finds it difficult and/or inordinately expensive to refinance its debt or to meet other obligations as they come due. A liquidity squeeze is usually rooted in an overleveraged balance sheet or an unsupportable business plan. In other cases, lending institutions should be able to recognize a firm's legitimate credit needs. However, when financial institutions in a given nation or region undergo serious liquidity crises of their own, their ability to support the liquidity needs of viable customers can be temporarily disrupted.

The desirability of preventing the dissolution of fundamentally healthy firms creates a logical case for the existence of private or governmental lenders of last resort (Thornton, 1802; Bagehot, 1873; Bordo, 1992).

A troubled firm falls into insolvency when the discounted value of its accumulated and projected losses exceeds its capacity to absorb these losses. For an individual nation, a corporate insolvency crisis amounts to a tsunami of individual-firm red ink. A *financial tsunami* occurs when losses passed into the accounts of at least one systemically important financial-services firm or sector overwhelm its enterprise-contributed capital and are perceived to be spilling rapidly into the balance sheets of various counterparties. The crisis is propagated by the political and economic efforts of potential loss-bearers to shift their contractual exposure to the tidal wave of losses onto less-wary parties, especially ordinary taxpayers.

A nation's financial safety net has three goals: (1) avoiding liquidity and insolvency crises; (2) identifying and alleviating temporary liquidity shortages (that is, "disorderly markets"); and (3) mitigating the effects of both isolated and widespread insolvencies when they surface. The fabric of the net combines arrangements intended to detect and contain developing financial-institution problems with politically feasible arrangements

for absorbing and distributing losses that protected institutions might incur. This paper argues that, whereas national safety nets in hub countries may be likened to a relatively sturdy nylon mesh, the fabric connecting these nets is tissue-thin. For safety net managers, the cross-country tissue fails to establish global accountability for the knock-on economic effects of the policies they follow. Without such accountability, national authorities are free to maximize a myopic and self-determined welfare function that they need not worry about revealing or defending *ex post*. Given so much discretion, global safety net support is unlikely to be allocated in distributionally defensible or cost-effective ways either within or across nations (cf. Todd, 2002).

Systemic risk concerns the chance of a system breakdown or devolution. Breakdowns may come from damage that spreads contagiously from one part of a network to another or from the disintegration of one or more network connections. Within a country, systemic risk expresses the danger that a wave of insolvencies will suddenly interfere with payments and credit flows between regions and major institutions. In a global context, systemic risk is the risk that losses embodied in one nation's wave of insolvencies will batter firms and households located on foreign financial shores. By expanding opportunities for transferring local risks across countries at low cost, globalization helps to reduce the concentration of idiosyncratic risks in individual nations. But at the same time, intrafirm and hub-and-spoke linkages between the financial-services firms and markets of individual nations provide opaque channels through which the destructive energy unleashed by one country's liquidity shortage or insolvency crisis and its speed of transmission to other countries might actually be amplified.

Regulatory lags in adapting to cross-country securitization have left the tissue connecting national safety nets dangerously thin. National markets for interbank loans and financing customer needs are integrating faster through intrafirm and hub-and-spoke linkages than arrangements for mitigating the consequences of cross-country shocks. By default, responsibility for managing global crisis pressures falls upon a handful of incentive-conflicted national regulatory institutions and cross-country lenders of last resort. To understand how these pivotal institutions might interact in different kinds of global crises, one must recognize that inconsistent constraints and incentives are built into the norms that govern the political and regulatory cultures within which their managers operate.

1.1 *Components of national nets*

Modern finance theory emphasizes that financial-institution customers and safety net managers must control incentives for opportunistic behavior by financial-institution managers, owners, and borrowers (Jensen and Meckling, 1976; Diamond, 1984; La Porta *et al*., 1998). Managerial opportunism has three intertwined roots:

(1) *Monitoring costs*: difficulties outsiders face in obtaining reliable information about unfavorable developments and observing adverse actions by institution managers, including recklessness, negligence, incompetence, fraud and self-dealing;
(2) *Policing costs*: difficulties outsiders face in adequately analyzing and responding to whatever information its monitoring activity uncovers;
(3) *Coordination costs*: difficulties customers and national safety net managers face in coordinating collective action.

Safety nets centralize the functions of monitoring, analyzing and responding to evidence about institutional performance. Ideally, this outsourcing of due diligence helps financial institutions to maintain customer confidence by solving three coordination problems: avoiding redundant monitoring expense; standardizing contracting protocols; and timing and calibrating disciplinary action. When its incentives are aligned with society's needs, a conscientious monitor-enforcer will make it unprofitable for institutions to misrepresent their economic condition to customers and to pursue profit-making opportunities that unfairly exploit their informational advantages.

Viewed as a bureaucratic structure, a safety net has three components: (1) financial-institution regulators and monitors; (2) lenders of last resort; and (3) regimes for financing safety net activities and allocating the losses imbedded in insolvent enterprises. This architecture is supported by a social contract whose counterparties are major sectors of a nation's political, regulatory and economic communities. In principle, the contract has three segments:

(1) Subcontracts that define and assign supervisory responsibilities for *preventing* and *resolving* disruptive financial-institution insolvencies;
(2) Subcontracts that define a range of *tax-transfer techniques* for financing this supervisory activity and whatever losses it fails to prevent; and

(3) Subcontracts that dictate the political and economic *incentives* under which such safety net operators discharge their responsibilities.

1.2 *Tissue connecting national nets in open economies*

Regulators in hub countries are well aware of the need to stretch the span of their safety nets to match the span of the markets and institutions under their purview. However, they lack the authority to tax or compensate foreign entities directly as global stability might require. The connections forged to date focus mainly on guarding against crises in good times and hardly at all on how to deal with crises when they occur (Eisenbeis and Kaufman**,** 2005).

Two world-spanning portfolio institutions were established in 1944 at Bretton Woods: the International Monetary Fund (IMF) and the World Bank. Unlike the Fund which can operate somewhat like a bank, the Bank operates as a fund that cannot provide timely crisis assistance. The European Central Bank (ECB) is an important and more recent regional portfolio institution. Its monetary-policy activities span the markets of Euro-area countries.

National safety nets are also linked by a series of less comprehensive international financial organizations. These bridging organizations are of two types: (1) *portfolio institutions* to which member countries have contributed funds that their managers invest in particular kinds of assets, and (2) intergovernmental and self-regulatory *forums for coordination* (such as the Financial Stability Forum and Financial Stability Institute) that serve primarily to debate, evaluate and secure agreement on rules and standards for overseeing cross-border business in a club-like atmosphere.

At least six worldwide coordinating forums deserve mention: the World Trade Organization (WTO), the Bank for International Settlements (BIS), the International Organization of Securities Commissions (IOSCO), the International Association of Insurance Supervisors (IAIS), and the International Association of Swaps Dealers (IASD).

Functioning within the BIS, the Basel Committee on Banking Supervision (BCBS) leads the way in formulating cross-country standards for banks. Regionally, the European Commission develops economic policy guidelines for European Union (EU) countries. These last two forums have developed the principle that primary responsibility for the solvency of multinational financial conglomerates lies with home-country regulators.

Arguably, only the BIS, the ECB and the IMF establish financial and regulatory tissue that meaningfully connects the supervisory activities and fiscal resources that constitute financial nets in different countries. These three institutions seek to persuade individual countries to identify and adopt improved safety net arrangements. However, only the ECB can truly create money and is able to react promptly enough to assist troubled institutions and markets when they fall into distress.

Because none of these institutions has the authority to levy taxes at will, their managers cannot overtly allocate losses in crisis circumstances. Whatever subsidized crisis assistance these entities can supply must flow through some form of last resort lending.

This paper makes three points:

(1) The global net enlarges the web of multiparty contractual duties and obligations facing managers of national nets. The links concern the deployment of implicit government guarantees and subsidized lender-of-last-resort credit facilities.
(2) Central bank repurchase agreements have evolved into a particularly opaque substitute for discount-window lending.
(3) The absence of a global tax-transfer mechanism for resolving the insolvency of multinational conglomerates is apt to call forth an inflationary oversupply of subsidized last resort lending from central banks in financial hub countries when substantial multinational shocks first emerge.

2. Incentive Conflicts Built into National Regulatory Cultures

In a democracy, financial regulation and supervision are cooperative endeavors. Anyone can propose rules, but to command compliance requires legitimacy: a mutual understanding that the rules are conceived and enforced to increase the social welfare of an identifiable community.

2.1 *Dimensions of regulatory culture*

To win and sustain a legitimate right to wield coercive force on behalf of a larger community, regulators must accept and respect appropriate checks on their authority. An "appropriate" check is one that incentivizes regulators to act in ways that are consistent with the community's political

institutions and its citizens' understanding of the community's past regulatory experience.

A culture is defined as customs, ideas and attitudes that members share and transmit from generation to generation by systems of subtle and overt rewards and punishments. Carnell (1993) and Kane (2000, 2004) assign regulatory culture the role of defining, authenticating and promoting the financial common good. One country's regulatory culture may differ from another's along as many as six dimensions:

(1) In the character of the statutory grant of authority, the reporting responsibilities and governance structure that a regulatory enterprise receives;
(2) In the specific rules the enterprise formulates and how it develops and promulgates them;
(3) In the methods the enterprise uses to monitor for violations;
(4) In the penalties it can or does impose on clients when it finds material violations;
(5) In the nature and extent of due-process restrictions (including specific burdens of proof) that protect regulated institutions from unfair administrative procedures; and
(6) In the character of institutions' rights to appeal regulatory decisions to a higher authority.

The taboos and traditions incorporated in a regulatory culture take the form of norms that embody community goals and standards of fair play and proper use of government power. The first four dimensions of the culture set limits on safety net managers' authority over their regulatees. Along with banks' rights to challenge and appeal adverse actions, the final two dimensions of a regulatory culture provide credible ways for regulators to bond themselves to exercise their authority in the joint interests of financial institutions and their various creditors and counterparties.

2.2 *Importance of transparency and deterrency*

To complete the cycle of social-contract enforcement, the suppliers of regulatory risk capital — healthy institutions and ordinary taxpayers — must be able to observe and discipline the economic value of their stake in the rule-making and enforcement activities that regulators undertake.

Ideally, savvy taxpayers would impose reporting requirements and establish deterrent rights sufficient to persuade net managers to deploy their examination, supervisory and lending powers at reasonable economic cost to society as a whole. Also ideally, these costs would be measured comprehensively and include both the costs of operating the net and the costs of managing its occasional breakdown. Taxpayer ability to monitor regulators is important because the cooperative nature of financial regulation and the exercise of appeal rights by regulated institutions would otherwise tend to make regulatory personnel overly responsive to industry concerns (i.e., subject them to regulatory "capture").

2.3 *What if monitoring and policing costs were zero?*

Regulators' tools of damage control are rule-making and enforcement. To understand the economic role these tools play, it is helpful to imagine a world in which customers' monitoring and policing costs are uniformly zero. In this world, financial contracts would not need external enforcement. Coordination costs would be irrelevant. Establishing a team of centralized monitors and enforcers to thwart risk-shifting and misconduct by bank insiders would offer no incremental benefit either to institutions or to their customers. In such a world, changes in an institution's condition and risk exposure would be transparent to everyone, and counterparties would possess sufficient expertise and sanctions to deter an institution's insiders from trying to take advantage of them.

Maximal transparency (MT) describes a framework of disclosure that would perfectly and costlessly inform customers about changes in bank or fund performance and risk-taking activities. To set up an easy-to-remember rhyme, we coin the term *maximal deterrency* (MD) to describe a situation in which customers would immediately and perfectly understand the implications of information flows and would be able to protect themselves completely and costlessly from whatever threat to their wealth this information might reveal.

The more closely an economy comes to offering creditors maximal transparency and maximal deterrency, the less *ex ante* value that financial institutions and safety net managers can create for their counterparties. In an MTMD economy, cash in advance and credit could substitute perfectly for each other in every payment context. Similarly, direct and indirect

finance would provide equally economical ways of mobilizing savings, of choosing which real investment projects savers ought to support, and of deciding how to price project risk. As envisaged in the Capital Asset Pricing Model, corporate and government securities could be offered in denominations small enough to allow virtually every individual saver to invest directly in a diversified portfolio of stocks, bonds and derivative securities.

The MTMD thought experiment clarifies that safety nets owe their existence to market imperfections which include: difficulties of contract enforcement; blockages in information flows; differences in monitoring costs; variation in financial transaction costs; delays in appreciating and processing relevant information; and the costliness and inadequacy of the deterrent remedies that individual depositors have available to them. It also clarifies that a national safety net is implicitly a six-party contract. The net imposes mutual rights and duties on institutions, investors, borrowers, depositors, safety net managers and suppliers of safety net capital (principally healthy banks and taxpayers). The touchstone by which to judge the performance of safety net managers is how fairly they treat each of the many counterparties participating in their social contract and how efficiently they control the diverse social costs of coping with divergences from MT and MD conditions.

3. Global and National Incentive Conflicts in Safety Net Management

In practice, national safety net managers assemble a staff that can wield six categories of regulatory instruments:

(1) Record-keeping and disclosure requirements;
(2) Activity limitations;
(3) Capital, loss-reserving and other position limits;
(4) Takeover rights and other enforcement powers;
(5) Lines of credit; and
(6) Performance guarantees.

It is not enough for safety net managers to use these instruments to block corrupt and unwise flows of institutional credit and avoid customer runs. They must seek also to minimize the social damage caused

by temporary bouts of illiquidity and by lasting insolvencies. Moreover, to administer lender-of-last resort facilities properly, safety net managers must perform a financial *triage* function. This begins by identifying solvent but illiquid institutions and shielding them from having to sell assets into momentarily disorderly markets at fire-sale prices. But efficient triage must also establish an accountable procedure for identifying and either winding up or recapitalizing insolvent institutions.

3.1 *What countries manage the global safety net?*

Arguably, procedures for developing recommendations and controlling the portfolio activity of supranational institutions give disproportionate weight to the interests of the US, Britain and the few other countries that function as global hubs. For example, in the Basel Committee on Banking Supervision, the US has four representatives and Britain two. This overweighting is no accident. Only a few national money markets have forged strong *interinstitutional* links with one another. While *intrainstitutional* linkages are extremely important, most cross-border institution-to-institution business (especially, securitizations and derivatives transactions) flows to and from major financial-services firms headquartered in global hub countries. To understand who manages systemic risk globally, one must first identify these hub countries.

Wojcik (2007) measures the value of international financial-services business currently performed by firms headquartered in 41 leading countries. His index shows that this product line is dominated geographically by firms headquartered in the UK, US, and Euro area (especially Germany, France and The Netherlands). Other countries perform much less international financial service.

The UK produces roughly 30 percent of the relevant services, followed by the US which supplies another 20 percent. Euro-area countries furnish 28 percent, although a good portion of this is probably transacted among area countries. Even though each of the following countries is among the world's top-ten producers, Hong Kong, the Caymans, Japan and Switzerland book only 12 percent of the market among them. Australia and Canada handle another 3 percent. The last 7 percent of the market is shared by 19 other countries.

3.2 *Differences in hub-country cultures*

The first dimension of any regulatory culture establishes a bureaucratic structure for managing particular portions of the net. In the hub countries we have identified, this structure is multidimensional and generates a number of uncomfortable incentive conflicts.

In the UK, the tasks of making and carrying out monetary-policy decisions and of monitoring financial-institution loss exposures are assigned to different organizations. The Bank of England is tasked with stabilizing the real economy and financial markets, while the Financial Services Authority (FSA) handles financial supervision. In the US, the Federal Reserve System jointly pursues both tasks. Additional incentive conflicts come from the Fed's need to share (and compete for) rights to supervise variously chartered institutions with other agencies. In theory, the Fed's interest in competing for regulatory turf — both globally and with other US agencies — adds goals and restraints to its monetary policy-making process and regulatory culture that the Bank of England (B of E) faces in more overtly political ways.

Although the Fed is the sole supervisor for the US *holding companies* that ultimately book the vast majority of America's cross-country loss exposures, by converting its national-bank subsidiary to a federally chartered thrift in March 2007, Countrywide Financial cleverly moved itself into the mortgage-market friendly jurisdiction of the Office of Thrift Supervision and extricated itself from direct supervision by the Fed and OCC. Moreover, as mortgage-market turmoil expanded, Fannie Mae and Freddie Mac sought to expand their role in stabilizing mortgage markets at the expense of the Fed. The policy significance of this intensification in regulatory competition has increased as mortgage-market turbulence became more and more prolonged.

In the global arena, the B of E competes for jurisdiction with both the Fed and the ECB. Like the B of E, the ECB conducts monetary policy (jointly for Euro-area countries) and has to leave supervisory activities to other parties — the member nations to whom it is politically accountable. However, unlike the B of E, in an emerging crisis, the ECB does not have a discount window and must adapt its decisions about substitute forms of last resort lending to the needs that individual-country regulators put forward.

These differences in supervisory responsibility and channels for clientele influence are bound to affect the amount and quality of information

available to central bank personnel at the outset of either type of crisis. In particular, with only a few large domestic organizations to investigate, one might have thought that B of E personnel would be able to separate liquidity shocks from solvency shocks more quickly and more effectively than either the Fed or ECB can. However, the B of E's handling of the Northern Rock episode throws both hypotheses into doubt.

Principal–agent theory indicates that incentive conflicts driven by regulatory competition and clientele pressure for relief explain, at least in part, the different patterns of diagnosis and initial response during the August 2007 sub-prime turmoil. The B of E's initially hard-line response to FSA requests for it to help UK mortgage lenders indicates that it did not see hedge-fund failures and wholesale writedowns of mortgage-backed and other structured securitizations as posing as great a threat to real economic activity as spokespersons for the two other hegemonic central banks vigorously proclaimed. Governor Mervyn King stressed a concern for mitigating moral hazard that spokespersons for the FSA, ECB and the Fed downplayed (Schieritz and Wiesmannin, 2007).

3.3 *Repurchase agreement as particularly opaque last resort loans*

Even in emergencies, the Fed's discount window is ordinarily available only to institutions chartered in the US and their condition and need for funds are reviewed before a loan is dispersed. In contrast, repurchase agreements are put out at auction to a previously designated set of 21 "primary dealers" in securities. As Table 1 indicates, eligible counterparties include subsidiaries of Countrywide Financial (the largest originator of zero-equity and nonamortizing mortgages in the US) and 11 foreign conglomerates (including HSBC whose US subsidiary was also an aggressive mortgage lender). Although interaffiliate loans from bank subsidiaries of US holding companies are restricted by the Fed's Regulation W and Section 23A of the Bank Holding Company Act, other primary dealers were able to on-lend the proceeds from Fed repos to affiliated parties without restriction. When the subprime turmoil intensified in early August 2007, several troubled mortgage lenders and selected hedge-fund sponsors (Countrywide, HSBC and Bear Stearns) and foreign institutions (whose opportunity cost for funds were rising sharply) were likely both to bid aggressively for repo funds and to enjoy substantial subsidies on

Table 1. List of designated primary dealers authorized to bid when repurchase agreements are offered by the Fed

BNP Paribas Securities Corp.
Banc of America Securities LLC
Barclays Capital Inc.
Bear, Stearns & Co., Inc.
Cantor Fitzgerald & Co.
Citigroup Global Markets Inc.
Countrywide Securities Corporation
Credit Suisse Securities (USA) LLC
Daiwa Securities America Inc.
Deutsche Bank Securities Inc.
Dresdner Kleinwort Wasserstein Securities LLC
Goldman, Sachs & Co.
Greenwich Capital Markets, Inc.
HSBC Securities (USA) Inc.
JP Morgan Securities Inc.
Lehman Brothers Inc.
Merrill Lynch Government Securities Inc.
Mizuho Securities USA Inc.
Morgan Stanley & Co. Incorporated
Nomura Securities International, Inc.
UBS Securities LLC

Source: Downloaded from the website of the Federal Reserve Bank of New York on September 15, 2007.

whatever funds they managed to raise in this way. Around August 20, the Fed used its authority to exempt banking organizations from 23A limits to grant Citigroup, JPMorgan Chase and Bank of America a parallel (albeit temporary) right to engage in well-collateralized securities financing transactions with their affiliates.

3.4 *How repurchase agreements substitute for discount-window loans*

Traditionally, last resort loans have been disbursed through the discount window and offered only to banks. In the midst of either a liquidity or insolvency crisis, last resort lending to a restricted class of borrowers

inevitably delivers implicit subsidies to members of the favored class. What we may call the *subsidy-minimization norm* of last resort lending requires that subsidy-minimizing collateral requirements be imposed and that contract interest rates show a substantial premium over rates observed on less risky securities in the open market.

Even though many nonbank institutions are eligible for emergency central bank loans today, penalty rates and collateral requirements make it costly and even dangerous for deeply distressed nonbank firms to meet their liquidity demands through the discount facility. For a firm that is in or approaching insolvency, central bank insistence on charging reasonable risk premiums and enforcing collateral standards raises the opportunity cost to borrowers of tying up eligible assets. Although in difficult circumstances central banks can and do lend at a lower premium and relax the collateral requirements they enforce, managers of deeply troubled institutions often fear the bad publicity that last resort borrowing might generate. This publicity can intensify the market pressure that a borrowing firm faces, in that it can lead private creditors (including other banks) to demand higher rates or stronger collateral support in private deals that might otherwise have carried less onerous terms. For deposit institutions during August 2007, the longer maturities, low costs and nonstigmatized character of Federal Home Loan Bank (FHLB) advances made the FHLB system the preferred source of government loans (Dudley, 2007).

From the central bank perspective, when funds are supplied through the discount window, borrowers hold the initiative and contract terms must conform to the posted schedule of discount rates and eligibility requirements. At the discount window, borrowers also decide when and for how long they want to borrow and what collateral they will offer. Central banks have discovered that they can use repurchase agreements ("repos") during to undertake last resort lending in a more flexible and less stigmatized way. By actively bidding for repos during an incipient crisis, a central bank can assure knowledgeable parties that the collateral it is prepared to accept includes the particular assets whose markets, originators and securitizers seem most sorely distressed. It can also shade its range of acceptable collateral to favor *specific counterparties* and set the maturity and price of particular deals without regard to the declared structure and terms of discount-window lending.

As valuable as this flexibility might be in times of turmoil, it is also dangerous. The danger is that nonbank institutions such as hedge funds, aggressive mortgage lenders and investment-bank subsidiaries of domestic

and foreign conglomerate firms that experience substantial demands for redemption from their investors and other counterparties will be able to misrepresent the *character* and to understate the *extent* of the unbooked losses driving their distress. Moreover, insolvent institutions can fuel regulatory competition by lobbying on behalf of other agencies in competing jurisdictions (such as Fannie Mae and Freddie Mac in the US) that might be eager to help them when and if the central bank does not.

LIBOR (London Interbank Offered Rate) is the interest rate at which US and foreign banks lend to one another. Figure 1 shows that in August 2007, overnight interest rates for banks in different nations and currencies responded differently to the onset of liquidity pressure. UK banks faced higher rates in the Euro market than either US or Euro-zone banks did. This indicates that foreign banks suspected that some British institutions might be holding or temporarily warehousing a disproportionate share of the particular kinds of credit risk that were being reassessed and repriced. Because the US federal-funds rate lay well below the Fed's 5.25 percent target and the Euro-market rate for dollars for most of the next month, one may infer that US banks were reluctant to borrow Fed funds to on-lend them in Europe.

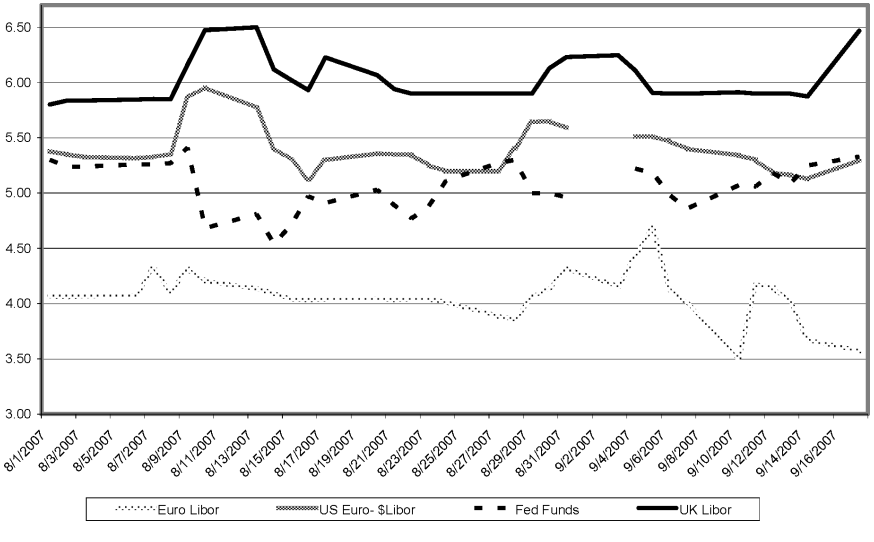

Figure 1. Overnight internet rates

Source: Compiled by Robert A. Eisenbeis from data on the websites of the British Bankers Association, *Financial Times* and Fed of NY.

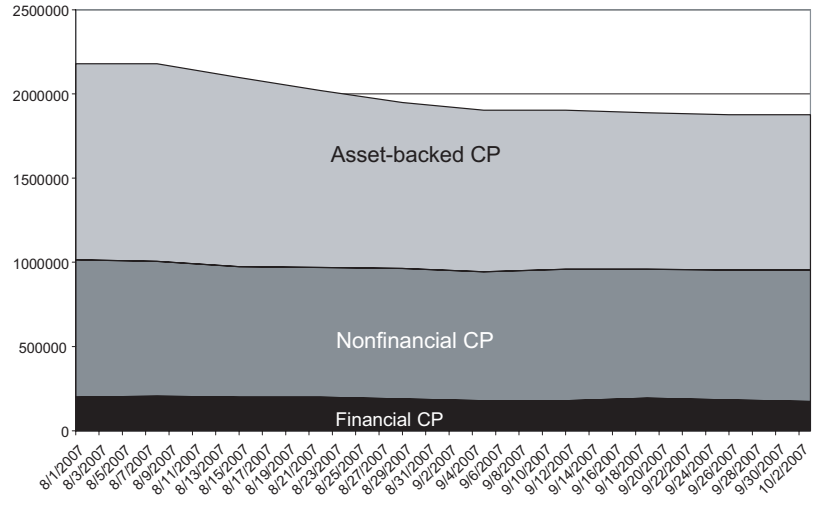

Figure 2. Outstanding commercial paper (weekly)
Source: Compiled by Robert A. Eisenbeis from data on the website of the Federal Reserve Bank of New York.

In the US, liquidity pressure focused not on banks *per se*, but on *securitizers of opaque pools of loans*. Figure 2 shows that, while the volume of commercial paper fell sharply when the turmoil first surfaced, the decline was concentrated in asset-backed paper. Moreover, even this market segment began to recover within a couple of weeks.

Figure 3 clarifies two points. First, in the US, liquidity never truly dried up. New-issue markets for AA-rated commercial paper remained active through every day of the turmoil period. Second, while the volume of all three types of issues declined in the week before the Fed's injection of liquidity on August 10, the sharp decline in the asset-backed segment was from a monthly high. Within two weeks, the volume of new issues in that segment had recovered and was fluctuating much less than in July.

These data (and the failure and government rescue of a few German and British banks) indicate that a market-driven triage process came into play as soon as the quality of underwriting standards embodied in mortgage-backed and complex securitizations came under fire. The market response was to require better documentation and stronger collateral from originators and conduits and to eschew questionable pools of loans. The regulatory response was to use primary dealers to flood troubled institutions

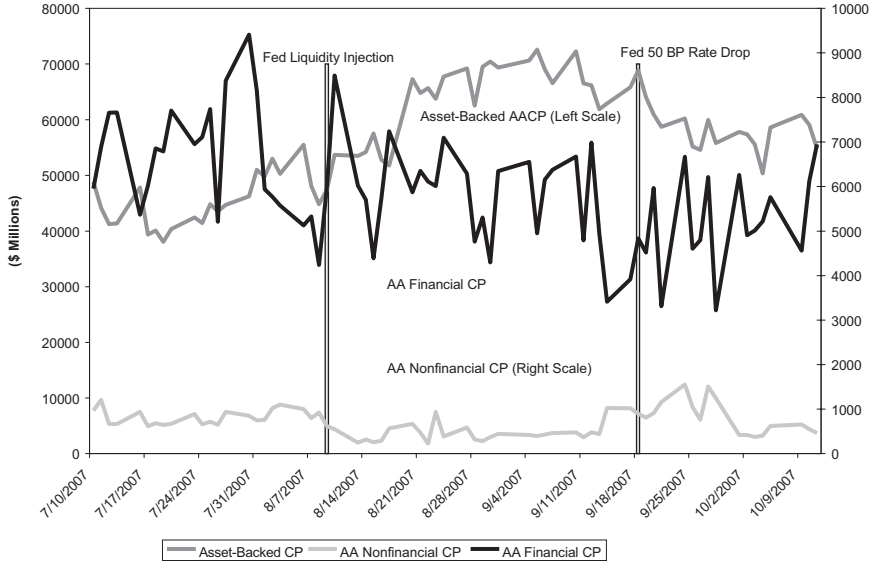

Figure 3. Daily value of newly issued overnight commercial paper
Source: Compiled by Robert A. Eisenbeis from data on the website of the Board of Governors.

and markets with funds. To justify this, officials characterize themselves as merely remedying a shortage of market "liquidity" rather than bailing out a set of institutions (including structured investment vehicles and their sponsors) that chose to compound their already substantial exposure to default risk with an interest-rate bet that posed potentially ruinous levels of roll-over risk.

4. Where Implicit Subsidies Originate: The Political Economy of Last Resort Lending

In its initial stages, an insolvency crisis is observationally indistinguishable from a transitory shortage of aggregate liquidity. The common symptom is that economically significant institutions or sectors suddenly find it impossible to roll over their debts on profitable terms. Established central banking practice is to take action that buys time for bank staff to determine the fundamental sources of the distress. This is done by announcing

a willingness to lend freely to banks in desperate circumstances on a collateralized basis at a penalty rate.

Last resort lending represents the first line of defense against an emerging national or global crisis. But it must be understood that this crisis-management strategy unfolds in a politically charged atmosphere — one that highlights the goal of minimizing exposure to blame and regret. Few top policy-makers are willing to risk being blamed by themselves or others for embracing policies that industry propaganda would characterize as escalating a bad situation.

Myopic blame avoidance is supported politically and ethically by three exculpatory norms that are imbedded in the regulatory culture of virtually every country in the world: (1) the mercy norm, (2) the nationalistic norm, and (3) the nonescalation norm. These all-purpose justifications for regulatory intervention conflict with the day-to-day norm of conscientiously tracking and minimizing the long-run social-welfare costs generated by the size and distribution of the subsidies the safety net delivers.

The mercy (or good-Samaritan) norm holds that it is politically unacceptable for regulators to abandon the employees, creditors and stockholders of institutions they oversee to the vagaries of the market at the first sign of distress. The mercy norm generates a unilateral regulatory right to alleviate sudden attacks of financial "pain". In particular, it allows safety net managers to claim without proof that their interventions are merely preventing a sudden liquidity shock from destroying institutions whose fundamentals are sound.

The nationalistic norm embodies a duty of loyalty to domestic institutions and even to foreign firms that accept responsibility for making markets in domestic bonds. Safety net managers face a politically enforced *de facto* obligation to maintain orderly financial markets and to protect institutions headquartered in their jurisdiction by supporting their ability to compete with firms headquartered in foreign lands. The help regulators provide may entail either granting subsidized access to government funds and guarantees, resisting the entry and subsequent local expansion of foreign firms, or paving the way for domestic firms to operate more effectively in foreign territory.

The nonescalation norm holds that it is better to interfere with market efforts to discipline a troubled institution (such as Countrywide Financial or Northern Rock) than to risk turning burgeoning financial turmoil into a national or international disaster. Relying on this norm, safety net managers can justify lending to insolvent institutions in any distressed sector.

They merely have to express a fear that allowing markets to work out what they are free to characterize as a liquidity shock would result in a disorderly liquidation of assets at fire-sale prices and that this event would spread adverse effects throughout the economy in ways that would be impossible to reverse.

These blame-avoidance norms come together in what we might call the First Commandment of Turmoil Management: *Be merciful unto important Home-Country Institutions and lead their problems not into contagion with other firms or markets.*

5. Policy Implications

An ideal safety net is one that would fairly and efficiently mitigate the particular monitoring, policing and coordination difficulties that present themselves to financial institutions, investors, depositors and taxpayers in the informational, ethical, legal and economic environment of connected countries at a particular time. This means that evolving differences in the size and shape of institutional risk-taking call for frequent adjustments in the dimensions of the mesh and in the strength and locations of the net's supporting piers. Politicians have so far been reluctant to involve themselves in the design and operation of regulatory linkages between country safety nets. They have allowed incentive-conflicted top regulators to decide how consistently and how promptly these links should expand to accommodate changes in the market, legal, bureaucratic and ethical/cultural problems the net is intended to alleviate.

Principal–agent theory tells us that decisions about how to forge and maintain safety net connections are influenced by incentives that result from political and bureaucratic arrangements that convey to nation-based regulatory officials and financial-institution stakeholders a collection of net economic rents and burdens.

To fashion a net of the social-welfare maximizing size and strength, decisions bearing on the cost and effectiveness of the net's components must be observable enough to allow watchdogs for outside stakeholders to exert healthy market discipline on protected institutions and healthy budgetary pressure on regulators. Because no hegemonic official feels fully accountable for policy-induced flaws in financial-institution risk-taking incentives, gaps in the global net are bound to subsidize risk in some venues. Welfare economics tells us that, for global strategies of

subsidy control to be more successful, employment contracts must assign top regulators the duty of measuring and managing the global social costs generated by decisions about net design and simultaneously incentivize regulatory personnel to support these duties appropriately.

Information systems and supervisory technology for monitoring bank capital and risk exposures are deemed to be transparent if they can be analyzed by trained outside experts and evaluated objectively in the financial press. From the point of view of accountability, it is unfortunate that — unlike the splattering of an unlucky or incompetent acrobat — breakdowns in financial safety nets are not immediately visible to the naked eye. This lack of transparency intensifies the conflict between the task of maximizing a net's effectiveness and minimizing the blame that safety net managers have to absorb for what they do and do not do. Losses can be blamed on events "technically" outside the regulator's span of control or attributed to unforeseeable events transmitted through opaque linkages across national markets.

Precisely because top regulators do not want their professional reputation besmirched by blame for banking scandals or policy mistakes, their authority over reporting protocols can be abused. Having the ability to reduce transparency supports an incentive to distribute implicit subsidies to needy clienteles and to delay insolvency resolution in tough times or tough cases. Such subsidies allow institutions whose insolvency cannot yet be publicly recognized an opportunity to gamble for resurrection at taxpayer and competitor expense (Kane, 1989). To protect the reputations of their agency or its top officers during their particular terms in office, opportunistic regulators may be tempted to conceal and sugarcoat information about emerging difficulties. In particular, policy-makers whose term in office is coming to an end may elect not to challenge misleading bank condition reports and might even encourage deceptive information to be entered on balance sheets and income statements.

Knowing that regulators dislike public criticism and can block the flow of adverse information enables managers and owners of insolvent institutions to exploit regulators' incentive conflicts. Unscrupulous managers can persuade officials to neglect their natural duty of truth-telling. The persistence of options to cover up subsidies and clientele weakness supports the hypothesis that most regulatory cultures give officials *de facto* authority to conceal or mischaracterize evidence of widespread losses as long as they can assert *ex post* that forthright statements might have generated or intensified a decline in customer confidence.

Incumbent officials can rely on this untestable claim to lessen their exposure to blame. In principle, the goals of calming public fears and taking cost-effective action to preserve or restore banking solvency can be pursued at the same time, but not with equal effectiveness nor with equal exposure to industry criticism. Depending on the quality of a nation's information and bureaucratic environment, high officials may escape blame for incurring insolvency-resolution costs on their watch by doctoring and suppressing evidence long enough to pass the bill for safety net losses onto the next generation of regulatory officials. The existence of this reputation-preserving escape hatch undermines the urgency of promptly understanding newly emerging forms of risk-taking and engaging in extensive crisis planning. In turn, myopically underinvesting in forward-looking activities disposes regulators to conceive of future financial breakdowns as if they were unique events that must always and everywhere be handled in an *ad hoc* manner.

Common sense tells us that, to cope with continuing financial innovation, politicians must enact legislation that makes regulators accountable for developing and regularly reviewing a strategic plan for managing different kinds of crises and for training their staff in the use of their evolving crisis-management protocols. Unless backed up by solid disaster planning, the existence of national safety nets may foster expectations of a secularly expanding propensity to bail out distressed firms. The need for markets to test the limits of this propensity from time to time may generate a series of infrequent, but highly disruptive, global crises. Ironically, the more time that passes between crises, the more important crisis planning becomes because fewer financial-institution managers and regulatory personnel will have hands-on experience in dealing with crisis pressures.

6. Summary Implications

Goodfriend (1994) underscored the need for someone to define specific principles under which the Fed would and would not be allowed to provide funds to troubled institutions. Intentionally or unintentionally, providing government liquidity support directly to troubled firms rewards firms that have made bad bets. Substituting flexible repurchase agreements for discount-window loans is dangerous because it better masks both the identities of recipient institutions and the size of the benefits they receive.

Editorial cartoonists seem to have understood the distributional effects of the hegemons' policies more clearly than the mainstays of our nation's financial press. One of my favorite cartoons shows a central bank helicopter lifting a well-dressed banker out of the sea and away from a shark that, despite a mighty leap, is just able to nip the seat of the banker's pants. A second cartoon shows a lifeguard proudly carrying a shark (which I would label "sponsors of structured securitizations") onto the beach, while leaving dozens of taxpayers and mortgage borrowers foundering in rough seas.

Ideally, last resort lenders should be required to model and maximize the present discounted value of the net social-welfare benefits generated by the size and distribution of whatever institutional subsidies their rescues deliver. Within nations, the principle of democratic accountability would dictate that central banks ask their economic staff to estimate in a reproducible manner the social value of these subsidies and to compare the social value of the damage that last resort lending and capital forbearance avoided with projections of the present and future social costs generated by the subsidy program. If any national government or supranational entity truly wanted to embrace this principle, it would have already enacted legislation to that effect and would have done so in a way that would not politicize decisions about aggregate monetary policy in the process.

It is difficult to imagine that central bankers and industry lobbyists in hub countries would tolerate such legislation today. Unfortunately, it is even harder to imagine that citizens of the hub countries care enough about the possible knock-on effects that nation-based last resort lending could have on the welfare of citizens in other countries to subject themselves to the cross-country tax-transfer obligations needed to construct an efficient financial safety net of appropriately global dimensions.

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Systemic Risk and Prudential Regulation in the Global Economy

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1. Introduction

It is well-known that one of the major functions of central banks is to preserve financial stability. In order to do so, thus preventing systemic banking crises that could impair the well-functioning of the payment side of economic transactions, central banks and regulatory authorities have developed a number of mechanisms that, together, constitute the banking system safety net. Given the huge social costs of systemic crises, there is a clear consensus on the need to deploy a safety net, and in particular, a lender of last resort (LOLR) facility that could preclude banking crises.

By using the mechanisms embodied in the safety net, regulatory authorities, central banks and the Treasury have intervened to inject liquidity and to bail out banks when deemed necessary. Typical examples of bank rescues are the cases of Crédit Lyonnais in France, Banesto in Spain, or the Long-Term Bank of Japan that have involved huge transfers from taxpayers into the hands of private liability holders. The intervention of the central bank is even more intricate when the crisis concerns a whole country: Thailand, Malaysia, Korea, Russia, or a group of countries as it happened during the Scandinavian bank crisis. According to Goodhart and Shoenmaker (1993), out of 104 banks in distress in 24 countries between

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1970 and 1992, only 31 ended in straightforward liquidation. So, ideally, each country would choose the extent of its safety net that is efficient, that is, that trades off the marginal cost to taxpayer with the marginal benefits of avoiding a financial crisis.

When we consider an international framework, this simple idea has to be revisited. This is indeed the case as the competition and/or cooperation of multiple regulators, each with a specific mandate to maintain financial stability in its own country, will not usually lead to the construction of an efficient safety net.

Reexamining the whole concept of the efficient extent of the safety net is therefore necessary, because during the last 20 years the financial environment has changed dramatically, with the emergence of multinational banks and the increase of international trade that implies higher convergence of business cycles. At the same time, the creation of large multinational conglomerates and the development of large international markets imply both larger diversification possibilities for the banks and a worsening of the possible contagion effects. As acknowledged by Duisenberg, "the probability of the problem spilling over to other Euro area countries is significantly greater than before. The wholesale market is a major channel of the transmission of potential financial instabilities" (Duisenberg, 2000, p. 3).

The issue is all the more complex that it involves regulatory cooperation and competition (see Acharya, 2003; Dell'Ariccia and Marquez, 2006; Morrison and White, 2005; Sinn, 2001; Dalen and Olsen, 2003), and this will distort the regulators' incentives. In the global economy, the safety net is to be thought of as the equilibrium of a game where each regulator has a different objective function, defined by its mandate to preserve financial stability at home.

Thus, the issues of the precise extent, organization and mechanisms of the safety net in general and of the LOLR that are already objects of debate within a country become particularly complex in an international set-up, where we might be faced with more interrogations than answers.

My objective in this paper is to show that the internationalization of banking activities has diminished the efficiency of national regulatory authorities in their role of preserving financial stability. Two implications can then be derived: first, the need for an international safety net and, in particular, an international lender of last resort, is now more acute than it was 30 years ago; and second, the cost of the safety net has increased, thus

justifying the development of mechanisms that limit the cost of banks' bankruptcy.

To begin, I briefly summarize in Section 2 the main costs and benefits of a bank bailout. Section 3 briefly reviews the main models that justify the existence of a crisis in the international interbank market. Section 4 considers the cost–benefit analysis of a multinational bank bailout and Section 5 the issues related to the implementation of an international bailout. Section 6 is devoted to the implications of globalization on the design of future international regulation.

2. The Cost–Benefit Analysis of the Safety Net

The banking system has always been characterized by a high degree of regulation to prevent banks' bankruptcy and to limit the impact of banks' bankruptcies on the banks' clients. The safety net plays a capital role in banking regulation, as it consists of all regulatory mechanisms that are intended to either diminish the probability or the impact of a bank failure. Its rationale is the divergence between the private and social costs of a bank bankruptcy. Its structure is country-specific, particularly because social costs differ from one country to another, and because legal systems, regulatory institutions and their mandate also vary from one country to the other. Still, there are common elements that the majority of countries share, such as deposit insurance, capital requirements and lender of last resort facilities, which allow us to model the interaction between the different regulators' objectives.

I will focus here on the lender of last resort in the context of international connections between countries.

2.1 *Direct benefits of bailouts*

The rescue of banks by central banks with the support of the Treasury has a number of direct and indirect benefits.

First, the empirical evidence points out that the value of a bank as a going concern is higher than when it is liquidated (James, 1991), as bailing out banks allows to preserve their charter value. Again, depending on the legal system, the preservation of the charter value may be more or less costly, as, in some legal systems, uninsured claimholders may not accept any dilution of their rights except if the bank is declared bankrupt.

A second direct benefit of a bank bailout comes from relationship banking. The literature on relationship banking developed in the last years has established that a bank's relationships with its clients are an asset. When a bank goes bankrupt, the value of all relationships with its clients is lost, and so are future growth opportunities (Herring and Vankudre, 1987). Evidence of this social cost was obtained, among others, by Slovin *et al*. (1993), which showed that the bankruptcy of Continental Illinois negatively affected its clients' stock market value. Obviously, the bankruptcy of a multinational bank will imply social costs in every country where the bank operates.

2.2 *Preventing contagion*

The main externality of a bank's failure is that its failure may cause other banks to default through a domino effect. Through this contagion mechanism, a bank failure may be systemic, thus endangering the stability of the whole financial system. Although the probability of a systemic crisis is small, the social consequences are devastating, so that this is a main concern for central bankers.

The mechanisms through which a bank crisis spreads throughout the banking industry may take different (nonmutually exclusive) forms: it may stem through expectations[1] or it may be generated by the credit position each bank has with another. Although during the 19th century contagion through expectations was considered to be the main channel of contagion, in today's environment, the payment system and the interbank market are the major potential causes of contagion.

It must be acknowledged that the evolution of payment system operations with the development of real time gross systems (RTGS) and delivery versus payment (DvP) has drastically reduced the risks of contagion via the settlement in the payment system. Thus, the interbank market, jointly with the over-the-counter one, is considered nowadays the major source of contagion among banks. This is also true when it comes to contagion from one country to another: the main source of contagion is the unsecured international interbank market.

[1] Contagion through expectations can take two main forms: *purely speculative contagion* occurs when the failure of a bank triggers a bank run at some other bank and thus its failure; *correlation risk contagion* develops when the failure of a bank triggers a bank run at all other banks with the same type of assets.

2.3 *Indirect contagion*

In addition to the direct effect of one bank failure on another bank's assets and liabilities, a second effect should be worth mentioning: the depressing effect of a bank's sale of assets on these assets' price, and therefore their reduced value as collateral. Following Irving Fisher's (1933) debt deflation view, several contributions have modeled the vicious circle that is implied from a decrease in bank's collateral. In their article on "credit cycles", Kiyotaki and Moore (1997) assumed a fully collateralized loans economy and showed that a regime of alternating equilibria existed, one characterized by a low value of collateral and a low level of credit, investment and output that supported the low price for collateral; and a second one characterized by high values of collateral, credit volume, investment and output.

More recently, Acharya and Yorulmazer (2006) developed a purely static model of optimal regulatory intervention that also emphasizes the role of collateral prices. The regulator has the choice whether to liquidate or bail out a number of financially distressed banks. But liquidation implies that the loans' repossession will generate an increase of the supply in the market for collateral, and the corresponding decrease in the collateral's price, which will, in turn, increase loans risk (through an increase in loss given default). This will reduce the expected return on loans, leading banks to an increase in the price of credit or in the required collateral, and therefore to a decrease in the supply of credit which will put additional downwards pressure on collateral prices. The implication is that when the number of banks is small, it is optimal for the regulator not to intervene, but when the number is large the regulator should bail out some of the banks, so as to avoid further decreases in the value of collateral and, therefore, further deterioration of the bank portfolio of collateralized loans.

It may be mentioned that Allen and Carletti (2006) have recently pointed at the possible interbank channel of contagion that the recent sub-prime turmoil has typified. In their paper, they show that credit risk transfer can be detrimental to welfare as it can lead to contagion between the bank and nonbank financial sectors. In the recent turmoil, low quality of securitized assets in some banks may have led to a generalized indiscriminate downgrade for the whole class of securitized loans, leading to a credit risk increase and a shortage of funding for the CDOs.

2.4 *The cost of a bailout*

Whether a bank is to be liquidated or to be bailed out, this entails a cost. In addition to a standard regulatory cost, a bailout has, first, a cost because it is necessary to provide funding to the bank which may imply, *ex post*, a transfer from taxpayers to liability holders.[2] The reason why the transfer is costly is that public money is obtained through taxes, which itself implies a distortion in the prices of the taxed commodities and a social cost.

The other costs of a bailout policy stem from two different sources of moral hazard. On the one hand, there is moral hazard on behalf of all banks that expect to be rescued to develop a high-risk/high-return investment strategy, thus abusing the safety net mechanism.[3] On the other hand, there is moral hazard on behalf of the banks' claimholders that will not exert a sufficient effort in closely monitoring the institution, as they know that in case of default it will be bailed out. This issue has become apparent in the international context in the 1990s, with the Mexican, Korean and Thai crises, when banks from developed countries, which have enjoyed high returns but have not closely monitored their investment, lobbied for a bail out that implied a transfer from local taxpayers (Calomiris, 1999).

3. The International Safety Net: Preventing the International Interbank Market Gridlock

I will focus here on the issue of the international interbank market and turn to the bailout of multinational banks in the next two sections. As Stanley Fischer (1999) argued, the role of an international lender of last resort is not to be limited to lending; it had to encompass the coordination of private lenders. Since then, a number of contributions has modeled this type of situation where coordination is critical.

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[2] Notice that banks' uninsured debtholders are often paid out, and this increases a bailout cost. This may be the price the regulator has to pay in some legal environments to avoid lengthy and costly litigation. Designing a specific bankruptcy mechanism that limits the claimholders' rights in case of a default, even if this implies a higher (*ex ante*) promised return on their claims, would lead to a lower cost of banks' bailout.

[3] Empirically there is no clear-cut evidence, however, that banks that are "too big to fail", and therefore expect to be rescued, take higher risks. There is some evidence, though, that in the US during the savings and loan (S&L) crisis, larger S&Ls took more risks.

This issue is particularly relevant in an international set-up, because the mechanisms usually available to cope with a bank run, such as the intervention of emergency lending (either through the standard monetary policy channels or the exceptional ones associated with the role of the lender of last resort), may be powerless. In an open economy, foreign currency-denominated deposits may be suddenly withdrawn. This phenomenon, a critical issue in emerging market economies, is referred to as a "sudden stop" (Calvo *et al*., 2004; Becker and Mauro, 2006), and is directly related to banks' liabilities structure and their short-term deposit funding.

Two papers address the issue of liquidity shocks and interbank market equilibrium. Allen and Gale (2000) on the one hand and Freixas, Parigi and Rochet (2000, henceforth FPR) on the other hand analyze this issue from similar perspectives. In both cases, the existence of the interbank market is shown to allow banks to cope with liquidity shocks in an efficient way, without having to resort to inefficient liquidation of long-term assets, and, again in both cases, these efficient interbank market links are a source of contagion.

In Allen and Gale, banks are subject to regional liquidity shocks, and therefore it is efficient for them to enter into a network of reciprocal deposits so as to prevent regional shocks. Figure 1 illustrates the links between banks. In the credit chains case, bank 1 has a deposit in bank 2, bank 2 has a deposit in bank 3, and bank 3 has a deposit in bank 1. In the diversified lending case, each bank has a deposit in the other two. In both cases, banks insure one another against idiosyncratic liquidity risks. However, this arrangement is financially fragile, as a small aggregate liquidity risk will create a systemic shock through contagion, because each bank will need to liquidate some of its assets, while there are not enough assets in the whole system.

Freixas, Parigi and Rochet are also concerned about systemic risk, but they do not focus on liquidity. The issue they investigate is whether the existence of a perfectly liquid interbank market constitutes a sufficient guarantee against a liquidity crisis affecting one institution. To analyze this issue, they consider a location-extended Diamond–Dybvig framework, where agents of different types have to travel to other locations in order to consume. It is efficient for each of them to travel with a check on the bank of destination, but they have the option to cash their deposits and carry the cash. This is inefficient as it will force the banks to close down some of their projects. Figure 1 helps also to illustrate the structure of the FPR model, where, instead, consumer-depositors are traveling from one bank to another as they wanted to have liquidity at their place of destination. The main result

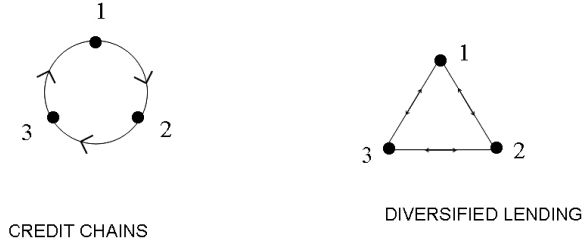

Figure 1. Banks' connectivity

is that two equilibria coexist: an efficient one where banks give credit to each other; and an inefficient one, which we refer to as "gridlock equilibrium" where banks suddenly stop lending and where depositors cash their deposits before traveling to their consumption destination. The switch from one type of equilibrium to another could be the result of change in expectations, but could also be the result of the default of one bank. This justifies an important role for the central bank as lender of last resort (LOLR).

In both cases, the risk of a systemic crisis depends upon the structure of links between banks, so that some financial architectures, as credit chains, are more fragile than others, as diversified lending, because contagion has a larger impact in the former.

The extension of Allen and Gale as well as FPR to the international arena seems quite natural, by reinterpreting banks as banking systems in different countries, provided we abstract from the issue of currency exchange and currency crises. The implication is that, then, there is a need for an international LOLR that would be able to avoid a gridlock in the international interbank market.

The idea of a shortage of funds in the international interbank market may be also considered from a different perspective — the adverse selection one. This is precisely the road followed by Freixas and Holthausen (2005), who consider a two-country economy characterized by adverse selection, where foreign countries are at a disadvantage in terms of information on their counterparts in the international interbank market. In this model, banks are exposed both to idiosyncratic liquidity shocks and to country liquidity shocks. The existence of these country-wide liquidity shocks creates a demand for cross-country interbank lending. Still, the existence of adverse selection will impose a limit to the well-functioning of the market. The main result of the paper is that even if an integrated

equilibrium may exist, it may coexist with an equilibrium where the interbank market is segmented. Therefore, market deregulation *per se* does not guarantee the emergence of an integrated interbank market.

4. Cost–Benefit Analysis of a Multinational Bank Bailout

The theory of banking regulation has been mainly developed in a one-country set-up. Focusing on the multicountry environment has allowed me to unveil a number of potential conflicts among home and host regulators. The extent of these conflicts depends upon the legal form the multinational bank has chosen to develop abroad: bank branch or subsidiary.

I will focus here on the bailout of multinational banks, but before doing so it is worth mentioning that a number of contributions have tackled the issue of the level of capital requirements for multinational banks. This is directly related to our point, as banks with a higher level of capital will have a lower bailout cost.

A first intuition on the level of capital requirements for multinational banks would be that capital requirements should be lower for a branch bank because of the increased geographical diversification and lower risk. But this is not obvious when we consider that the main role of banks is monitoring, and that more diversification may imply a lower level of monitoring in their lending, as both theoretical (using Boot and Schmeits, 2000) and empirical literature (Acharya, Hasan and Saunders, 2006) has pointed out.

Loranth and Morrison (2007) consider a model of moral hazard, where banks are able to choose the (unobservable) level of risk in their portfolio of loans, and thus benefit from the deposit insurance option. They show that capital requirements for a subsidiary bank should be higher than for a branch bank.[4]

Harr and Ronde (2003) also explore optimal capital requirements for a multinational bank and consider the option, once a division of the bank

[4] In a multinational branch-structured bank, increased diversification reduces the risk, and therefore, as intuition suggests, capital requirements for multinational banks should be lower than for domestic banks. In a multinational subsidiary-structured bank, the effects of diversification still imply a reduction in the optimal level for capital requirements. Still, the home bank is not forced to bail out the subsidiary, and this provides an incentive to make riskier investments than in the branch bank case. Consequently, capital requirements for a subsidiary bank are higher than those for a branch bank.

is in trouble in one country, to gamble for resurrection in the other country. Because of this, in normal times, a branch-structured multinational bank should face lower capital requirements. Yet, at the same time, in order to avoid gambling for resurrection, they should have higher capital requirements in times of financial distress, a condition that is difficult to fulfill, as it implies a counter-cyclical capital requirement. I will now study the regulator's cost–benefit analysis of a multinational bailout.

4.1 *Perfect information*

In order to study how banks' cross-country activity affects the regulator's decision regarding their bailout or their liquidation, I start by considering the framework of Repullo (2000) and Kahn and Santos (2005) in a two-period, one-good, zero interest rate economy.

I assume a bank that has a proportion λ of its activities at home and $1 - \lambda$ in a foreign country. The total amount of deposits and the initial value of investment is 1, implying no capital.

Each depositor invests 1 at $t = 0$ and decides to withdraw at $t = 1$, or wait until $t = 2$. We denote that the aggregate amount of withdrawals at $t = 1$ in the home country by v_d and the corresponding amount in the foreign country by v_f. Banks invest $1 - I$ in liquid assets and I in a long-run risky technology that yields Y with probability u and 0 with the complementary probability. The amount of withdrawals (v_d, v_f) is observable and verifiable, while the probability of success u is nonverifiable. From an *ex ante* viewpoint, both u and v_d, v_f are random. The bank's investments can be liquidated for a value L ($L < 1$) at $t = 1$.

The closure of a bank has a cost in each country, c_d for the home country and c_f for the foreign country, which is assumed to be the same at $t = 1$ and $t = 2$.

The regulators will face the choice whether to liquidate the bank or to lend it the necessary liquidity only if it cannot obtain a loan from the market.[5] Consequently, when the interbank market is perfect, loans to banks

[5] This will happen when the bank has not enough liquidity, so that $v_d + v_f > 1 - I$ and when a loan at the market rate is impossible. Assuming the interbank market is perfectly competitive, so that interbank loans have a zero expected return, a loan with nominal repayment R ($R < IY$) is possible provided that $uIY > v_d + v_f - (1 - I)$. If we assume perfect interbank markets, this implies that this condition is not fulfilled and that the bank is, in fact, insolvent. If instead we assume imperfect interbank markets, this need not be the case.

in difficulties are not made at a penalty but at a subsidized rate, contrary to Bagehot principles on the lender of last resort.

4.1.1 *A unique regulator*

Consider first the case of a single regulator that is able to provide liquidity and is responsible for deposit insurance: in case of failure, all depositors are fully reimbursed.

The regulator mandate is to choose closure decisions that minimize its total cost for a given repayment, R. This embodies an inefficiency bias, as Kahn and Santos remark, because the upper tail of the distribution $IY - R$ does not enter its objective function. This inefficiency may be eliminated if we allow the regulator to seize all the bank's assets, by setting $R = IY$ and thus capturing all of the surplus. We will follow here Repullo and assume that the regulator minimizes the total cost.

Assuming the loan bears no interest, R is the amount to be repaid on the loan that amounts to $v - (1 - I)$. The regulator will choose continuation of the bank provided that

$$\begin{aligned} &uR + (1-u)(-(1-(v_d + v_f)) - (c_d + c_f)) - ((v_d + v_f) - (1-I)) \\ &\quad \geq IL + (1-I) - 1 - (c_d + c_f), \end{aligned} \tag{1}$$

which, using $R = v_d + v_f - (1 - I)$, simplifies to

$$u \geq \hat{u} = \frac{IL}{I + c_d + c_f}. \tag{2}$$

As intuition suggests, the higher the bankruptcy costs $c_d + c_f$ and the lower the recovery value L, the lower the threshold $\hat{u}$, so the more generous the bank bailout policy.

4.1.2 *Decentralization with two countries*

Two cases should be distinguished, depending on whether the activity in the foreign country is structured as a branch and the bankruptcy law does not allow to segregate the foreign country assets and liabilities; or, on the contrary, it is structured as a subsidiary, in which case the foreign regulator

might intervene. A different distinction is the one between the two main bankruptcy regimes: "territoriality", in which assets and liabilities are adjudicated by the jurisdiction in which they are located at the time of the bankruptcy; and "universality", in which all assets are adjudicated in a single jurisdiction (see Bebchuk and Guzman, 1999). Under territoriality, the analysis of a branch-structured bank bankruptcy comes closer to the one of a subsidiary-structured one, although with a major difference: that once the bankruptcy is declared, it is impossible for the home or host part of the bank to remain open. The main intuition is that, in general, decentralization with two countries leads to excessive (inefficient) liquidation.

The analysis is complicated by the large number of cases to be considered, depending on whether the risks in the two countries are perfectly correlated or independent, on whether deposit insurance is offered by the home or by the host country and on the structure of the bank abroad, branch or subsidiary.

The social cost bias. A first point to be considered is the regulator's perspective on the social cost of liquidation. While the total social cost is $c_d + c_f$, the regulator's mandate is based on a responsibility to its domestic stakeholders, and therefore will have to take into account c_d and ignore the externality c_f its decisions generate. Now, because one of the reasons of liquidity provision to the bank is that liquidation and its cost are avoided with probability u, the decision becomes now biased toward excessive liquidation.

Assuming a perfect correlation of risks between the two countries, two cases have to be considered: the case where deposit insurance is provided by the home regulator, which corresponds to the bank-branch structure; and the case where the bank has a subsidiary abroad that is subject to the host country deposit insurance regime.

In the bank-branch case, the analysis follows the same lines as before, but the cost that will be taken into account by the regulator will be limited to the domestic cost. The bank will be bailed out if and only if:

$$u \geq \hat{u}_d = \frac{IL}{I + c_d}. \tag{3}$$

This occurs both in the bank-branch case and in the subsidiary case.

The comparison with the unique regulator case shows that, as $\hat{u}_d > \hat{u}$, the regulator will bail out the branch-structured bank less often, simply, as intuition suggests, because in the case of liquidation the foreign country

costs are not internalized. So, when deposit insurance is provided by the home regulator to a branch-bank structured multinational bank, there is a bias towards liquidation.

Still, the choice of the home regulator will be more complex, as it involves who bears the cost of deposit insurance.

Branch versus subsidiary structure. Consider, again, the case of perfectly correlated risks and a unique signal u. Then, in the bank-branch case, the home regulator bears the cost of deposit insurance, and its analysis is the one we have already developed, with the multinational bank being bailed out if $u > \hat{u}_d$. In the subsidiary-structured bank, we have to take into account the decisions of the foreign (host) and domestic (home) regulator. This implies that we have to examine the reaction function of the two regulators.

In the subsidiary-structured case, the size of assets and liabilities in the home and host country will obviously matter. So, as mentioned, in order to establish the possible conflicts of interest between regulators, we will focus on the case where assets and liabilities are proportional.

The analysis of the host regulator leads to the same result as before, although applied to a bank of size $1-\lambda$. The foreign regulator will bailout the subsidiary if:

$$u \geq \hat{u}_{f1} = \frac{IL}{I + \dfrac{c_f}{1-\lambda}}. \tag{4}$$

Symmetrically, if the host regulator is not lending to the subsidiary, then the home regulator will consider only the fraction λ of assets and liabilities that are relevant, and the decision will be, symmetrically, to bail out the home bank (and abandon the subsidiary) if

$$u \geq \hat{u}_{d1} = \frac{IL}{I + \dfrac{c_d}{\lambda}}, \tag{5}$$

or bailout both the home bank and the subsidiary if

$$\begin{aligned} &uR + (1-u)(-(\lambda - v_d) - c_d) - (v_d + v_f - (1-I)) \\ &\quad > \lambda(IL + (1-I)) - \lambda - c_d. \end{aligned} \tag{6}$$

Notice that here the amount of the loan is $v_d + v_f - (1 - I)$, but if the bank is not successful in its project, the home deposit insurance will only have to pay the residual depositors $\lambda - v_d$, because in case of liquidation the home regulator will not bear the deposit insurance cost. Yet if a loan is to be made, it benefits both the parent bank and its subsidiary, while the cost is borne by the home regulator. The intuition is therefore that the home regulator will be more inclined to liquidate than in the bank-branch structured case. This is confirmed by proceeding as before, and taking the point of view of the home regulator who is in charge of the bailout versus liquidation decision.

Comparing with expression (1), it is possible to remark that the left-hand side, which represents the cost of making a loan, has decreased, because in case of failure of the bank, only the local depositors have a right to the deposit insurance repayment ($1 - \lambda - v_f > 0$, as $1 - \lambda$ is the total amount of liabilities). Yet, at the same time, the right-hand side has also decreased, because the assets in case of liquidation are proportionally shared. Rearranging the terms, expression (6) can be rewritten:

$$u \geq \tilde{u}_d = \frac{\lambda IL + (1-\lambda)I + v_f - (1-\lambda)}{\lambda I + (1-\lambda)I + v_f - (1-\lambda) + c_d}. \tag{7}$$

Obviously, $\hat{u}_{d1} < \tilde{u}_d$ and if the host regulator chooses not to bail out the subsidiary, for values of u in the interval $(\hat{u}_{d1}, \tilde{u}_d)$ the home regulator will choose to abandon the foreign subsidiary but to bail out the parent bank.[6]

This has two main implications: first, for some range of values, namely for values of the signal u in the interval $(\hat{u}_{f1}, \tilde{u}_d)$, the foreign regulator will be forced to bail out the subsidiary. Second, when $u > \max(\hat{u}_{f1}, \tilde{u}_d)$, because loans are made at a negative expected return, each regulator prefers to free ride on the bailout of the subsidiary by the other one. Such a bargaining game may have an inefficient outcome if the subsidiary ends up being liquidated.

When we consider country-specific risks and independent signals, u_d and u_f for the two countries, Calzolari and Loranth (2005) show that, in this case, the subsidiary-structured bank will be biased towards excessive liquidation. The intuition behind their result is that the parent company

[6] This may imply a very high cost if the host country is an emerging market economy, with a high social cost of banks' bankruptcy and a limited financial capacity to bail out banks because of the high cost of collecting taxes.

holds an option on the subsidiary which is an additional asset. Consequently, if the subsidiary project succeeds, in case of liquidation, the profits of the subsidiary, $(1 - \lambda)(R - 1)$, would allow to reduce by that amount the cost of liquidation to the domestic deposit insurance company, thus making liquidation more attractive.

Notice the argument is not symmetric, as the parent company owns the subsidiary, but the subsidiary has no rights on the parent (except for some possible reputational cost for the parent bank of letting a subsidiary be closed down).

In the bank-branch case, the argument is more involved because "the home regulator behavior toward the branch ... is shaped by two considerations: the possibility of reducing foreign losses with home assets and the possibility of subsidizing home losses with foreign assets" (Calzolari and Loranth, 2005, p. 13).

The subsidiary-structured bank will, nevertheless, have the option of benefiting from the profits from the subsidiary, and therefore, this is why, when comparing branch-structured and subsidiary-structured multinational banks, Calzolari and Loranth (2005) obtain that the home regulator will be softer than the host regulator (Proposition 4).

These issues lead naturally to think that regulators might have a strategic behavior in fulfilling their mandate, that is, financial stability within their borders. So, it is worth analyzing the behavior of regulators in terms of their possible cooperation in the bailing out of a multinational bank and in terms of their incentives to collect and disclose information. This we will analyze following Freixas (2003).

5. Implementing the Bailout of a Multinational Bank

I consider now the case where it is optimal to bail out a multinational bank and focus on the conflicts arising from the actual implementation. In order to emphasize the conflict of interest between the different regulators, it is interesting to simplify our notations and consider, on the one hand, the amount t_j that each country j contributes to the necessary loan, and, on the other hand, the net benefit to the country of bailing out the bank, θ_j. Each regulator knows the value of θ_j in his own country, but it seems reasonable to assume that this variable is not observable across countries.

If we denote the amount of the required loan by v, then $v \leq \Sigma_j t_j$ indicates the bailout can be implemented.

5.1 *Optimal ex post decision*

The decision to continue or to close is simply a variable x with values in the space $\{0, 1\}$.

The optimal decision will be to bail out banks so as to maximize the following product:

$$x^* \left(\sum_j \theta_j - v \right),$$

so that x^*:

$$\begin{cases} x^* = 1 & \text{if } \sum_j \theta_j - v > 0 \\ x^* = 0 & \text{if } \sum_j \theta_j - v < 0 \end{cases}. \tag{8}$$

5.2 *The ex post mechanism*

To begin with, I will consider the mechanism of intervention once a bank is in financial distress. I will question first the allocation efficiency of an improvised cooperation and compare it with the allocation resulting from an incentive compatibility mechanism.

5.2.1 *Improvised cooperation*

The term "improvised cooperation" has been coined to convey the view of a feasible, adaptive exchange of information and decision-taking among regulators.[7] In this section, I will make use of elemental game theory to give a precise content to the concept of improvised cooperation and to identify its implications in terms of efficient closure policy.

[7] Concerning the existing mechanisms for a bank bailout in Europe, Padoa-Schioppa argues that the lack of transparency on "the procedural and practical details of emergency action" (1999, p. 12) is in line with the idea of "constructive ambiguity". But this is open to debate, since constructive ambiguity does not require to state the procedural arrangements to solve financial crises on a case-by-case basis.

Contributing to the cost of a bailout

To begin with, consider the case where the mechanism is set in such a way that only if a sufficient contribution is reached the bank bailed out. The decision is therefore

$$\begin{cases} x^* = 1 & \text{if } \sum_j t_j - v > 0 \\ x^* = 0 & \text{if } \sum_j t_j - v < 0 \end{cases} \tag{9}$$

and the *j*-country objective function will be:

$$x^*(\theta_j - t_j).$$

This game may have a multiplicity of equilibria, and, in particular, one independent of the specific net benefits $\theta = (\theta_1, \theta_2, \ldots, \theta_n)$ to each country of the multinational bank bailout, the liquidation equilibrium,[8] $x^* = 0$, $t_j = 0$.

It is not surprising that such an equilibrium exists, as each country in isolation would not take the burden of financing the total cost of the bailout. On the other hand, if other countries are already contributing, each country will find in its interest to contribute, but only in so far as their contribution is pivotal.

Consequently, this suggests that the implementation of a mechanism with a more complex and efficient sharing rule depending on θ_j, should be implemented. The drawback is that these sharing rules will then become sensitive to the issue of information revelation.

So, from this simple framework, it is clear that a multicountry bailout has a public good dimension, and that improvised coordination as a subscription equilibrium will lead to underprovision of the public good, in this case the bailout of multinational banks and the preservation of financial stability.

[8] This will occur provided that for no *j* do we have

$$\theta_j - v > 0,$$

that is, no individual country is ready to finance the whole cost of the bailout by itself.

5.2.2 *Noncommitment and truthful revelation*

To improve upon the subscription equilibrium, it would be possible that the different countries initially agree on a mechanism, then announce the value of θ_j. The problem is then that not all mechanisms lead to truthful revelation, so that regulators may have an incentive to understate or overstate the value of the benefits from a bailout. Fortunately, the theory of incentives provides some instruments to solve this problem.

The revelation principle allows us to simplify the game and resort to direct mechanisms where a country characterized by a social benefit parameter θ_j will decide, first, the amount it will announce ($\hat{\theta}_j$). On the basis of the announcement of each regulator, the multinational bank is bailed out or liquidated.

The use of an incentive compatible mechanism corresponds to the opposed extreme of "improvised cooperation", as the countries have no room for *ex post* renegotiation. It has the benefit of being robust to information manipulation and *ex ante* beneficial. Also, although this aspect goes beyond our model, it provides a simple way to generate a rapid response to a bank crisis. Because the mechanism is *ex ante* Pareto superior, the countries will be *ex ante* unanimous in their commitment to the mechanism.

5.2.3 *Proxy-based mechanisms*

Since the implementation of truthful revelation mechanisms may prove to be impractical, an alternative is to assume that a variable highly correlated with θ_j is observable (portfolio of loans, . . .). In this case, the mechanism may be defined *ex ante*, and all regulators would be committed to contribute to the bailout, in case the bailout is considered the best option, as initially agreed depending on the observed variable. Goodhart (2004) and Goodhart and Shoenmaker (2006), in their analysis of the European case, explore different *ex ante* burden-sharing mechanisms of this type. A bailout could be financed from seigniorage of participating central banks (generic burden-sharing), or it could depend on the location of the assets of the bank to be recapitalized (specific burden-sharing). Their point is that "it would not be possible to bargain internationally over burden-sharing after the event, *ex post*" (p. 51), so that the existence of a suboptimal mechanism will always be preferred to the absence of any mechanism.

5.3 *Asymmetric information and regulatory cooperation*

The previous framework allows us to point out the implication in terms of the incentives to cooperate in the production and sharing of information. This is a key issue from a regulatory perspective. In Europe, it has led to extensive legislation allowing regulators to share confidential information. The Banking Supervision Committee as well as the Groupe de Contact have developed mechanisms for more extensive cooperation.[9] I will model the regulators' objective function by means of an effort the supervisor has to produce collecting information. This effort is costly.

Assume that the variable observed is $\tilde{\theta}$ (which I assume to be an unbiased predictor of θ) but that the noise depends upon the effort level e, which cannot be contracted upon. Denoted by $f(\theta, e)$, the probability density function for θ given the effort level e, and by $\psi(e)$ the cost of exerting an effort level e, with the standard convexity assumptions.

The optimal level of effort e_j will be chosen by country j, conditional on all other levels of effort, by solving the following problem:

$$Max_e \int x^*(\tilde{\theta} - t) f(\tilde{\theta}_j, e)\, d\tilde{\theta}_j - \psi(e_j),$$

where θ denotes the n-vector of social benefits provided by the countries under a truthful revelation mechanism, t is the n-vector of contributions to the financing of the bailout, and $x^*(\cdot)$ is the decision mechanism agreed upon.

The objective function depends, as before, on each country's net benefit from a bailout. As the decision taken depends upon the signals of all countries and with some probability the decision will be contrary to the country's interest, this reduces the incentives to provide the same level of effort as before, and therefore, the level of effort is inferior to the one implemented in the single-country case.

As a consequence, under the decentralized scheme, there is underprovision of information regarding the costs and benefits of a transnational bank bailout.

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[9] The Banking Supervision Committee in the European Central Bank comprises representatives of the banking supervisory authorities of the European Union countries. It is developing into a key forum for multilateral cooperation in Europe. With a more informal structure, the Groupe de Contact is allowed to discuss individual banking cases from a multilateral perspective (see Padoa-Schioppa, 1999, p. 9).

This issue of the incentives to provide information in a multiregulator set-up has previously been explored by Holthausen and Ronde (2004) and Kahn and Santos (2005) in a more complete framework with similar results.

Holthausen and Ronde (2004) consider the "cheap talk" game between regulators when a branch-structured bank is in financial distress. The ultimate decision is in the hands of the home regulator, but both regulators have access to private information relevant for the closure decision. The authors show that the host country supervisor has incentives to conceal part of the information it possesses. This will lead to "type I" and "type II" mistakes, that is, banks that should be closed down being bailed out and banks that should be bailed out being liquidated.

A similar result could be derived from the extension of Kahn and Santos (2005) to a multinational set-up. Kahn and Santos address the issue of the transmission of information from the central bank to the deposit insurance company in Repullo's model and show that, except in extreme cases, the central bank will never reveal its information. The extension to the multinational bank would provide the same type of results.

6. Regulatory Implications

As multinational banks become the main type of banking business unit, as information asymmetries and conflicts of interest between regulators develop, the cost–benefit analysis of regulation is modified. Globalization affects banks' regulation in two different ways. First, the existence of an international interbank market leads banks to rely on this mechanism in order to cope with their liquidity needs. The possibility of a gridlock in the international interbank market would therefore imply a sudden stop for some countries and would precipitate a crisis. The lender of last resort may therefore have a more active role in preventing this type of crises by coordinating the different countries' lending.

Second, the existence of multinational banks leads to a higher cost of bailout, for three main reasons: first, the different regulators have different objective functions, so that each regulator considers only the home bank bankruptcy social costs while disregarding the costs for the host country; second, there is a cost of sharing the total cost of a bank bailout among the different countries; and third, the incentives to produce reliable accurate information are decreased.

The implication is that, as the cost of the safety net is increased, the optimal extent of the safety net is to be reduced. In other words, regulators should rely more on the mechanisms that allow them to limit the social cost of a bank crisis. This means that, because we have to acknowledge that in a multinational environment, banks' access to a possible bailout will be much more infrequent, regulators have to adapt to this new environment where a higher probability of a bank bankruptcy is to be expected. From an efficiency viewpoint, this implies that regulators should decrease the cost of closure and build additional firewalls against contagion. This implies, in particular, that regulators should go further in the development of the legal and institutional framework (as the US prompt corrective action), so as to allow for the orderly closure of multinational banks that are in financial distress.

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The Broad Yen Carry Trade

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1. Introduction

A carry trade is constructed by borrowing a low interest rate currency to fund the purchase of a high interest rate currency — that is, in selling currencies forward that are at a significant forward premium. The "yen carry trade" in particular has been a topical subject of debate over the last decade or more given the extended period of low interest rates in Japan.

Although the carry trade is often portrayed purely as a bet on the foreign exchange markets, the significance of the carry trade extends far beyond the narrow confines of the foreign exchange market, and arguably extends into all reaches of the global financial system. The key to understanding the wider significance of the carry trade is to follow the trail of leveraged bets through the financial system through interlocking balance sheets of the financial intermediaries involved. Take an example: a hedge fund that wishes to take on a larger position in a security obtains funding from its prime broker (a Wall Street investment bank, say) by pledging assets in a repurchase agreement (a "repo"). The prime broker, for its part, funds the loan to the hedge fund by borrowing from another party. But who lends to the Wall Street bank and at what rate?

If the Wall Street bank borrows in New York, it will pay a rate closely tied to the short-term US dollar interbank rate. However, if it

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were to borrow in Tokyo, and in Japanese yen, it can borrow at the much lower yen overnight rate. A bank with global reach can borrow yen through its Tokyo office. The Tokyo office of the Wall Street bank then has yen liabilities to Japanese banks, but has yen assets against its New York head office. The lending by the Japan office of the Wall Street bank to its head office is captured in its "interoffice" accounts, and reported to the Bank of Japan. By monitoring the waxing and waning of the interoffice accounts of foreign banks in Tokyo, we can gain a valuable window on the overall risk appetite and the workings of the global financial system.

We find that the interoffice accounts of foreign banks in Tokyo reveal some important lessons. We focus on three in particular:

- Until recently, foreign banks have maintained a net long position in Japanese assets through its interoffice accounts. However, in the period leading up to the credit crisis of 2007, yen liabilities of foreign banks surged, leading to an unprecedented net *short* position in Japanese assets. We see this surge as bearing the hallmarks of the yen carry trade, interpreted broadly as above. These net short positions were sharply unwound in August 2007, coinciding with the peak of the credit crisis of 2007.
- As found in Adrian and Shin (2007a) for the fluctuations in US primary dealer balance sheets, we find that the fluctuations in the size of the net interoffice accounts are intimately tied to the state of overall risk appetite, as measured by the VIX index of implied volatility on the broader US stock market. The periods when foreign banks have large yen liabilities are also those periods with low readings of the VIX index. This fact gives a clue as to why major global stock indices have been so closely aligned with the exchange rates of high yielding currencies *vis-à-vis* the yen in recent years.
- Finally, we find that the difference between the yen overnight rate and a summary measure of overnight rates in developed countries mirrors closely the overall size of the net interoffice accounts. Yen liabilities are high when foreign overnight rates are high relative to overnight rates in Japan. Conversely, when foreign overnight rates are close to Japanese rates, foreign banks have low yen liabilities. During the period of exceptionally low US interest rates in 2002 to 2004, foreign banks maintained low yen liabilities, suggesting that they could satisfy

their funding needs by borrowing in US dollars without tapping the yen market.

This last bullet point holds potentially important lessons for monetary policy. Although monetary policy is conducted primarily with domestic macroeconomic conditions in mind, there are inevitable global spillovers of monetary policy. In recent years, with the advent of formal inflation-targeting and moves toward greater focus on managing market expectations of future central bank actions, attention has shifted away from short-term rates as an important price variable in its own right. Our preliminary findings suggest that short-term rates and balance sheet size may be important in their own right for the conduct of monetary policy.

The outline of our paper is as follows. We begin with a review of the institutional background of the interoffice accounts of foreign banks in Japan and chart the shifts in the balance sheet composition of foreign banks over time. We chart the fluctuations in the interoffice accounts, and highlight the surge in yen liabilities immediately preceding the 2007 credit crisis. We then investigate how the fluctuations in the net interoffice accounts relate to risk appetite, as measured by the VIX index, and how they relate to the difference between foreign overnight rates and the yen interest rate. We conclude with some tentative observations on the implications of our findings for monetary policy.

2. Institutional Background

Our focus is the chain of balance sheet interconnections that link a global financial intermediary with sources of yen funding. The stylized chain is depicted in Figure 1.

A Wall Street bank can tap short-term yen funds through its office in Japan by borrowing in the yen interbank market. Some of these funds will be lent on to its headquarters for further recycling to other users (e.g., hedge funds), or kept on the bank's books for its own use (such as funding its own proprietary trading desk).

Two links in the chain are of particular interest in the context of this paper, namely, the size of the short-term lending and borrowing in the yen interbank market (the final link), and the interoffice accounts (the penultimate link). Although the interbank positions will give some idea of the

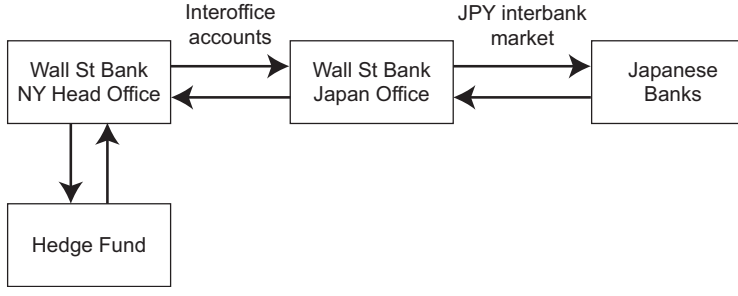

Figure 1. Balance sheet trail

aggregate yen liabilities, the interoffice account gives an insight into how much of the yen liabilities are used to fund activities *outside* Japan. The telltale signs of the "broad yen carry trade" (if we may coin this term) would be the conjunction of:

- Large yen liabilities in the JPY interbank market, and
- Large net assets on the interoffice account.

This is because when yen funds are channeled for use outside Japan, there is the conjunction of large yen borrowing and then the on-lending of these yen funds to entities outside Japan.

Figure 2 illustrates the trail through the balance sheet of the Japan office of the global bank. The left-hand panel shows the initial stylized balance sheet of the Japan office. The Japan office holds various assets — such as Japanese securities and loans to Japanese entities ("call loans") — and funds the asset holding partly by borrowing locally in the JPY interbank market ("call money"), and partly by funding from its New York headquarters through the interoffice liabilities. In the left-hand panel, the net interoffice account (interoffice assets — interoffice liabilities) is negative, meaning that the Wall Street bank holds a net long position in Japanese assets.

The right-hand panel of Figure 2 shows the increased channeling of yen funds to the New York head office via the interoffice account. The Japan office borrows more yen (increases call money), and then lends on the proceeds to the New York headquarters through increased interoffice assets. In the illustration in the right-hand panel, the net interoffice account becomes positive, reflecting the larger on-lending to the New York office.

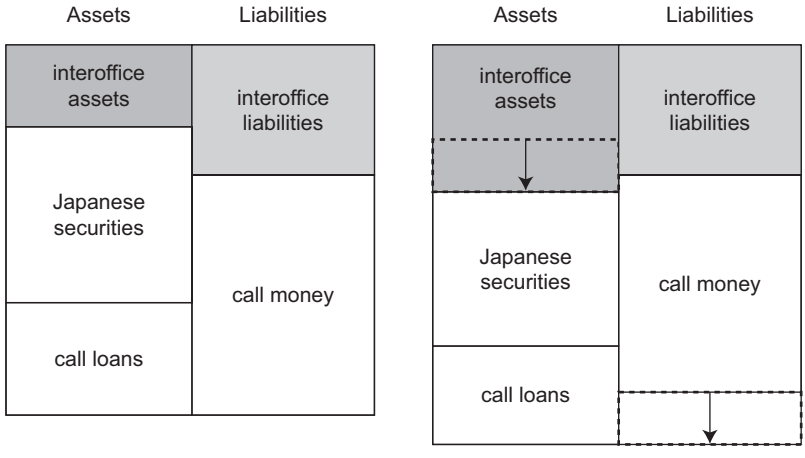

Figure 2. Channeling of yen funds via interoffice account

Such a position is tantamount to a net short position in Japanese assets, and can be seen as part of the broad yen carry trade.

As we will see, the net interoffice account has normally been negative, implying that foreign banks have held net long positions in Japanese assets. However, in the run-up to the credit crisis of 2007, the channeling of yen funds surged, making net interoffice accounts *positive*, until being unwound sharply in August 2007. The implication is that the broad yen carry trade reached a peak in this most recent period leading up to the credit crisis of 2007.

3. A First Look at the Data

3.1 *Total assets of foreign banks in Japan*

Before going to our key plots, we first plot the total assets of foreign banks in Japan in Figure 3. Total assets of foreign banks increased rapidly in the late 1990s, and have stayed high since. The composition of total assets (given in Figure 4) gives clues as to the reasons for the increase in the late 1990s.

The sharp increase in foreign bank assets in 1997 and 1998 is accounted for by the increase in "bills bought". The Japan premium ruling at the time

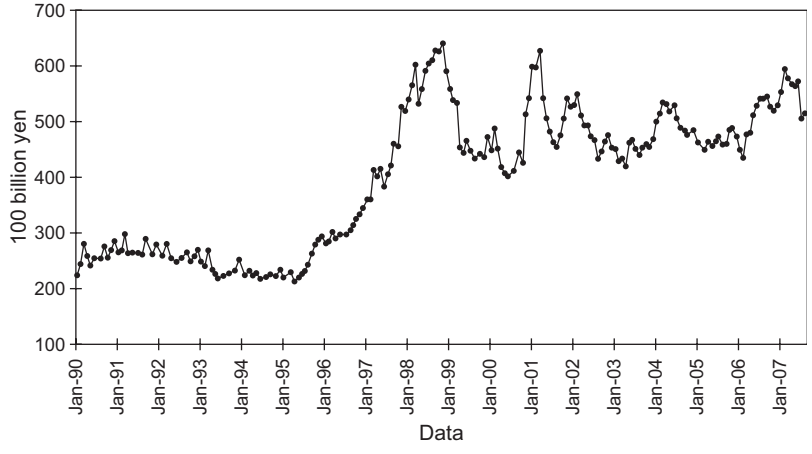

Figure 3. Total assets of foreign banks in Japan

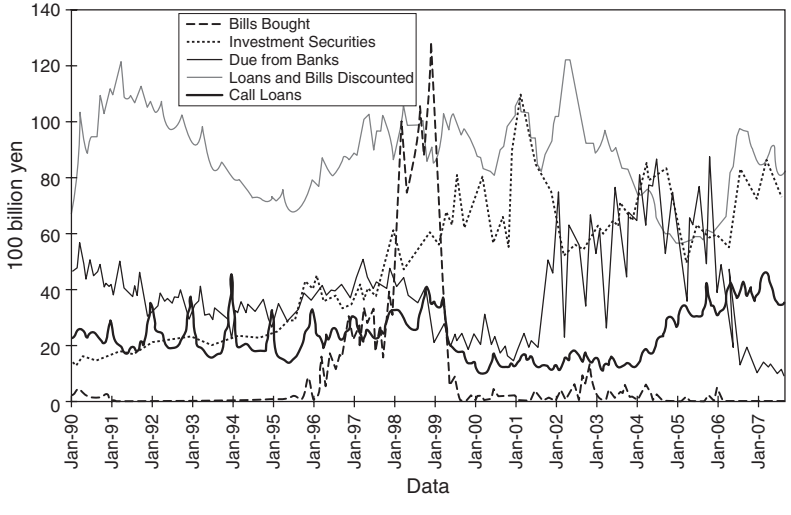

Figure 4. Composition of assets of foreign banks in Japan

meant that non-Japanese banks had a considerable pricing advantage over local Japanese rivals, and managed to exploit this advantage.

Even as the "bills bought" amount falls in 1999 and 2000, the slack is taken up by holdings of Japanese securities in 2000 and 2001. Lately, the item "due from banks" has taken up the slack left by falls in other

categories. This period coincides with the period of quantitative easing by the Bank of Japan, and suggests that even foreign banks had surplus balances at the BOJ.

3.2 *Broad yen carry trade*

We now focus on the key series. Figures 5 and 6 plot, respectively, the aggregate interbank assets of foreign banks in Japan ("call loan") and the aggregate interbank liabilities of foreign banks in Japan ("call money"). Call loans have fluctuated over the years, and were low in the early part of the decade when US interest rates were exceptionally low. Call money (yen liabilities) have fluctuated even more, with a surge in the period after 2004, when the US interbank rate was rising. Note that the scale is different in the two series, so that the surge in yen liabilities is larger than at first meets the eye.

As a result of the surge in yen liabilities, the net interbank position of foreign banks becomes sharply negative in the most recent period, beginning in 2006 (see Figure 7). However, the critical piece in the jigsaw puzzle is the stance on the interoffice account. In order to conclude that the surge in yen liabilities is associated with the broad yen carry trade, we need to verify that the increased yen liabilities have been channeled out of

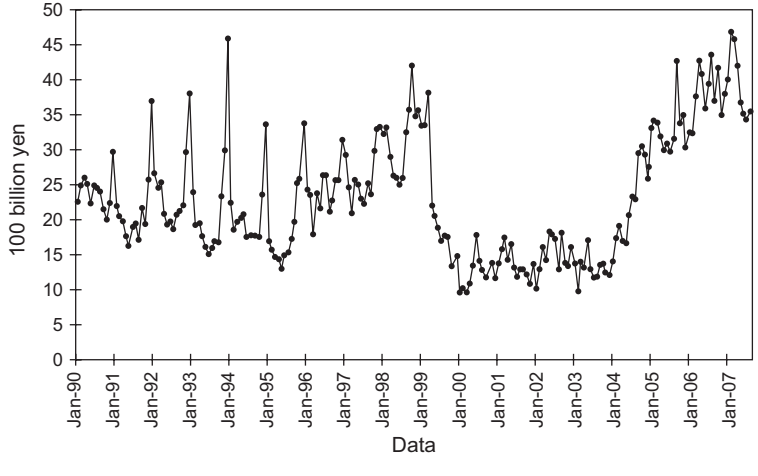

Figure 5. Interbank assets (call loan) of foreign banks in Japan

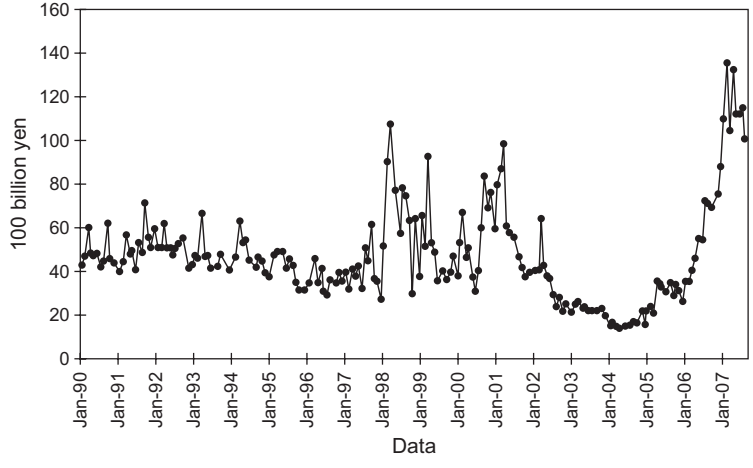

Figure 6. Interbank liabilities (call money) of foreign banks in Japan

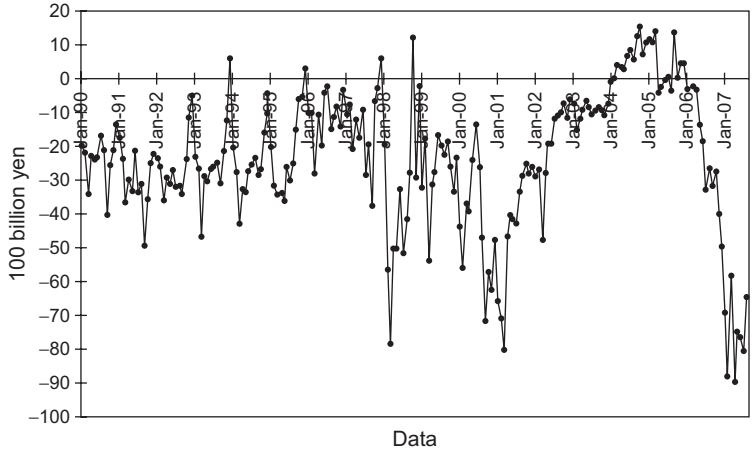

Figure 7. Net interbank assets of foreign banks in Japan

Japan to other offices of the banks concerned. The crucial piece of evidence is therefore the net interoffice accounts, as presented in Figure 8.

As previously discussed, the net interoffice accounts of foreign banks have normally been negative, implying that foreign banks have held a net long position in Japanese assets. In the period of the "Japan premium" (roughly 1997 to 1998), foreign banks held large net long positions in

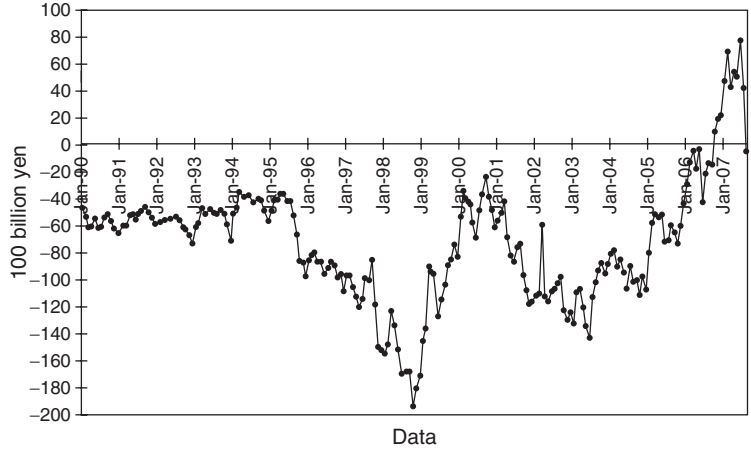

Figure 8. Net interoffice accounts of foreign banks in Japan

Japanese assets, given their funding advantage over Japanese rivals handicapped by the Japan premium.[1]

However, the most noteworthy feature of Figure 8 is the surge in net interoffice accounts in the most recent period, dating from around 2005. The increase in the net interoffice account is so large that the usual sign of the net interoffice account was reversed in the period leading up to the crisis of 2007. The implication is that yen funding had been channeled out of Japan in large quantities immediately prior to the credit crisis of 2007.

Figure 9 is a scatter chart of the monthly change in the interoffice accounts of foreign banks against the monthly change in the net interbank assets (call loan — call money) of foreign banks from 1999. If our hypothesis is correct that the fluctuations in yen liabilities reflect the broad yen carry trade, then the points on the scatter chart should be negatively sloped. The slope of the relationship would depend on the degree to which the yen liabilities of the foreign banks' Japan office merely reflects the channeling of yen to uses outside Japan. If the slope is −1, then there is a one-for-one relationship between increases in yen interbank liabilities and yen interoffice accounts, suggesting that changes in yen liabilities reflect the broad yen carry trade. If the slope has a lower absolute value, then the

[1] The Japan premium explains the very sharp spike upward in the "bills bought" component of foreign banks' assets, as shown in Figure 4.

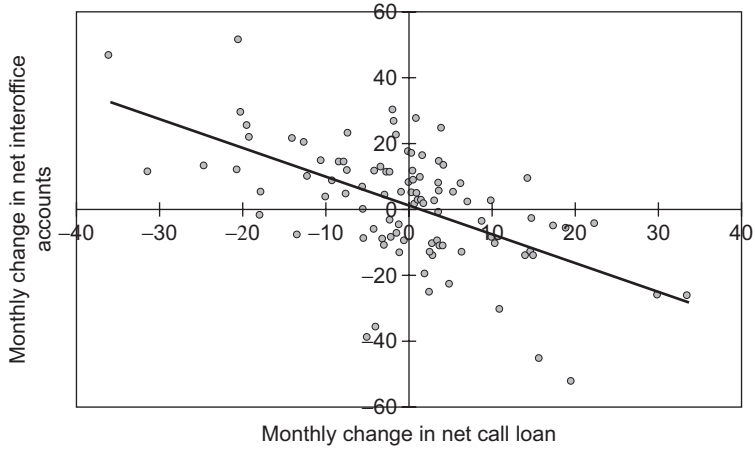

Figure 9. Scatter chart of change in net interoffice accounts against change in net call loans (unit: 100 billion yen)

fluctuations in yen interbank liabilities would reflect other motives for borrowing yen (such as funding the purchase of Japanese securities).

In the scatter chart, we see, indeed, that the relationship is strongly negative. The slope of the OLS regression is –0:89.[2] Thus, the slope is reasonably close to –1, which is consistent with the hypothesis that the Japan offices of the foreign banks play the role of channeling yen liquidity out of Japan in the broad yen carry trade.

The evidence focuses attention on the question of how such yen funding has been used by the headquarters offices of the foreign banks. At this point, the trail becomes murkier, but it would be a reasonable conjecture (to be verified through other evidence) that the increased yen funding has either been recycled for use by the customers of the foreign banks in their home markets (e.g., hedge funds), or have funded the broad yen carry trade on the bank's own books (e.g., through its proprietary trading desk).

We have focused on the yen interbank for evidence of the broad carry trade, but there are other means through which foreign institutions can raise funding in Japan, such as the issuance of "Samurai bonds" — i.e., yen-denominated bonds issued by nonresidents, especially when the issuer is a foreign bank. A more comprehensive study of the carry trade would need to take account of such alternative funding sources.

[2] The *t*-statistic is –7:15 and the R^2 is 0.34.

4. Carry Trades and Risk Appetite

We now examine the wider implications of the carry trade. Our focus is on the implications of expansions of balance sheets for the appetite for risk. In a financial system where balance sheets are continuously marked to market, changes in asset prices show up immediately on the balance sheet, and so have an immediate impact on the net worth of all constituents of the financial system. The reactions of financial intermediaries to such changes in net worth is a critical influence on overall market risk appetite.

If financial intermediaries were passive and did not adjust their balance sheets to changes in net worth, then leverage would fall when total assets rise. Change in leverage and change in balance sheet size would then be negatively related. However, as documented by Adrian and Shin (2007a), the evidence points to a strongly positive relationship between changes in leverage and changes in balance sheet size. Far from being passive, financial intermediaries adjust their balance sheets actively, and do so in such a way that leverage is high during booms and low during busts.

Procyclical leverage can be seen as a consequence of the active management of balance sheets by financial intermediaries who respond to changes in prices and measured risk. For financial intermediaries, their models of risk and economic capital dictate active management of their overall value at risk (VaR) through adjustments of their balance sheets. Credit ratings are a key determinant of their cost of funding, and they will attempt to manage key financial ratios so as to hit their credit rating targets. From the point of view of each financial intermediary, decision rules that result in procyclical leverage are readily understandable. However, there are aggregate consequences of such behavior for the financial system as a whole that are not taken into consideration by an individual financial intermediary. Such behavior has aggregate consequences on overall financial conditions, risk appetite and the amplification of financial cycles.

Figures 10 and 11 are taken from Adrian and Shin (2007a) and plot the contrasting patterns in the quarterly changes in total assets to quarterly changes in leverage as given in the Flow of Funds account for the United States. The data are from 1963 to 2006. For households, Figure 10 shows a strongly negative relationship, suggesting a passive stance toward changes in net worth arising from asset price changes.

In contrast, Figure 11 shows that for financial intermediaries, leverage is high exactly when balance sheets are large. In this sense, leverage is

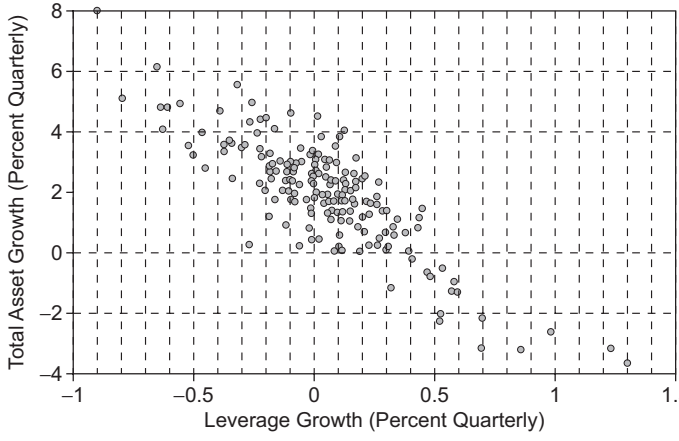

Figure 10. Households: Total assets and leverage
Source: Board of Governors, Federal Reserve, Flow of Funds, 1963Q1–2006Q4.

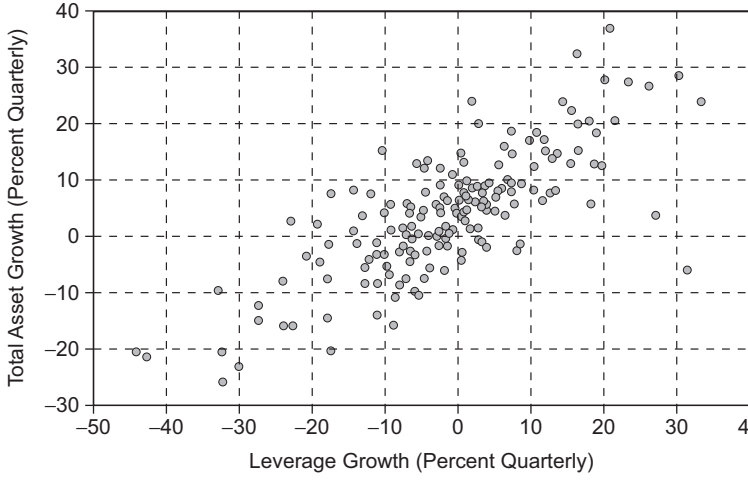

Figure 11. Security dealers and brokers
Source: Board of Governors, Federal Reserve, Flow of Funds, 1963Q1–2006Q4.

procyclical. Ayuso, Perez and Saurina (2004) exhibit similar evidence on regulatory capital over the cycle from panel data for Spanish banks.

In order to appreciate the aggregate consequences of procyclical leverage, let us consider the behavior of a financial intermediary that manages

its balance sheet actively so as to maintain a *constant* leverage ratio of 10. Suppose the initial balance sheet is as follows. The financial intermediary holds 100 worth of securities, and has funded this holding with debt worth 90.

Assets	**Liabilities**
Securities, 100	Equity, 10 Debt, 90

Assume that the price of debt is approximately constant for small changes in total assets. Suppose the price of securities increases by 1 percent to 101.

Assets	**Liabilities**
Securities, 101	Equity, 11 Debt, 90

Leverage then falls to 101 = 11 = 9:18. If the bank targets leverage of 10, then it must take on additional debt of D to purchase D worth of securities on the asset side so that

$$\frac{\text{assets}}{\text{equity}} = \frac{101 + D}{11} = 10.$$

The solution is $D = 9$. The bank takes on additional debt worth 9, and with this money, purchases securities worth 9. Thus, an increase in the price of the security of 1 leads to an increased holding worth 9. The demand curve is *upward*-sloping. After the purchase, leverage is now back up to 10.

Assets	**Liabilities**
Securities, 110	Equity, 11 Debt, 99

The mechanism works in reverse, too. Suppose there is a shock to the securities price so that the value of security holdings falls to 109. On the liabilities side, it is equity that bears the burden of adjustment, since the value of debt stays approximately constant.

Assets	**Liabilities**
Securities, 109	Equity, 10 Debt, 99

Leverage is now too high (109 = 10 = 10:9). The bank can adjust down its leverage by selling securities worth 9, and paying down 9 worth of debt. Thus, a *fall* in the price of securities leads to *sales* of securities. The supply curve is *downward*-sloping. The new balance sheet then looks as follows:

Assets	**Liabilities**
Securities, 100	Equity, 10 Debt, 90

The balance sheet is now back to where it started before the price changes. Leverage is back down to the target level of 10.

Leverage targeting entails upward-sloping demands and downward-sloping supplies. The perverse nature of the demand and supply curves are even stronger when the leverage of the financial intermediary is procyclical — that is, when leverage is high during booms and low during busts. When the securities price goes up, the upward adjustment of leverage entails purchases of securities that are even larger than that for the case of constant leverage. If, in addition, there is the possibility of feedback, then the adjustment of leverage and price changes will reinforce each other in an amplification of the financial cycle. If we hypothesize that greater demand for the asset tends to put upward pressure on its price (a plausible hypothesis, it would seem), then there is the potential for a feedback effect in which stronger balance sheets feed greater demand for the asset, which in turn raises the asset's price and leads to stronger balance sheets. Figure 12 illustrates the feedback during a boom.

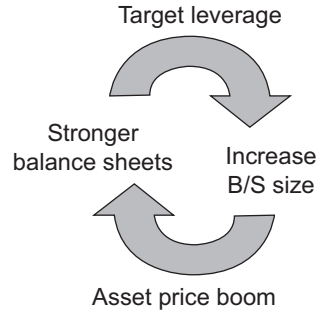

Figure 12. Target leverage in booms

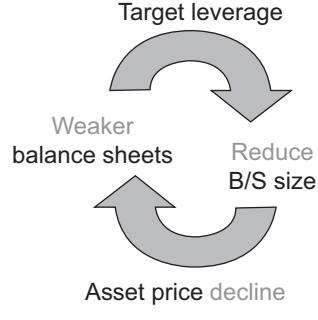

Figure 13. Target leverage in busts

The mechanism works exactly in reverse in downturns. If we hypothesize that greater supply of the asset tends to put downward pressure on its price, then there is the potential for a feedback effect in which weaker balance sheets lead to greater sales of the asset, which depresses the asset's price and leads to even weaker balance sheets. Figure 13 illustrates the feedback during a downturn.

For these reasons, it would be important to draw a distinction between the capital outflows from Japan due to the carry trades by financial intermediaries and the outflows due to the household sector's purchase of foreign assets, or the diversification of the portfolios of institutions such as mutual funds and life insurance companies that are not leveraged or have minimal leverage. Indeed, the purchase of foreign currency assets for these entities should not be seen as part of the broad yen carry trade we have discussed so far. In contrast, the most important marginal players are

the financial intermediaries whose fluctuating balance sheets determine overall financial market liquidity conditions.

Aggregate liquidity can be understood as the rate of growth of aggregate balance sheets. When financial intermediaries' balance sheets are generally strong, their leverage is too low. The financial intermediaries hold surplus capital, and they will attempt to find ways in which they can employ their surplus capital. In a loose analogy with manufacturing firms, we may see the financial system as having "surplus capacity". For such surplus capacity to be utilized, the intermediaries must expand their balance sheets. On the liabilities side, they take on more short-term debt. On the asset side, they search for potential borrowers that they can lend to. It is in this context that the broad yen carry trade comes into sharper focus. By allowing intermediaries to expand their balance sheets at lower cost, the broad carry trade fuels the financial boom. Aggregate liquidity is intimately tied to how hard the financial intermediaries search for borrowers. In the sub-prime mortgage market in the United States, we have seen that when balance sheets are expanding fast enough, even borrowers that do not have the means to repay are granted credit — so intense is the urge to employ surplus capital. The seeds of the subsequent downturn in the credit cycle are thus sown. Jimenez and Saurina (2006) show from their study of Spanish banks that the loans granted during booms have higher default rates than those granted during leaner times.

Adrian and Shin (2007a) have shown that balance sheet changes are closely related to the overall market risk appetite, as measured by the VIX index of implied volatility of stocks. In the context of the broad yen carry trade, it would be reasonable to conjecture that something similar holds, too.

Figure 14 is a scatter chart of the VIX index against the net interoffice account of foreign banks in Japan. There is a striking negative relation, where large net interoffice accounts are associated with lower implied volatility — i.e., large balance sheets with greater risk appetite. We know from the period immediately preceding the 2007 credit crisis that implied volatility had plumbed historical lows. As we have seen earlier, this was precisely the period when the net interoffice accounts became positive — also an unprecedented event. More worryingly, the unwinding of these large net interbank assets to return the system to its historical norm will undoubtedly have adverse aggregate consequences.

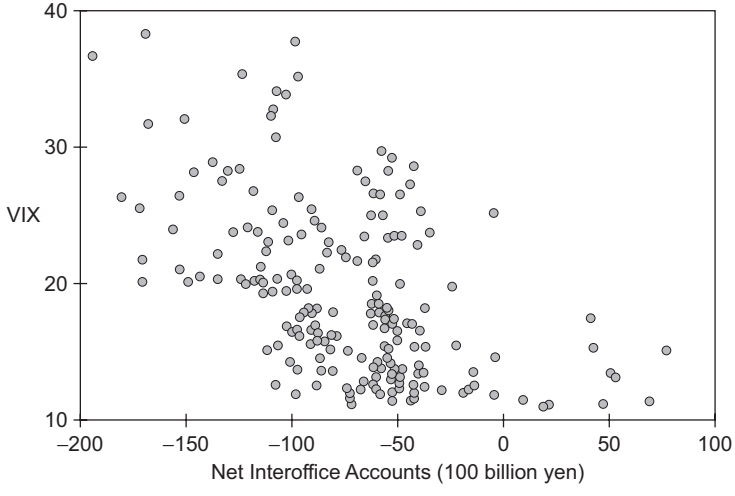

Figure 14. Scatter chart of VIX against net interoffice account

5. Carry Trades and Monetary Policy

Given the importance of balance-sheet fluctuations for overall risk appetite and their spillover effects for the economy as a whole, the role of the carry trade in facilitating or amplifying the balance-sheet fluctuations make it a prime concern for monetary authorities. We examine the determinants of the size of the yen carry trade, especially the role of the short-term interest rate.

The important role played by the overnight rate can be gleaned from the relationship between the extent of the broad yen carry trade and the interest rate differential between Japan and other developed countries. Figure 15 charts the net interoffice accounts with the difference between the overnight rates in Japan and a simple average of the policy rates in the US, Euro zone and Australia. The chart suggests that since 1999, we have a negative relationship between the two. The larger is the difference in short-term rates between Japan and the group of countries we consider (US, Euro zone and Australia), the greater is the broad yen carry trade. It is notable, especially, that in the period 2002–2004 when US interest rates were low, and hence close to that of Japan's, the net interoffice account shows little evidence of large-scale carry trades. In contrast, the period from 2005 onwards shows a surge in net interoffice accounts coming at

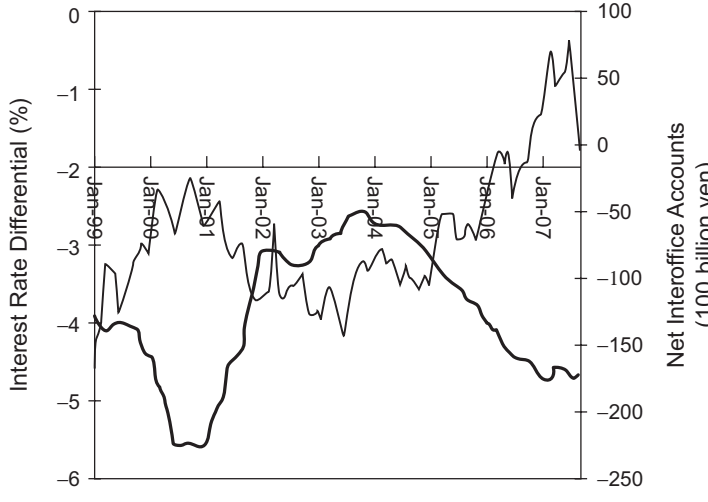

Figure 15. Net interoffice accounts and interest rate differential between Japan and simple average of USD, EUR and AUD

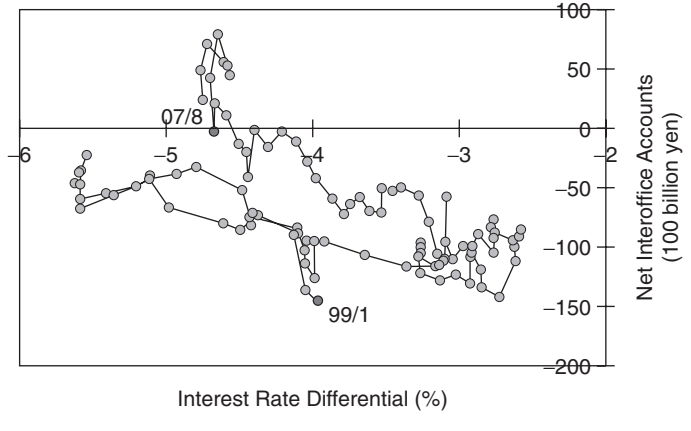

Figure 16. Scatter chart of the net interoffice accounts and interest rate differential

the time when US interest rates were moving back up to historically more normal levels.

The same information can be represented as a timed scatter chart as in Figure 16. There is a strongly negative relationship in the two

series. The first and last data points (January 1999 and August 2007) are indicated with the black dots. An OLS regression has a *t*-statistic of −7:8.

The importance of the interest rate differential also figures in theoretical models of the carry trade (see Plantin and Shin, 2006). The carry element combined with a procylical leverage ratio (illustrated in the previous section) serve to increase the spillover effects of one currency speculator's actions on others, making speculative trading strategic complements. The carry element turns out to be crucial in this regard. Without the carry element, speculators' actions are strategic substitutes.

Our empirical findings suggest that the overnight rate set by central banks may have an important role in influencing the scale of the carry trade, but more broadly in determining balance-sheet size in the financial sector as a whole. Our results are in line with the results of Adrian and Shin (2007b), who show that the residuals from a Taylor rule regression is closely (negatively) related to the growth of financial sector balance sheets in the United States. These results suggest that overnight rates may have some importance in their own right when conducting monetary policy, not merely as an instrument to signal the central bank's intentions of future actions.

Indeed, the trend in recent years, especially with the advent of formal inflation-targeting at many central banks around the world, has been to emphasize the role of the overnight rate only as a means of communicating with the market on future central bank actions, and thereby managing market expectations. Alan Blinder (1998, p. 70) in his Lionel Robbins lectures states that:

> "central banks generally control only the overnight interest rate, an interest rate that is relevant to virtually no economically interesting transactions. Monetary policy has important macroeconomic effects only to the extent that it moves financial market prices that really matter — like long-term interest rates, stock market values and exchange rates."

Blinder's comments are echoed by other leading monetary economists — Svensson, Woodford, Bernanke and others — who have similarly emphasized the insignificance of the overnight rate, other than as a means of communicating with the markets on the future course of monetary policy (see, for instance, Bernanke, 2004a,b).

However, to the extent that financial stability concerns should impinge on monetary policy, the insignificance of the overnight rate may have been somewhat overdone. On the contrary, short-term rates could be conjectured to play an important role in their own right, since it is the short-term rate that determines the cost of rolling over liabilities. In addition, although monetary policy is conducted primarily with domestic macroeconomic conditions in mind, there are undoubted international spillover effects. The experience of the 2007 credit crisis is a lesson in the importance of financial stability in the conduct of monetary policy.

6. Concluding Remarks

In this paper, we have examined the broader implications of the yen carry trade for risk appetite and financial cycles. Although the yen carry trade has traditionally been viewed in narrow terms purely as a foreign exchange transaction, we have argued that it holds broader implications for the workings of the financial system and for monetary policy. The evidence from the waxing and waning of balance sheets of foreign banks operating in Japan points to a broader notion of the carry trade. Yen liabilities fund not only pure currency carry trades, but also fund the general increase in balance sheets of hedge funds and financial intermediaries. Finally, we have shown that the difference in overnight rates across countries is a crucial determinant of balance-sheet changes. Therefore, the short-term interest rate may be more important as a gauge of the stance of monetary policy than is given credit for by many leading monetary economists. Domestic monetary policy has a global dimension through the workings of the global financial system.

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Systemic Risk in a Global Context: Comment on Freixas, Hattori and Shin, and Kane

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1. Introduction

At first glance, events during the summer of 2007 seemed like an eerie manifestation of chaos theory. Instead of the flapping of butterfly wings on one continent causing a hurricane on another, however, an increase in delinquencies on sub-prime mortgages in California appeared to cause banking crises in Germany and England. On closer inspection, the turmoil in financial markets followed a familiar pattern, although the details involved new financial instruments and provided new evidence of the global integration of capital markets.

Competition among lenders, in the context of a sustained global expansion with low interest rates and rising home values, had led to deterioration in underwriting standards. Lenders (and investors in securitized loans) had accepted greater insolvency exposure, in some cases without making a conscious decision to do so.[1] Sub-prime lending was highly profitable so long as real estate markets remained buoyant, interest rates stayed low, and the expansion continued. But when a shock occurred and default rates on sub-prime mortgages rose markedly above their predicted levels, investors (and the ratings agencies) began to question the value of

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[1] While underwriting standards for sub-prime mortgages in the US are heavily implicated in the turmoil in financial markets during the summer of 2007, the deterioration in lending standards could be observed in many other sectors and countries. For example, loans to fund private equity deals were made on increasingly liberal terms with declining spreads, lighter covenants, and the acceptance of payment in kind options.

collateralized mortgage obligations (CMOs), for which they served as collateral, and the collateralized debt obligations and asset-backed commercial paper (ABCP), for which parts of these CMOs served as collateral. Financial markets began to search for institutions that would be least able to sustain the shock.

Although Hattori and Shin (2007) do not address sub-prime lending directly, their contribution provides a framework for showing how macroeconomic imbalances may have led to conditions which facilitated it. I will focus on Hattori and Shin at the conclusion of the introduction.

A German bank was damaged by *direct* exposure to the securities for which sub-prime mortgages served as part of the underlying collateral. The damage to Northern Rock was *indirect*. Market participants withdrew funding from the ABCP conduits and structure investment vehicles (SIVs) that bought and packaged mortgages and mortgage-backed securities and from institutions thought to have heavy exposures to mortgages. This was especially punishing to institutions that relied primarily on their ability to roll over liabilities in the wholesale market and to originate mortgages and securitize mortgages. The authorities in Germany and the United Kingdom promptly intervened to prevent the damage from spreading to other institutions. These interventions implicitly affirmed that these banks were special (although neither was especially large) and should not be subjected to the full rigors of market discipline. These kinds of interventions can be costly, not only in fiscal costs to taxpayers, but also in terms of moral hazard and the reputation of the authorities. Moreover, they raise troubling questions about the quality of oversight these institutions have received in the past. The contributions by Freixas (2007) and by Kane (2007) focus on emergency rescues, the lender of last resort (LLR) function, and the safety net more broadly. I will focus on these contributions after discussing Hattori and Shin (2007).

2. Hattori and Shin on the Yen Carry Trade

Although the yen carry trade (YCT) has received widespread attention as a driving force in foreign exchange markets, less emphasis has been placed on the broader implications. Hattori and Shin (2007) analyze each stage in the YCT and show how the YCT may have led to expansion of leverage and appreciation of asset prices outside of Japan.

The YCT may be defined as selling borrowed yen to invest in higher yielding assets denominated in another currency. To those who regard interest differentials as containing information about future exchange rate movements, the YCT may seem like scooping up nickels in front of a steamroller. But, it must be admitted that billions of nickels have been scooped up over the last decade and the steamroller has, so far, moved at a leisurely pace. They distinguish "broad YCT" conducted by banks and funded by interbank borrowing, which is likely to be highly leveraged, from other YCT conducted by households, mutual funds and insurance companies, which is much less likely to be leveraged. While I believe this distinction is useful, the behavior of Japanese households deserves closer attention.

Hattori and Shin (2007) rely on US flow of funds data to justify the assertion that households do not engage in procyclical leveraging. But Japanese households may behave quite differently from households in the United States. For example, Japanese housewives have a remarkable appetite for bonds issued in New Zealand dollars by the government of New Zealand (Uridashi bonds) that have no counterpart in the US Japanese retail investors may account for as much as 30 percent of the activity in foreign exchange markets and margin trading is rising. The *Economist* (2007) reports that brokers offer leverage as high as 200:1, although 20–40:1 is more typical. Moreover, in July 2007, Japanese retail investors' short position on yen exceeded those of traders on the Chicago Mercantile Exchange. These observations suggest that the Japanese household sector may also be an important component of the YCT.

Hattori and Shin (2007) focus primarily on the behavior of foreign banks in Japan. For more than a decade, Japanese interest rates have been very low relative to interest rates in most other countries. Nonetheless, when Japanese banks were subject to a credit risk premium, foreign banks were net placers in the call money market in Japan. When the premium disappeared, foreign banks became heavy net borrowers in the call money market and lent the proceeds to head offices outside Japan. This is evidenced by the large yen liabilities of foreign banks in the interbank market and the large net claims of these banks on their head offices.

How does the head office use the yen funding? Hattori and Shin (2007) assert that substantial amounts may be used to fund the firm's own proprietary trading and other customers such as hedge funds that trade actively. Even if these borrowers did not increase their leverage, this would tend to put upward pressure on asset prices. But Hattori and Shin

argue that leverage in financial intermediaries tends to be procyclical and thus the impact is amplified. As asset prices rise, net worth and the capacity for bearing risk increases. The positive correlation between net borrowing by foreign banks in Japan and the implied volatility in the US stock market indicates that perceived risk may also decline. The implied volatility also appears to be highly correlated with the yen price of the dollar (see Figure 1).

With higher net worth and lower perceived risk, firms are likely to take larger risk positions and balance sheets will grow, increasing overall liquidity. In effect, the YCT fuels a financial boom outside Japan, and the growth in balance sheets increases overall liquidity and risk-taking. Consequently, the financial system becomes increasingly vulnerable to a shock. In the event of a shock, of course, the unwinding of the YCT may amplify a downturn, just as it amplified the expansion. Based on this framework for analyzing the YCT, Hattori and Shin (2007) conclude with an admonition to central banks: since differences in overnight interbank rates fuel the YCT, central banks should pay much closer attention to the broader implications of these policy rates and consider them more than just a signal of their intent.

3. The Safety Net

Hattori and Shin (2007) describe a plausible mechanism through which financial systems become more vulnerable to a shock. Freixas (2007) and Kane (2007) focus on the safety nets that countries have established to prevent the financial system from becoming increasingly vulnerable to a shock and protect the financial system and the broader economy from collateral damage when a shock occurs. Despite the clashing of metaphors, it is useful to think of the safety net as a collection of circuit breakers. These safety nets differ markedly across countries and mesh imperfectly, but they have several circuit breakers in common. First is the chartering authority, which could prevent imprudent, incompetent or dishonest bankers from obtaining a banking license. Most countries do not rely exclusively on this circuit breaker, however, because they perceive advantages in a more competitive financial system with more liberal chartering standards.

The supervisory function of circuit breakers is designed to prevent imprudent, incompetent or dishonest bankers from taking excessive insolvency exposure. The fundamental tools of supervision are capital adequacy

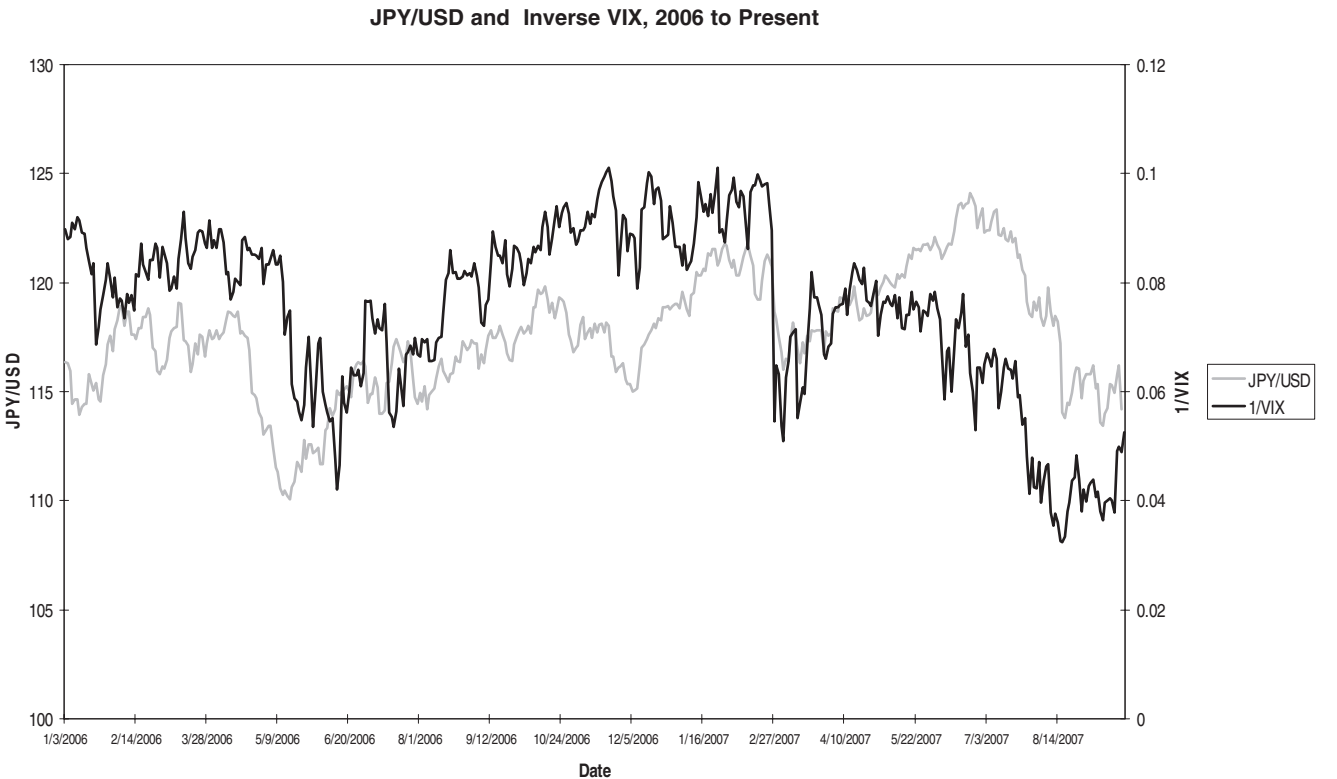

Figure 1. The yen price of the dollar tracks volatility in the US stock market

requirements and restrictions on holdings of risky assets. Either could be made sufficiently stringent to ensure that a bank was perfectly safe, but it is generally believed that banks add value through risk-taking. Consequently, prudential regulations are far looser than they would need to be to ensure perfect safety.

The termination authority could be deployed as a circuit breaker to back up prudential supervision. If the termination authority intervenes to take control of a faltering bank before its capital is exhausted and maintains depositors' access to their funds, depositors need not fear loss and are unlikely to run even if a bank encounters difficulties. The US's prompt corrective action system approaches this standard but does not always succeed in intervening before losses are incurred. In general, it is difficult to deploy the termination authority with this precision because of problems in monitoring the value of bank assets with such accuracy, and because (in most countries other than the US) the termination authority lacks the statutory power to intervene before a bank is book-value insolvent.

In principle, deposit insurance could be deployed as a circuit breaker to reassure depositors that even if the termination authority fails to intervene before a bank becomes insolvent, they need not fear loss. To function effectively in this manner, depositors must have complete confidence in the deposit insurer, insurance must cover the entire deposit and accrued interest, and depositors must have confidence that they will not lose access to their deposits in the resolution process. In practice, deposit insurance is usually less than complete and, in many countries, depositors may have to wait a considerable amount of time before regaining access to their deposits even when their deposits are fully insured. When deposit insurance fails to deter a run on a bank deemed to be systemically important, governments often issue blanket guarantees. This may stem the run, but at a potentially substantial fiscal cost. Moreover, such guarantees exacerbate moral hazard and thereby increasing the likelihood of even larger systemic crises in the future.

Finally, the lender of last resort (LLR) serves as a circuit breaker to prevent illiquidity problems from becoming insolvency problems by permitting a bank to discount assets with the LLR rather than selling them at distressed prices in the market. Freixas (2007) and Kane (2007) share a concern that the LLR will function less efficiently in the global economy, and the supervisory function and termination function need to be strengthened.

But Kane argues that bailouts may happen too frequently, and Freixas argues that they will not happen often enough.

A major part of the supervisory function involves monitoring banks with the objective of identifying problem banks for closer inspection. Problem banks may be classified as illiquid, but solvent or insolvent. Bagehot's advice was to lend only to solvent institutions, but to lend freely, at a penalty rate. Under these circumstances, last-resort lending would provide a potentially powerful, positive signal that an institution was solvent. This might be sufficient to restore confidence in the institution without the necessity of large loans.

The rationale for lending only to solvent banks is straightforward. If a bank is not solvent, liquidity assistance will not be sufficient to rehabilitate it. Moreover, lending to an insolvent bank creates moral hazard and involves a redistribution of wealth that lacks political legitimacy and is difficult to justify on grounds of equity. Finally, lending to an insolvent bank would undermine the value of the positive signal that would otherwise be conveyed by lending, thereby undermining the effectiveness of future LLR interventions for solvent but illiquid banks.

Why then do LLRs often lend to insolvent banks?[2] One possibility is that solvency is difficult to judge in a crisis and, as Kane (2007) emphasizes, LLRs are likely to give banks the benefit of any doubt. Another possibility is that a bank was solvent when it received assistance from the LLR, but experienced an additional shock and subsequently became insolvent. I suspect, however, that LLRs generally know that they are lending to an institution that is highly likely to be insolvent. They may believe that they can buy time for an orderly resolution and thus mitigate the potential costs of an abrupt closure such as loss of the firm's going concern value, loss of relationship-specific capital, loss of transactions balances and contagion to other institutions. In addition, they may hope that an institution's problems will be self-correcting. Supervisors tend to be judged by the institutional failures that occurred on their watch rather than the costs of resource misallocations that occur when an insolvent institution is permitted to continue operations. Moreover, they know that any interference with the control rights of shareholders will be challenged. Thus, they tend to provide liquidity assistance and forbear.

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[2] For a more extensive analysis of the LLR problem in an international context, see Guttentag and Herring (1983, 1987).

4. Kane and Freixas on the LLR in a Global Context

Kane (2007) emphasizes the role of conflicting regulatory objectives embedded in national regulatory cultures. He notes that regulatory cultures may vary across countries in six dimensions: (1) the statutory grant of authority and governance structure; (2) specific rules and how they are implemented; (3) surveillance methods to monitor compliance with the rules; (4) penalties that can be imposed to enforce the rules; (5) the nature and extent of due process safeguards; and (6) the scope to appeal regulatory decisions to a higher authority. One might add that regulatory resources also differ across countries in terms of human capital — the number and quality of employees — and financial capital and the ability to enforce decisions. In addition, the financial infrastructure also varies across countries as reflected in the quality of external audits, the importance of informed, institutional creditors, and the sophistication and candor of the financial press. Despite these differences, Kane notes that three norms are common to all countries: (1) the mercy norm; (2) the nationalistic norm; and (3) the nonescalation norm. All three reinforce a tendency to provide LLR assistance and exercise capital forbearance. Competition among regulators may add to these pressures as do political pressures from regulatees and their clients.

Linkages across national safety nets have not kept pace with the globalization of financial markets and institutions. When the collapse of an institution threatens to ignite an international crisis, Kane (2007) argues that incentive conflicts will be heightened. In the absence of established procedures for sharing losses arising in the resolution of a multinational financial conglomerate, LLRs may attempt to compensate through bailout lending. Pressures to give the benefit of the doubt to institutions in distress, protect domestic institutions, prevent the spread of distress through liquidation of assets at fire-sale prices and protect turf from rival regulators will result in the provision of LLR assistance with little regard to potential expense to the underwriters of the safety net — other banks and taxpayers.

Kane (2007) emphasizes that the substitution of repurchase agreements (repos) for discount window lending has weakened accountability for inappropriate LLR assistance. When LLRs rely on discount window lending, qualifying borrowers decide when to borrow, how long to borrow and what collateral to use, and the transaction is usually transparent. Repos offer much greater control to the LLR. The LLR initiates the repo

and can target particular kinds of collateral. Kane warns that this greater flexibility for the LLR comes at a price. Repos are much less transparent than discount window lending. They can mask implicit subsidies and cloak the identity of recipients, and so they make it much easier for an LLR to execute an inappropriate bailout. Kane argues that during the financial turmoil in the summer of 2007, the Fed and the European Central Bank used repos to transfer subsidies to several of the institutions whose imprudent underwriting standards caused the disruption. He notes that primary dealer status with the Fed opens channels through which both foreign and domestic financial institutions can extract hidden subsidies.

Kane's (2007) remedy for the problem of inappropriate bailout lending is to promote greater transparency to enable underwriters of the safety net to monitor costs including implicit subsidies. Regulators would be required to justify and account explicitly for the value and distribution of subsidies in LLR operations and they would be required to develop and review strategic plans for managing different kinds of crises. Unfortunately, Kane does not address the question of "How to bell the cat?" The magnitude of this challenge can be inferred from the testimony of the Governor of the Bank of England, Mervyn King, before a Select Committee of Parliament following the Northern Rock collapse. He regretted the inability of the Bank of England to provide secret emergency liquidity assistance and advocated a change in regulations to cloak future LLR operations.

Freixas (2007) views the prospect of gridlock in the interbank market as the main rationale for LLR intervention. He draws on his own earlier work to show that interbank markets may have two equilibria: (1) a good equilibrium in which the interbank market provides banks with an efficient way to deal with liquidity shocks; and (2) a bad equilibrium in which concerns over adverse selection cause the market to disintegrate. He asserts that the role of the LLR should be to sustain the good equilibrium and argues that this is much more difficult to accomplish when the interbank market becomes international.

Freixas's (2007) analysis of the decision to provide a bailout loan begins with a case in which a single regulator has perfect information, is also responsible for deposit insurance, and can claim all of a bank's assets in the event of default. This represents his benchmark case of the optimal bailout decision. The threshold probability of success to justify a bailout loan is lower, the lower the recovery value and the higher bankruptcy costs.

He shows that if another LLR is introduced, the bailout decision is more complex and less likely to be optimal. For example, if cross-border bank expansion occurs through branches, both countries adopt a universal bankruptcy regime, and deposit insurance is provided by the *host* country. A bailout is less likely because the headquarters country LLR does not internalize the costs that will occur abroad in the event of liquidation. Similarly, if the home and host country LLRs perceive different probabilities of success, they are likely to have conflicting views on whether a bailout is warranted. In addition, home and host countries may have differing insolvency regimes. Freixas (2007) examines a general case in which one country has a universal regime and the other has a territorial regime, but the differences in insolvency regimes may be even more complex.

In addition, countries often differ with regard to the point at which a weak bank requires resolution. In many countries, intervention occurs only when a bank's net worth declines to zero. In others, intervention may take place when net worth falls below some positive, specified level; and in some, simply when the authorities perceive a threat to depositors' interests.

Countries may also differ with regard to the entity — the supervisory authorities, creditors, the courts or the bank itself — that initiates the insolvency process. Conflicts may also occur over the location of the insolvency jurisdiction; as the chartering country for an international bank may differ from the seat of management, the principal place of business, the largest concentration of assets and the largest concentration of creditors as was the case in BCCI (Herring, 2005).

Differences may also exist regarding the powers and obligations of the resolution authority. For example, is the resolution authority bound by a least cost test or depositor preference or a requirement to impose haircuts on uninsured creditors? Does the resolution authority have the ability to provide a capital injection?

Countries may differ, as well, in the objectives of the resolution process. Is the objective to protect the domestic banking industry, safeguard the financial system, protect the deposit insurance fund, minimize the fiscal costs to domestic taxpayers, or minimize the spillover costs in all countries in which the faltering bank conducts business? The remote possibility that any national resolution authority would adopt this last, cosmopolitan objective makes clear how difficult it might be to coordinate a bailout decision.

Freixas (2007) next turns to implementation challenges. He assumes that each LLR knows the net benefit to its own country from a bailout and the size of the minimal bailout loan, but does not know the value of the bailout to other countries. He first examines the case of improvised cooperation in which the bailout occurs only if total contributions reach the necessary amount. He shows that voluntary contribution may often fall short of the necessary amount. Consequently, an international bank may be liquidated even though a bailout would be preferable (and more likely to happen if the bank was purely domestic and only the home country authority was involved).

Freixas (2007) next introduces the possibility of strategic behavior by the national LLRs. He assumes that LLRs agree on burden-sharing mechanism *ex ante* and that each LLR announces its perception of the net benefit of the bailout to its own country. In the absence of complete information, individual LLRs may understate the true net benefit and attempt to free ride on the efforts by other LLRs. When the total net benefits are understated, it may not be possible to raise a sufficient amount to finance a successful bailout.

This problem could be remedied if LLRs were to agree to adopt an *ex ante* burden-sharing mechanism that does not rely on truthful revelation of net benefits from the bailout, but instead relies on an observable variable that is highly correlated with the net benefit and less subject to manipulation. Freixas (2007) suggests that each country's share of the faltering bank's total loan portfolio might serve this role. I'm skeptical that LLRs would be willing to commit *ex ante* to such mechanism, however, because perceptions of the cause of the bank's problems will inevitably affect the willingness to contribute to a bailout loan. If, for example, deficient home country regulation is thought to be a primary cause, other LLRs are likely to be less willing to contribute. Just as there is a moral hazard problem in last resort-lending to banks, there is also a potential moral hazard problem in burden-sharing among LLRs.

Freixas (2007) concludes that the prospects for an optimal bailout are even dimmer when incentives for the production of information are taken into account. The production of information requires effort and is, therefore, costly. Since bailouts are less likely to succeed when banks expand across borders, expected net benefits will decline and, therefore, effort allocated to producing information relevant to a bailout will decline as well.

In practice, the information problem may be even more serious. Bad news tends to be concealed as long as possible. Managers are reluctant to share bad news with regulators because they fear loss of discretion for dealing with their bank's problems, precipitation of a liquidity crisis if the bad news is leaked to the public and, no less importantly, the loss of their jobs. In turn, an institution's primary supervisor is often very reluctant to share adverse information with other domestic supervisors, much less foreign supervisors. Even if the primary supervisor shares objective information regarding a bank's balance sheet and income statement, it may withhold soft information regarding a bank's likely future condition, on grounds that it is somewhat speculative and not objectively verifiable. More importantly, the primary supervisor may fear that full disclosure of a problem may reduce the scope of its discretion for dealing with the problem. Worse still, leakage of information regarding the bank's problems could destabilize a weak bank and cause it to become insolvent. Consequently, bad news tends to be closely guarded until conditions deteriorate to the point where it can no longer be suppressed.

Freixas (2007) concludes that globalization has made optimal bailouts harder to organize and more expensive to implement, and thus less likely to happen. Consequently, he concludes that policy-makers must rely more heavily on liquidation tools and should place heavier emphasis on improving the efficiency of resolution procedures.

Although Kane (2007) fears that LLRs will act too often in a global context, Freixas (2007) fears that they will not act often enough. Both agree, however, that resolution tools should be strengthened so that there is less need to mount bailout operations. As Kane emphasizes, to function efficiently, the LLR must be able to perform financial triage. Not only must it identify solvent but illiquid banks that deserve LLR assistance, but also it must resolve insolvent institutions by either restructuring and recapitalizing them or winding them down. This may require instituting special resolution procedures for large, international banks that are believed to be systemically important.[3] For the LLR and resolution policy to function effectively, the system must be made safe for the failure of any financial firm.

[3] See Herring (2003) for an analysis of the potential problems in resolving an international financial conglomerate.

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IV. GLOBALIZATION AND SYSTEMIC RISK — NONBANK FINANCIAL INTERMEDIARIES

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Remarks on Globalization and Systemic Risk: Nonbank Financial Intermediaries

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Good afternoon. I want to explore this afternoon the extent to which the insurance — and, more specifically, reinsurance — sector could pose a source of systemic risk. I then want to move on to consider some of the policy tools which might be available to regulators to mitigate such a risk, if indeed it exists.

There are various definitions of what constitutes "systemic risk", but virtually all of them have the following common features: the first is a notion of contagion — risk spreading from one firm or sector to another — and the second is that, regardless of its point of origin, a systemic risk should be capable of having a negative impact on the wider economy.

Therefore, in considering whether the reinsurance sector poses systemic risk, we need to examine:

- The nature of the sector's interaction with other parts of the financial system; and
- Whether there is a transmission mechanism from the reinsurance sector to "real life", that is, the real economy in goods and services.

1. Interaction with the Financial System

In the last two years, we have seen a significant increase in the levels of participation by capital markets players in assuming reinsurance risk

* Julian Adams was, until recently, the chairman of the IAIS Reinsurance Transparency Group. Views are those of the author and not necessarily the IAIS Reinsurance Transparency Group.

(although it should be noted that overall amounts remain small in the context of global capital flows). As well as presenting the opportunity for worthwhile short-term returns, it seems to be generally accepted that part of the attraction of such transactions (from an investor perspective) derives from a perception of an almost complete noncorrelation between insurance risk and the other forms of risk to which financial institutions are subject.

This noncorrelation is understandable when one looks at the nature of different types of institutions' liabilities, and the events which could give rise to them crystallizing. Insurers and reinsurers are not subject to the same kind of liquidity pressures that are a feature of banks because they have virtually no "on demand" liabilities: policyholders only have a right to cash in the event that they present a valid claim, and these (by their very nature) are often not settled quickly.

Two major studies have looked at the interaction of the reinsurance market with other parts of the financial system in recent years[1] and both have concluded — convincingly — that the comparatively small size of the reinsurance sector makes it difficult to conclude that it is "systemic" in this respect. Whilst reinsurers are participants in the securities markets as investors and providers of credit enhancement to securities issued by others, in neither capacity does it appear that their scale is even approaching large enough to pose a significant threat to the rest of the financial system. Figures provided by the world's largest reinsurers to the IAIS suggest that at end 2005, the balance sheet value of financial instruments held by those reinsurers totaled around US$740 billion, which is relatively insignificant when viewed against total global capital flows.[2]

Of course, reinsurers also provide credit risk protection to banks and other financial intermediaries, and this might prompt one to wonder whether the level of system risk had been increased by cross-sectoral risk transfer. Again, the data supplied to the IAIS suggest that this is improbable. Whilst there are important limitations to note in the compilation of data on this subject,[3] there is little evidence to suggest that, at their present levels, reinsurers' aggregate financial strength is threatened by their involvement in credit risk transfer. Further, the data suggest that reinsurers' use of

[1] Swiss Re, "Reinsurance — a systemic risk", Sigma 5/2003; and Group of Thirty, "Reinsurance and financial markets", 2006.

[2] IAIS, "Global reinsurance market report 2006", p. 49.

[3] *Ibid.*, p. 44.

derivatives is primarily for hedging purposes and their involvement with credit derivatives continues to be primarily for portfolio return and optimization purposes. Whilst it is true that their participation in the CRT market is growing, it remains very small when viewed in the context of their overall balance sheets.

2. Interaction with "Real Life"

So, it would appear that the reinsurance sector has limited scope to cause significant damage to the financial system. But what about its influence on the real economy in goods and services? The reinsurance market's principal interaction with this part of the economy is indirect, arising as it does through the direct insurance market.[4] Here, the evidence of systemic risk is more ambiguous. The role of the reinsurance market is to increase the capacity of the direct insurance market to assume risks in the real economy by:

- Widening the capital base available to support undiversifiable risks — so that available capital is no longer limited to the capital resources of one direct insurance firm, sector or geographical market;
- Pooling risks across different direct insurance firms, sectors and geographical markets — in effect, many risks which are undiversifiable at the level of a single firm, sector or geographical market become diversifiable within the global reinsurance market; and
- Supplying information, expertise and similar services — which helps direct insurers quantify, and so insure, risks that might otherwise have been unquantifiable.

[4] Herring and Litan (1995), *Financial Regulation in the Global Economy*, The Brookings Institute: "Domestic insurance markets are exposed to a variation of international systemic risk by virtue of the fact that many domestic primary insurers depend on foreign reinsurers to assume excess or catastrophic risks. When these reinsurers become reluctant to extend reinsurance in any particular line, their actions can force their primary insurance customers to raise rates or cut back the availability of insurance in domestic markets. To be sure, it would be inappropriate to classify small changes in the willingness of reinsurers to provide their services as a source of systemic risk. But if many or all reinsurers run for the door simultaneously, the effects on primary insurers and their customers could be immediate and significant."

The systemic risk posed by global reinsurance to the real economy appears to be greatest for the most advanced — and therefore most globalized — economies, and also for the least developed markets.

In less developed economies, the direct insurance markets tend to be small, and domestic reinsurers tend not to be a feature. This happens because the economy is small, and in turn makes it difficult for domestic direct insurers to gain expertise in pricing risks, and impractical for them to achieve significant risk diversification. Their ability to raise capital and invest it safely is also limited. All of these factors militate to make the domestic market heavily dependent on the actions of reinsurers, generally based overseas.

At the other end of the spectrum, the increasing pace of legal, social and technological change has made it more difficult to price risks, especially those relating to catastrophes, liabilities and new technologies. The increasing interconnectedness and geographical, legal and physical concentration of relationships, processes and resources has made it more difficult to diversify risks by pooling and has increased the capital strain on domestic direct insurers — an effect which has been exaggerated by the ever-increasing value of certain types of asses, notably real property.

This is not just theoretical. There is real evidence of changes in reinsurer behavior (either by cutting back in or pulling out of certain lines of business) having an immediate and significant impact on the availability of direct insurance cover, which in turn gives rise to significant disruption in the wider economy. A number of examples demonstrate this phenomenon, and I offer you one today from the UK.

In the 1990s, there were a number of terrorist attacks, particularly in London, which gave rise to significant property and business interruption losses. In reaction to these losses, the reinsurance market indicated its intention to withdraw cover for terrorist events on UK property risks, which in turn would have left the primary market unable to continue to offer cover, which in turn would have caused significant disruption to the operation of the commercial property market in London.

In this particular case, as with the aviation market following the September 11 terrorist attacks in New York and elsewhere, state-backed reinsurance was introduced to fill the gap. This is increasingly a feature, not only in relation to short-term supply issues, but also in areas such as those prone to natural catastrophes where it is economically unrealistic for the conventional insurance market to continue to offer cover, but where insurance coverage is necessary for normal economic life to continue.

This demonstrates all too clearly that changes in behavior by reinsurers can have a significant impact on the functioning of parts of the real economy. But what would be the effect of the collapse of a significant market player? Does this pose a source of significant systemic risk? I have already examined the interaction between the reinsurance sector and the real economy in one direction, but to answer these questions we need to consider the two-way effects of the interaction.

Shocks in the real economy such as natural or man-made catastrophic events, or changes in legal, economic, political, social or demographic circumstances generally feed through to large and often unexpected losses to reinsurers. More seriously, such shocks may lead to risks becoming unquantifiable or subject to moral hazard. In these circumstances, significant increases in reinsurance rates to match increases in claims experience where they are expected to persist or recur is not a failure of reinsurance markets; the reinsurance markets are reflecting to the real economy an issue that has arisen in the real economy. Similarly, neither is the temporary, or even permanent, withdrawal of reinsurance cover a failure of the reinsurance markets where this occurs, because risks have become unquantifiable or subject to high moral hazard. These circumstances are widely regarded as the main factors defining the limits of the insurability of risk.[5]

Indeed, on closer examination it could be argued that recent examples of capacity or affordability "crises" are in fact examples of the reinsurance markets functioning properly. As examples of the sorts of issues I am talking about, one could consider:

- Circumstances in which coverage has been withdrawn for certain perils or territories, where risks became unquantifiable or inevitable — I am thinking here of the availability of terrorism cover for UK commercial property which I discussed earlier, or constraints on capacity for natural catastrophe cover in certain US states;
- Nonavailability of reinsurance in jurisdictions where the absence of mature political and — particularly — legal systems give rise to significant levels of moral hazard; and
- Significant increases at various times in rates for many lines of insurance (for example, liability coverage in the US) to reflect social and

[5] Berliner, Baruch (1982), *Limits on the Insurability of Risks*, Prentice Hall.

legal inflation in those jurisdictions, even where those increases rendered the insurance unaffordable to most potential insureds.

In fact, the reinsurance markets may only be said to have failed where *insurable* risks are not being insured, or are only being insured at premium rates *significantly* in excess of (or below) economic cost. In this sense, in recent times reinsurance markets have only failed temporarily, if at all, in narrow sectors in the immediate aftermath of a catastrophic shock to the real economy.

Reinsurer defaults have been few and far between, numbering below 30 bankruptcies since 1980, and in fact the sector has proved remarkably resilient in the face of extreme stress events, including Hurricanes Andrew and Katrina (to name but two), the destruction of the World Trade Center, and the significant volumes of post-Enron financial institutions claims. The ongoing viability of the sector following a major loss is improved by the fact that such major losses normally give rise to an immediate commercial opportunity through higher rates. Thus, following the record loss caused by Katrina, the industry was able to raise in excess of US$21 billion, partly to recapitalize, but mainly to fund new underwriting opportunities. It is characteristic of the global nature of the industry that significant amounts of this capital flowed to offshore centers, notably Bermuda, rather than to more traditional markets.

This all serves to paint a relatively rosy picture, but what could happen to change this relatively benign assessment?

First, it is possible that the system might run out of capacity, an event which could be driven either by increases in frequency and severity of claims, or by the market attempting to provide capacity for peak risks in the rapidly expanding economies of India or China. It is not clear that the industry would necessarily be able to attract increased levels of capital against this peak risk, as it would further erode levels of return. A recent report[6] calculated the historic return on equity for European reinsurers at less than 9 percent, which is effectively value-destructive once the cost of capital is taken into account and compares poorly with other parts of the financial economy.

The second change has been the emergence of a *small number* of very large, well-capitalized, expert reinsurers. The drivers for this are

[6] Stearns, Bear (2007), European reinsurance: Diversification or pollution?", May.

well-understood, and there are obvious advantages which arise from a small number of reinsurers who:

- Have access to wide data sources and the economies of scale to enable them to develop in-depth pricing expertise;
- Are able to diversify risks by pooling internationally; and
- Are well-capitalized and have the economies of scale and expertise to access the capital markets through risk securitization and other alternative risk transfer methods.

What is uncertain, however, is whether the market would be in a position easily to absorb the failure of one of these reinsurers, especially if the failure was not for idiosyncratic reasons but occurred as a consequence of an event which also had a significant impact on other reinsurers. The failure of a major international reinsurance group in such circumstances could lead to an immediate mismatch at market-clearing price of supply and demand for reinsurance coverage, in turn leading to a consequential mismatch between supply and demand in the primary insurance markets. The effects on the real economy could be significantly disruptive, particularly if sustained into the medium, and long-term, although this possibility is relatively remote, as prices would almost certainly rise, which would attract new capital, which would correct the market to an economically sensible price.

Disruption could also be caused by an event that caused significant impairment to reinsurers on the liability side of their balance sheets at the same time as depressing the value of their assets. It is possible that this could arise in the event of a very significant influenza pandemic, which would give rise to some or all of the following simultaneously:

- An increase in reinsurers' liabilities for mortality and morbidity caused by the spread of the illness amongst the insured population;
- Operational stresses on reinsurers' businesses (in common with many other businesses) caused by staff illness, lack of appetite to travel, and the like; and
- Significant depression in global asset values caused by lack of market confidence and forced selling.

In these circumstances, the impact of the failure of a major reinsurer could be significant, with a lack of capacity in existing markets to fill

the gap even at increased rates, and a lack of available capital to create new capacity. This sort of event, if of sufficient magnitude, would, however, have significant structural implications across the global economy, which would go way beyond those caused by the failure of a reinsurer, even a very significant one. So, assuming one accepts that there is some degree, although limited, of systemic risk caused by the reinsurance industry, and that its effects are principally on the real economy, what are the policy responses available to regulators worldwide? Below I outline four, some of which are already in hand, whereas others are perhaps more aspirational.

3. Risk-Based Solvency

The adoption of a risk-sensitive approach to determine solvency of major groups and which provides incentives for firms to develop comprehensive risk management capabilities is one of the most obvious steps forward. This would have the effect of aligning regulatory and commercial interests, as well as ensuring that groups' own management take increasing responsibility for assessing the levels of capital required to support their commercial activities. Solvency II[7] is a determined step in that direction from the European Union, and its direction has been anticipated to a certain extent in some countries already — for example, the Swiss Solvency Test and the UK's Individual Capital Adequacy Standards (ICAS) framework.

4. Transparency and Disclosure — IAIS and Pillar 3

We should continue to press for higher levels of transparency of firm-specific and industrywide information, which should encompass the magnitude of risks being run, and the method by which that magnitude is estimated and controlled. The work that the International Association of Insurance Supervisors (IAIS) has done in this area in the past five years has gone a long way towards improving standards in this area, but equally there is much more to do. I have already mentioned European efforts in

[7] European Commission (2007), Proposal for a *Directive of the European Parliament on the taking up and pursuit of the business of Insurance and Reinsurance*, 10 July.

relation to Solvency II, and it is likely that a Pillar 3 element will be a significant feature of the new regime.

5. Increased Interaction with the Capital Markets

Recent years have seen significant increases in the level of assumption of insurance risk by the capital markets, principally through insurance-linked securities — "cat bonds" and the like — but also through the establishment of special-purpose quota share reinsurers, generally known as sidecars. The attractions of these sorts of transactions to the contracting parties are obvious, as

- Cedants gain access to reinsurance or retrocession capacity that might not be available to them via the traditional reinsurance marketplace; whilst
- Capital markets investors gain access to an asset class which is almost totally uncorrelated in risk terms with the rest of their holdings.

From a regulator's perspective, such transactions clearly give rise to the potential for a greater degree of contagion risk between sectors, although issues of scale mean that this is probably not significant. Concerns could also be raised about the presence of so-called "hot money" in a market traditionally associated with relatively sticky capital, and where liabilities often take some time to come to fruition. However, provided capital markets transactions are properly structured for the protection of policyholders, it is possible to see significant upside in regulatory as well as commercial terms: first, the presence of relatively mobile capital, which is redeployed frequently to maximize returns, may serve to ameliorate some of the more extreme manifestations of the insurance cycle, reducing prudential risk in the market; and second, the process which needs to be observed to establish such arrangements promotes a greater degree of risk management and modeling capability, which goes a long way to furthering wider regulatory objectives.

6. Need for Effective Groupwide Supervision

The position in the insurance sector is some way behind that in other areas, notably banking. Insurance supervisors often do not have even

basic infrastructure such as memoranda of understanding in place, which would allow exchange of information, let alone a system of global standards for groupwide solvency and risk management. Within Europe, there are directives which go some way towards achieving this, but with many of the world's major reinsurance markets being outside the European Union, these clearly only go part of the way to achieving something meaningful, and there is much more for the world's regulatory community to do for the approach to supervision to match the economic realities of how the reinsurance market operates.

7. Conclusion

So, to conclude. Does the reinsurance sector pose a form of systemic risk? No — not in the sense that banks and other financial companies may. There is a fundamental difference in the nature of its liabilities, which means it is partially disconnected from the rest of the financial system.

In providing the socially and economically desirable risk transfer function that they do, insurers and reinsurers have an impact on the real economy, and there are a number of examples from recent decades of this taking place. These examples do not, however, represent failure, but rather a reassessment of the nature and scale of insurable risks in response to outside factors. In general, reinsurers have shown resilience in the face of extreme shock events and have not presented issues for the rest of the economy. This relatively optimistic assessment may be affected over time by changes in the global economy, particularly increasing growth in currently less developed parts of the world.

Globalization Duality and Nonbank Financial Intermediaries

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It is a pleasure and an honor to attend the Tenth Annual International Banking Conference. I would like to thank colleagues at the Chicago Federal Reserve and at the International Monetary Fund for inviting me to participate in this panel. This combination of national and international financial institutions has demonstrated perfect timing in arranging this conference just a few weeks after the July/August liquidity and price disruptions that impacted financial markets around the world!

As one of the few representatives from the market risk-taking community at this conference, I would like to start my remarks with a simple and obvious statement: financial globalization has changed, and continues to change, the configuration of risks and returns facing nonbank financial intermediaries. Specifically, the last few years have illustrated two distinct factors: first, the significant investment return upside for global portfolios that are able to capture various risk premia around the world in a disciplined manner; and second, the changing nature of risks facing such portfolios, including those that impact such basic activities as short-term cash management.

This duality will likely continue and even grow in the months and years ahead, with interesting implications for the management of nonbank financial intermediaries and their systemic influence. At the heart of this process is a phenomenon that is now attracting greater attention in the globalization debate: the often bumpy dynamics of reconciling the old and the new. This reconciliation challenge applies to institutions, products, instruments, strategies and market participants with marginal price-setting influence.

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In order to shed light on this issue, I will focus my remarks initially on institutions that have "privileged" capital attributes that, at least in theory, place them in the strongest position to exploit the new opportunities and manage the different risks. My remarks will suggest that even these institutions face significant institutional and investment challenges that must be tackled early on and in a sustained fashion. I will then suggest that the challenges are more acute for other institutions. In the process, the analysis will highlight both the stabilizing and destabilizing aspects of financial globalization.

In addition to the direct implications for the management of nonbank financial intermediaries, the analysis will speak to important issues facing supervisory and regulatory bodies in both the public and private sectors (that is, also including the nature and robustness of the governance structure of nonbank financial institutions). Indeed, the analysis reinforces a simple yet powerful point that has general validity across the financial sector and beyond: globalization has enabled certain market behaviors and activities that, while welfare-enhancing over the long-term, have clearly outpaced the ability of the system — economic, institutional, and political — to accommodate and sustain them in the short run.

As various market participants and supervisory bodies try to play catch-up, problems of congested plumbing systems and temporary market failures will reappear periodically. This, in turn, will raise the question of whether cyclical hiccups can derail a phenomenon that so far has demonstrated resilient secular dynamics.

Let us start the analysis with a simple hypothesis: in addition to opening up new market segments, financial globalization has served to dramatically lower the barriers to entry to a whole range of markets and activities. This is true across geographies, product lines, and risk factors.

It is not just that any individual investor — institutional and retail — now finds it easier and cheaper to gain access to an increasing set of asset classes. He/she can now do this using a myriad of new instruments and composite products, and in the process can better fine-tune exposures through the tranching of risk according to various characteristics.

The phenomenon speaks to both existing and new investors. Due to financial globalization and related technological advances, existing investors have greater ability to reposition and manage their portfolios; and additional investors emerge due to a new capacity to enter domestic and international market segments that were previously inaccessible.

The potential outcome is greater portfolio efficiency as reflected in a higher *ex ante* information ratio. In turn, by completing markets and overcoming segmentations and other market imperfections, this may also allow for a better allocation of capital across various boundaries — geographical and thematic.

It is increasingly recognized today that there is a complex two-way relationship between greater investor demand and the production of new products. Witness the shift among financial intermediaries to an "originate and distribute model".[1] In the process, many balance sheets — directly and in a contingent fashion through various off-balance-sheet conduits — have been used to warehouse risk that is subject to eventual transfer to satisfy demand by nonbank financial intermediaries.

Not surprisingly, there has also been concern that the emphasis of due diligence has shifted excessively from the careful assessment of the underlying credit characteristics of individual components of credit risk to the modeling of correlations. Indeed, these elements have been so strong as to result into what is now more widely recognized as an overproduction and overconsumption of structured products, leading to short-term overshoots involving instruments that have proved hard to value and whose liquidity is less than robust.

Financial globalization is attractive to long-term investors who are able to benefit from the combination of improved liquidity and access, efficiency gains, greater diversification, and lower transaction costs, due to progress in harmonizing regulation and supervision. Consider the specific example of endowments and foundations. Most have the capital characteristics that, analytically at least, come closest to a pool of extremely patient investible funds: the capital allocation is permanent in that it cannot be redeemed by its contributors; distributions are usually programmed well ahead of time and adjust only slowly over time; the funds are mandated to target "long-term return" opportunities; and some, like Harvard, are backed by a AAA balance sheet.

With these characteristics, this pool of capital should have no problem in reacting to financial globalization in a manner that (1) maximizes returns, and (2) minimizes risks. After all, their robust capital base can be applied to a broader set of opportunities, and the risks can be managed through the larger set of risk-mitigating approaches now available, including self-insurance.

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[1] Please refer to Duffie (2007) for an analysis of this trend.

Yet, even these institutions are facing challenges in adapting as they continue to target superior investment returns on their privileged capital. The required revisions are visible in the three key factors that anchor superior long-term investment management:

- The specification of the "neutral" asset allocation;
- The choice of appropriate investment vehicles to best express this allocation over time; and
- The responsiveness of risk management tools and approaches, including the effectiveness of portfolio-wide reconciliation methodologies.

It is natural for investors to get excited about the potential for higher return generation associated with financial globalization; and, indeed, some have already exploited the situation effectively. After all, in terms of the three factors just cited, it has:

- Opened up to investors a much larger set of asset allocation permutations that result in significantly more attractive *ex ante* risk-adjusted returns;
- Facilitated the emergence of investment vehicles that can better exploit the risk premia on offer — either through construction from first principles using modern portfolio theories and tools, or through the purchase of an ever increasing set of complex instruments that tranche and bundle risk; and
- Allowed for more effective portfolio-wide reconciliation, seemingly better integrating micro bottom-up considerations with top-down consistency tests.

Not surprisingly, these factors are translating into a significant migration of capital to the "endowment model".[2] The migration is particularly evident among public and private pension funds, as well as sovereign wealth funds.

Reflecting the unusually favorable market conditions of the past few years, it has been difficult to get some investment managers to focus on the other (less sunny) side of the financial globalization story — *viz.*, the potential for instability. Yet, this potential is real and consequential.

As an illustration, consider the unusual nature of the drivers and consequences of the recent global market disruptions. We live today in a

[2] The best description of the model may be found in Swensen (2000).

world where the latest source of disruptions and of contagion risk originated in the most sophisticated economy in the world — the US — and not in an emerging economy. And while collateral damage was felt around the world, the contagion-induced run on a bank occurred in another industrial country — the UK — and not in an emerging economy. All this took place while the interest rate on "risk-free" short-dated US Treasury bills experienced wide intra-day swings (up to 100 basis points) that exceeded the moves on emerging markets bonds.

Admittedly, these are extreme examples. But they do point to a more general trend. The configuration of risks is changing. To illustrate, let us go back to the three key factors that anchor superior returns over time, starting with asset allocation. It is becoming apparent that:

- Diversified asset allocations no longer offer the same amount of risk-mitigating characteristics that they once did. Put another way, you get less actual diversification for each unit of historically-implied diversification.
- Hedge funds and private equity funds — the most popular investment vehicles (in terms of growth of assets under management) — are inherently fragile in a world in which they face "sudden stops" in liquidity,[3] banking intermediaries that no longer perform the traditional shock absorber role, and valuation methodologies that have proven less robust than anticipated, especially if they are "model-based".
- Risk management is further complicated by counterparty risk issues that, in the past few weeks, have touched the most sensitive part of the investment chain — that is, cash management — and/or require serious consideration of active hedging activities and tail insurance programs.

In sum, even the institutions with the strongest structural capital attributes face challenges that relate to portfolio analytics, implementation approaches, and risk mitigation. Indeed, unless they adapt, the fat tail of the distribution will be getting more pronounced and it will prove trickier to cut it off through traditional portfolio construction.

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[3] Guillermo Calvo popularized the concept of "sudden stop" in the context of the emerging market crises of the late 1990s and early 2000s (see, for example, Calvo, Izquierdo and Mejia, 2004). The term was originally coined by Rudi Dornbusch (see Dornbusch, Golfajn and Valdes, 1995).

These investment challenges are compounded by institutional issues that pertain to key support functions (mainly in operations and technology). Firms must also ensure that the expertise and capabilities of their middle and back offices are keeping up with the pace of innovation in the front office (that is, the portfolio management platform).

These considerations are significantly amplified for nonbank financial intermediaries that do not have privileged capital characteristics. Indeed, the ability to navigate the changes resulting from globalization is quite sensitive to the set of initial institutional and investment conditions.

More specifically, financial globalization has heightened the risk associated with the combination of leverage, maturity mismatches, and lack of term financing. And there are vivid examples where seemingly "smart trades" — that is, those that have significant "positive carry" in the steady state and positive expected value in a "jump-to-default" scenario — get seriously challenged in many interim states of the world.

Of course, this phenomenon is not new. It played out vividly in the context of the 1998 collapse of Long-Term Capital Management (LTCM).[4] It has also been apparent in some of the more recent institutional casualties.

There is no easy way out for investment vehicles that lack privileged capital attributes. As an example, consider the dilemma that a representative hedge fund faces in a world of periodic and sharp liquidity and market disruptions. The hedge fund can arrange sufficient cushion of term financing and underwrite the negative carry that comes with that; or it can opt for some form of "permanent capital".

Both these options raise significant principal/agent problems. In particular, the former involves a "consistent bleed" in carry/premia and, as such, is generally perceived as unattractive by many hedge funds, especially under the 2/20 fee arrangement given the asymmetrical return profile; and the latter involves the risk of disrupting internal dynamics and governance, as well as obfuscating the incentive alignment among the general and limited partners.

Let me now turn briefly to some broader issues that relate to the potential systemic effects of nonbank financial intermediaries. As nonbanks adjust to the realities of financial globalization, they can encourage certain changes in the behavior of banks. One way to think about this is through the perspective of the "disruptive technology" literature.[5]

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[4] Lowenstein (2000).

[5] See, for example, Bower and Christensen (1995).

In order for "dominant players" to avoid a costly displacement from what may be seen as either innovations or lower-end activities, they have to adapt their activities. In the case of today's marketplace, this has served to enhance the attractiveness for banks of setting up structured investment vehicles (SIVs) and other off-balance-sheet conduits, as well as purchasing ownership stakes in alternative finance firms (principally hedge funds). And many have, thereby rising the risk exposures in their balance sheets and increasing the contingent claims on them.

The market dislocations of July/August 2007 provided a vivid illustration of what can go wrong when some of the assumed "parameters" of the marketplace come unstuck. An important catalyst was the inability of the system to value complex structured products. The result was a classic market failure that inhibited buyers and sellers from coming together and engaging in the classic tatonement process. Meanwhile, banks were unable to perform the role of shock absorbers as they, themselves, were impacted. Indeed, we witnessed a near-paralysis of interbank activities as banks hoarded cash — not only because of the perception of higher counterparty risks, but also because of the uncertainty as to the exact claims on their own balance sheets. This near-paralysis compounded the problems in the money market segment occasioned by the disruptions in the commercial paper segment.

The systemic impact of these factors includes a dramatic increase in the financial system's betas and correlations and a higher risk of "sudden stops" in liquidity and traditional market-clearing activities. No wonder supervisory bodies in both the private and public sector are concerned, and rightly so. The challenges are further compounded by the more general phenomenon of large-scale migration of risk away from the purview of sophisticated regulatory/supervisory regimes. This pertains to both banks and nonbanks, impacting areas that (1) historically have lacked the required sophistication, and (2) rely excessively on outsourcing to other bodies (such as rating agencies).

The result of all this is also to heighten the probability of a harmful political backlash. Indeed, the political debate will go well beyond the adequacy of the emergency liquidity response by the Federal Reserve (and other central banks in industrial countries), and the related moral hazard risks. Political interest will also extend beyond the debacle in the subprime mortgage segment, the related increase in foreclosures, and the inadequacy of consumer protection mechanisms. Questions will be asked about the robustness of the banking system and, more generally, of the

supervisory and regulatory structure. And the risk is that the politically-induced reaction function would cross the delicate line that separates repairs from distortions.

So, where does all this leave us? Financial globalization is exposing nonbank financial intermediaries to a broader set of return opportunities. But this comes wrapped with significant challenges due to the changing configuration of risks.

The last few months have illustrated vividly the extent to which the institutional and supervisory/regulatory structure has not been able to keep up with the changes in the financial industry. Indeed, a key issue facing all participants in the international financial system is how best to progress in improving both systemwide and firmwide plumbing systems and other support functions.

The longer these adaptations take to materialize, the greater the risk of periodic sudden and sharp disruptions in markets/liquidity that result in institutional casualties. Inevitably, this would trigger systemwide official responses that, over time, risk diluting the discipline governing financial market transactions. This, in turn, would tend to accentuate the cyclical risk to the financial globalization phenomenon that, up to now, continues to demonstrate robust secular dynamics.

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Pension Plans and Systemic Risk

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Pension plans do not have the same sort of systemic risks as many other financial institutions have. They will not directly create credit crunches or bank runs. They will not directly require central bank action in order to save a country's financial system. However, there are some issues with pension plans that could affect a country's real economy, which, in turn, could lead to turmoil in a nation's financial markets.

1. State-Sponsored Pension Schemes

State sponsored pension plans are, for the most part, defined benefit plans. That is, the sponsoring entity agrees to pay a fixed sum to eligible retirees. Moreover, most of these plans have some kind of cost of living allowances (COLAs) built into them so that retirees have some protection from inflation.

The first sort of systemic risk that is troublesome is faced by the national pension schemes of many Western European countries and the United States' Social Security System. This risk has to do with the increase in the number of retirees relative to the population of workers who pay into the systems. In much of the Euro zone, the populations are not replacing themselves. That is, more people are dying than are being born. Thus, the burden on individual taxpayers to support state retirement schemes is growing. In the United States, fertility is not yet below the replication rate, but the United States is nonetheless experiencing a growing retiree population relative to the existing workforce, that is those who

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are contributing to the Social Security Fund. Tax receipts relative to payment requirements are declining; this is a source of great concern among policy-makers and social scientists.

Not only is fertility contributing to this problem, but so is longevity. For instance, when the Social Security System was first established in the United States, life expectancy was approximately 65 years. Life expectancy is now a bit over 78 years for men and 80 years for women. The situation in most of Western Europe is much the same: men and women are living longer than expected when the retirement schemes were introduced. Benefits and conditions for state pensions were set when people died at much earlier ages than they now do. This means that benefits must be paid over a longer than originally anticipated time horizon. Medical advances and better information about healthy lifestyles, for example, the dangers of cholesterol and smoking, adversely affect the situation of potentially having insufficient revenues to meet the promised levels of benefits without taking actions which could hurt the entire economy. Problems in the real economy may help to create problems in financial markets.

To cope with this situation, one thing governments can do is raise taxes, thus dampening economic growth. Governments might also reduce benefits, thus adversely affecting consumer spending and breaking a social contract with those who have paid into the various systems over their working lives. This latter issue alone could create great social and political unrest. Governments could also open the door to legal immigration to shore up the working portion of the population. This would generate more tax revenue without raising tax rates. Finally, governments could encourage people to have more children, again potentially raising tax collections without raising rates. This, however, is a long run response.

Neither of the first two possibilities is attractive. Both could have severe consequences for the affected economies and perhaps even harm their trading partners, for if economic growth slows in Country A, it will buy less from Country B and have less to invest in Country C. The third possibility is economically plausible, but could be a political nightmare. There are potential migrants that just will not be warmly welcomed in the countries where additional workers to contribute into the national pension schemes are most needed. As noted, the fourth possibility is a potential long-term solution, but may not be socially or politically feasible. We are thus left with the distinct possibility of higher taxes and

their deleterious effect on economic growth, which is particularly true in this situation since the increased taxes will not be spent in especially productive ways.

2. Private and State and Local Pension Plans

There are two types of private pension plans. The first is a defined benefit plan. This is the sort that national government-sponsored plans are, but very few private plans compensate retirees for inflation. That is, few private plans make allowances for COLAs. Defined benefit plans are also offered by state and local governments in the United States, and these often do make specific provisions for periodic adjustments to pension payments due to inflation. The risk of poor investment performance is the responsibility of the sponsoring institution. Poor investment performance simply means the organization has to contribute larger sums to make the plan whole.

As above, the systemic risks of these plans have to do more with real economic effects than directly creating turmoil in financial markets.

First, both private and state and local plans are subject to longevity risk. For private plans, this means that funds may have to be diverted from productive uses, such as capital investment or research and development, in order to pay benefits over a longer than anticipated time horizon. The same is true for state and local plans. However, the political subdivisions also have the power to tax, so benefits may be unaffected despite rising taxes and the concomitant slowing of economic activity. In this case, the polity's citizens may suffer as a result of longevity risk.

In the Unites States, the Employee Retirement Security Act (ERISA) was passed in the mid-1970s. The primary purpose of the act was to strengthen the private pension system. By strengthening the private sector's pension system, political pressures to increase Social Security benefits would, it was hoped, be reduced. One feature of ERISA was the creation of the Pension Benefit Guarantee Corporation (PBGC). This created a new kind of private pension plan risk, however.

This new risk that private pension plans pose, though not state and local plans, has to do with the fact that private pension plans are insured by the PBGC. Private companies can put their pension liabilities to the PBGC under a variety of conditions; generally, this will occur when they

become insolvent. Though unlikely, if the pension plan is fully funded, all retirees and those who will become retirees will get full benefits because the company turns over all the pension assets to the PBGC. However, if the pension plan is only partially funded, those who expected high pension benefits may not get all that they expected to get because the PBGC sets a maximum insured benefit. If the pension plan has insufficient assets, retirees expecting pension benefits above the insured maximum will be disappointed.

Systemic risk arises if the PBGC finds that its assets can no longer sustain its required payments. The PBGC can, in principle, itself go bankrupt when its liabilities exceed its assets because its obligations are not guaranteed by the federal government. This will leave many pensioners without pensions, again dampening consumer spending and creating much social and political turmoil. However, in reality, even if the PBGC did run out of funds, it is inconceivable that the federal government would allow it to default on its obligations. Again, taxes would rise in order to cover its obligations; again, higher taxes could dampen economic growth. Alternatively, the government could tolerate a bit higher rate of inflation and pay off those obligations with devalued dollars. (Recall that private plans do not have COLAs.) Neither scenario is attractive.

The second type of private pension plan is a defined contribution plan. Here, employees invest funds on a pre-tax basis into a variety of investment alternatives offered by the sponsoring company. Many companies even match a portion of the employees' voluntary contributions. In such plans, the employee bears the risk of poor investment performance. This sort of plan is rapidly replacing the defined benefit plan, in part because the degree to which such plans are controlled by ERISA is considerably less than the degree of control over defined benefit plans. Defined contribution plans are also becoming increasingly popular because they are portable, which is a desirable characteristic in an economy with a high degree of labor mobility.

The systemic risk of this type of plan has to do with potentially poor investment performance and with the voluntary nature of most defined contribution plans. Either one of these issues can leave some retirees with inadequate retirement income. This, in turn, would contribute to enhanced political pressure on the Social Security System in the US to compensate these retirees with more generous benefits. Again, this brings the prospect of higher taxes and reduced economic growth.

3. Conclusion

The systemic risks associated with pension schemes of all types work through the real economy. To the extent that higher tax rates and/or reduced retiree incomes adversely affect economic growth or create political or social turmoil, pension plans deserve monitoring, prudent management, and sensible public policies.

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V. GLOBALIZATION AND SYSTEMIC RISK — BANKS

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International Integration, Common Exposure and Systemic Risk in the Banking Sector

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1. Introduction

Worldwide, the banking sector has gone through profound transformations in the last few decades. Technical progress in financial engineering and communications technologies as well as global deregulation policies have significantly modified the international financial landscape. In Europe, the launch of the euro has also helped to accelerate these changes (Baele *et al*., 2004). An obvious outcome of these developments is a quickening in the pace with which international financial markets are being integrated. Financial institutions — large banks in particular — now benefit from much easier access to a wider range of markets and financial instruments. These developments have led some observers to worry about a possible increase in the systemic risk of the banking sector. Their main fear is that financial integration increases direct interlinkages between banks and also causes banks to compete more and more on the same markets, exposing them to the same risk factors. This common exposure to

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risks means that a downward shock could impact on most of the banks simultaneously and thus trigger a systemic crisis in the banking sector.

Although this concern is well-founded, from a theoretical point of view it is not clear that financial integration automatically induces higher common exposure to shocks. Neither is it clear that higher common exposure causes an increase in systemic risk. On the one hand, a wider range of markets and financial tools offers banks an opportunity to differentiate themselves by implementing their own specific business strategy.[1] Adopting different strategies reduces the common exposure of two banks to shocks. Access to new markets and new financial techniques also offers financial institutions more opportunities to manage and diversify their risks, which is beneficial in terms of systemic risk. On the other hand, easy access and low entry costs are likely to increase the number of banks competing in the same market. Furthermore, intensified cross-border linkages between banks increase the risk of contagion. Both effects bring about an increase in banks' common exposure to shocks and are relatively negative as regards systemic stability. To sum up, a higher level of financial integration gives rise to both positive and negative effects in terms of common exposure to shocks and systemic risk. The net effect is ambiguous. Furthermore, the link between common exposure and systemic risk is also ambiguous. Indeed, a higher common exposure to shocks does not necessarily imply higher systemic risk. An increase in common exposure can, for example, be compensated by a decrease in banks' total exposure, causing the overall systemic risk to decrease. This situation occurs, for example, when two banks switch from independent risky strategies (no common exposure, very high individual risk) to a common safe strategy (complete common exposure, but a very low risk).

In this paper, we try to clarify these theoretical ambiguities on the basis of an investigation using empirical data encompassing a panel of large international banks over a period running from 1993 through to 2006. Specifically, we pose the following questions: (1) What was the impact of international financial integration on banks' common exposure to shocks between 1993 and 2006? (2) What was the impact of international integration

[1] Hellwig (1998) shows that banks have an incentive to specialize rather than diversify in order to reduce their monitoring costs. Winton (1999) and Stomper (2006) show that both specialized and diversified banks can coexist in equilibrium. Fecht, Grüner and Hartmann (2007) show that the improvements in risk-sharing induced by integrated financial markets can lead banks to specialize on a given market.

on systemic risk in the international banking sector between 1993 and 2006? (3) Is there an empirical link between common exposure to shocks and systemic risk during the period under consideration?

To estimate the impact of international integration on common exposure, we analyze the way in which the co-movement — that is, correlation — of banks' asset-to-debt ratios (AD ratios henceforth) changes. AD ratios sum up banks' assets and liabilities as well as their interrelationship. Changes in the AD ratio can thus be considered a good summary of changes in the overall financial health of the banks. A high correlation between AD ratios suggests that both banks are similarly affected by shocks and, thus, that they have a high common exposure to shocks.

To estimate the impact of international integration on systemic risk, we compute a systemic risk index based on Lehar (2005), and study its changes during the period 1993–2006. Lehar's index measures the probability of observing a systemic crisis — defined as the simultaneous defaults of a given proportion of banks — in the banking sector at a given point in time. Finally, we investigate whether there is a link between movements in banks' common exposure (that is, the correlation between AD ratios) and systemic risk.

Several studies have analyzed correlations between variables relating to banks. DeNicolò and Kwast (2002) find a significant rise in stock return correlations between large US banking institutions during the 1990s. In a similar study for the European Union, Schröder and Schüler (2003) show that the correlations between 13 national bank stock indices have risen significantly in recent years. Brasili and Vulpes (2006) draw a similar conclusion when studying the correlations between distance-to-defaults for European banks. Hawkesby, Marsh and Stevens (2007) analyze the correlations between equity returns (and between premiums for credit default swaps) of large and complex financial institutions (LCFI) in Europe and the US. The general conclusion from these studies is that co-movement between banks has increased in the last decade, which suggests that banks are increasingly exposed to the same risk factors. Most of these studies conjectured that the observed increase in co-movements leads to higher systemic risk.

Our paper differs from the previous studies in two ways. Firstly, we use a new method based on Ledoit, Santa-Clara and Wolf (2003) to estimate the joint dynamic of the AD ratios as a whole (that is, for all banks at the same time), whereas previous studies concentrated on the dynamic between pairs of banks. The resulting time-varying covariance matrix can

then be used directly in the computation of the systemic risk index as well as for computing the evolution of correlation between banks. Secondly, and this is our main contribution, we study in detail the link between common exposure and systemic risk. We assess whether a higher common exposure to shocks (that is, higher correlation) is associated with higher or lower systemic risk, or whether it plays no role in systemic risk. As mentioned before, other studies have often claimed that higher correlation yields to higher systemic risk, without formally verifying this assumption.

The main results of our analysis are the following. Firstly, we find that the correlation between banks' AD ratios decreases in the first part of the sample period, and increases after 2000. This suggests that, before 2000, banks specialized — and thus reduced their common exposure to shocks — rather than diversifying their portfolios in response to changes in the banking sector environment. After 2000, however, the banks appear to have become increasingly similar and their common exposure has risen. This finding holds for the whole sample as well as for different regional sub-groups (namely North America and European Union). However, the degree of common exposure differs between these groups. Correlations between North American banks tend to be higher than between their European counterparts. Co-movements between US and European banks are far less pronounced than within each regional sub-group, suggesting that these two groups are (at least partially) exposed to different shocks.

Secondly, as opposed to the correlation analysis, we do not find any significant trend in the systemic risk index. The latter is rather characterized by two peaks, one at the end of 1998 and the other at the end of 2002 and the beginning of 2003. These two periods correspond to two well-known episodes of high stress levels affecting the banking sector: the LTCM and Russian crisis at the end of 1998, and a persistent downturn on the stock market in 2002–2003. Taking a closer look at individual sub-groups, we find that the high level of systemic risk in 2002–2003 was mainly attributable to the fact that European banks were also suffering from the poor economic conditions in the European economy.

Thirdly, our results point out that correlation between banks is not a reliable measure of systemic risk. The link between correlation and our systemic risk index is weak and its direction can change, depending on the period considered. The distance-to-default, by contrast, which is a combination of the volatility and level of the AD ratio, turns out to be a very reliable explanatory factor with respect to the systemic risk index. In other words, systemic risk seems to be the consequence of each bank's individual

risk-taking (that is, its distance-to-default), rather than of all banks' common exposure to shocks (correlation). This finding warns us against viewing systemic risk as a pure correlation phenomenon and highlights the danger of high and volatile leverage at the individual bank level. Note, however, that once the effects of the distance-to-default are taken into account, we find that correlation is positively associated with systemic risk. In other words, for a given level of individual risk, a higher common exposure implies a higher systemic risk.

2. Methodology

As mentioned in the Introduction, we require two elements in order to answer the main questions posed in this paper: the changes in the correlations between banks' AD ratios, and the changes in the correlations for the systemic risk index. To obtain these, we proceed in three steps: (1) since AD ratios are not directly observable, we recover them from observable equity and debt data using Merton's method (Merton, 1974); (2) we estimate joint dynamic of AD ratios with a multivariate GARCH model; and (3) we use the estimated dynamic to compute the systemic risk index. These three steps are briefly described in this section. A detailed description can be found in Allenspach and Monnin (2007).

Before estimating changes in the correlations of AD ratios, we must first collect these ratios. Unfortunately, market values for assets are not directly observable. Merton (1974) suggests modeling bank equity as a call option on bank assets in order to compute market participants' estimates of bank default probability. This method implicitly computes the market value of bank assets, and thus can be used to recover AD ratios from equity prices. So that we can use Merton's method, we assume that the assets and debts of all banks follow Itô's processes and that shocks to one bank's assets (or debts) influence other banks' assets and debts. Or, to express this in other terms, the assets and debts of one bank are correlated with the assets and debts of other banks. Under this assumption, we show that each bank's assets and debts are log normally distributed and that bank equity is equivalent to an exchange option.[2] Margrabe (1978) shows how to compute the value of such an option. The AD ratio can be

[2] Exchange options are sometimes also referred to as options to exchange one asset for another.

recovered by solving a system of two equations derived from Margrabe's formula.[3]

Once the AD ratios are known, we can estimate their dynamic and, more importantly, the dynamic of their correlations. In order to do this, we assume that the AD ratios follow a random walk with drift — which is the discrete time equivalent of Itô's process used in the previous step — with a time-varying covariance matrix. From changes in the covariance matrix over time, we can derive changes in the correlations between AD ratios, which are our measure of banks' common exposure to shock. We model the covariance matrix with a multivariate GARCH model. As in the traditional univariate case, each variance or covariance is a function of its own past value and of last period residuals. We estimate this process with a method developed by Ledoit *et al.* (2003), which is particularly well-suited for the estimation of large multivariate GARCH models.

The last step of the procedure is to estimate the systemic risk index. Our index follows Lehar (2005). The index is an estimation of the probability of a systemic banking crisis at a given point in time. We define the probability of a systemic crisis as the probability that a given proportion of the banking sector (e.g., 10 percent of the number of banks) become insolvent in the next year. We define a bank as insolvent if its assets fall below its debt face value. Unfortunately, it is not possible to compute the probability of a systemic crisis analytically, and we thus estimate it using a Monte Carlo simulation based on the AD ratio dynamic estimated in the second step.

3. Data

The dataset consists of individual banks' debt and equity prices. Data on debt is taken from Bloomberg, while equity prices originate from Datastream. As data on debt is not available on a monthly basis, quarterly and — for some banks — annual data have been transformed into monthly data by linear interpolation.

We constructed two different datasets. The first dataset comprises monthly data on 27 large international banks from November 1992 to

[3] The first equation corresponds to the value of the equity-to-debt ratio obtained with Margrabe's formula, and the second equation to the volatility of this ratio derived from the same formula using Itô's lemma.

June 2006 (long sample).[4] The second dataset (short sample) comprises data on a total of 39 large international banks — including the 27 institutions already represented in the first dataset — from June 1997 to June 2006.[5] For each sample, we constructed two sub-samples, one with North American banks only and one with European banks only.

4. Common Exposure to Shocks

To get an idea of how banks' common exposure to shocks has evolved over time, we try to identify a potential common trend in AD ratio correlations between pairs of banks. A high AD ratio correlation indicates that two banks are both equally affected by a shock, that is, that they have a high common exposure to shocks. Thus, if we observe a common upward trend in all correlations, we can conclude that, in the aggregate, banks' common exposure has increased.

A first impression concerning the trend in correlation is given by the evolution of the average AD ratio correlation (Figure 1). In both samples, the average correlation decreases until about 2000 and then increases

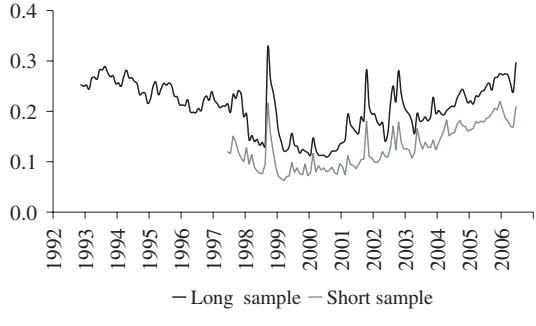

Figure 1. Average correlation between AD ratios

[4] The long sample consists of banks from: Germany (3), France (1), Italy (2), Netherlands (2), Spain (2), Sweden (2), Switzerland (1), UK (3), US (2), Canada (5), Australia (4).

[5] The short sample consists of banks from: Belgium (3), Germany (3), France (2), Italy (3), Netherlands (2), Spain (2), Sweden (2), Switzerland (1), UK (5), US (7), Canada (5), Australia (4).

regularly. This pattern is also observed in regional sub-samples. In the aggregate, banks' common exposure to shocks seems to have decreased until about 2000 and increased afterwards.

The hypothesis of a V-shaped pattern in the correlations between banks is confirmed by the estimation of a common trend for all correlations in a panel data analysis and a subsequent test for breaks in the slope of this trend. We applied the break test developed by Bai and Perron (1998, 2003) that simultaneously estimates the most probable break date and then tests whether the break date is statistically significant. The estimated break dates for the different samples and regional sub-samples all lie around 2000 and are all statistically significant. This indicates that a change in banks' common exposure occurred around the beginning of this century. Before this date, the trends are negative, implying that the common exposure to shocks had a tendency to decrease. After 2000, the trends reverse and common exposure to shocks increases, hinting at increasing similarities or interdependencies between banks. An increase in banks' comovements since 1999 is also documented by Brasili and Vulpes (2006).

We find that the average AD correlation between North American banks is generally higher than between EU banks. North American banks seem to be more commonly exposed to shocks, or more homogeneous, than EU banks. The average correlation between EU and North American banks is the lowest, indicating that banks from different regions are less commonly exposed to shocks or more heterogeneous. This result is in line with Hawkesby, Marsh and Stevens (2007), who find a high degree of heterogeneity between both sub-groups and a higher correlation between US banks.

5. Evolution of Systemic Risk

Do the changes observed in the banking industry in the past years have any impact on systemic risk? In particular, does the increase in common exposure to shocks observed since 2000 generate higher systemic risk? To answer these questions, we constructed a set of indices of systemic risk. Figure 2 presents the systemic risk indices for the samples with all banks and for different crisis definitions (that is, when 10 percent, or 20 percent, of the banking sector must become insolvent to trigger a crisis).

The indices point out two periods of high systemic risk: at the end of 1998 and at the period from the end of 2002 until the beginning of 2003.

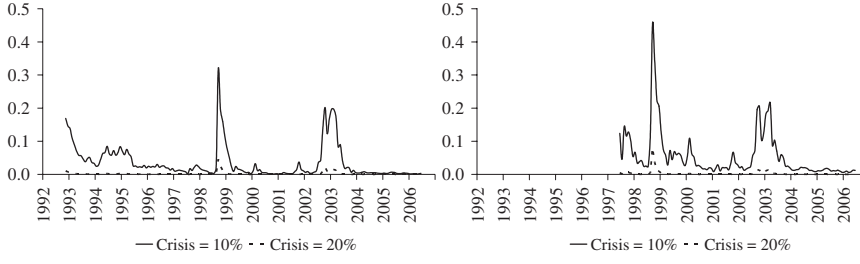

Figure 2. Systemic risk index (left: long sample, right: short sample)

These two episodes correspond to the LTCM and Russian crisis in 1998 and to the stock market downturn in 2002–2003. The systemic risk during the rest of the sample is less acute. In the different regional subsamples, we find that the 1998 peak is observed in both the US and the EU sub-indices, but the EU banks seem to have been more affected than the North American banks in 2002–2003. The latter is probably due to the fact that European banks were also facing bad economic conditions at that time.

A quick look at Figure 2 suggests that the path of the systemic risk index is very different from the changes in banks' common exposure to shocks presented in Figure 1. The latter has a distinct V-shape, whereas the former is characterized by two peaks of higher systemic risk for the banking sector. This visual impression is confirmed when we try to fit a trend with a break at the beginning of 2000 (which corresponds to the break date observed in the correlation trend) with the systemic risk indices. Most indices do not display any significant trend. Furthermore, no significant break date is detected by the Bai and Perron test for any of the indices. This result contrasts with the unambiguous trends and breaks observed in the AD ratio correlations: while a clear V-shaped trend appears in the dynamic of banks' common exposure to shocks, no apparent trend is detected in the systemic risk index pattern.

Many other studies record similar results to ours for banks' common exposure to shocks or banks' co-movements. Most of them conclude, without explicitly verifying their statements, that an increase in co-movements induces a higher systemic risk. However, given our results for the systemic risk index, the existence of the link between co-movements (or common exposure to shocks) and systemic risk is ambiguous. The next section studies this question in more detail.

6. Are Common Exposure and Systemic Risk Related?

Our results so far raise questions about the existence of a link between banks' common exposure to shocks (that is, AD ratio correlations) and systemic risk in the banking sector. Do common exposures really play a role for systemic risk? How can we interpret a change in common exposure in terms of systemic risk? From the construction of the systemic risk index, we know that three elements determine its value: (1) the correlation structure between banks' AD ratios, (2) the volatilities of the AD ratios, and (3) the level of the AD ratios. While the first component captures the systemic characteristics of a banking sector, the last two components are bank-specific. Combined in the distance-to-default,[6] they describe bank's individual risk-taking. The systemic risk index is a function of these systemic and bank-specific dimensions. Unfortunately, we do not know the exact form of this function. We can guess, though, that it is likely to be nonlinear.

An initial idea of the relationship between the systemic risk index and each of these two components is given by Figure 3, in which (an inverse logit transformation of) the systemic risk index is plotted against average AD ratio correlation (left) and distance-to-default (right). We observe a

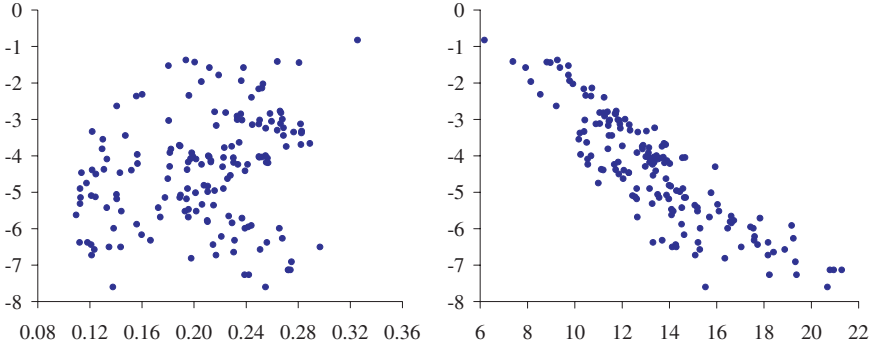

Figure 3. Systemic risk index vs. AD average correlation (left) and average distance-to-default (right)
Note: Inverse logistic transformation for the systemic risk index.

[6] The distance-to-default is equal to the level of the AD ratio divided by (the square root of) its volatility.

clear negative relationship between systemic risk and distance-to-default, while the dispersion with AD ratio correlation is much higher. Interestingly, with this transformation, the link between the systemic risk index and the distance-to-default seems to be relatively linear.

This visual impression is confirmed by the results from our rank correlation and regression analysis. We first compute the rank correlation between the systemic risk index and (1) the banks' AD ratio correlations, and (2) the banks' distance-to-default. The rank correlation statistics are preferred to the traditional (linear) correlation (Pearson coefficient) because they measure the relationship between two variables independently of the form taken by the function that links them. We use both the Spearman rank-order correlation coefficient and the Kendall measure of correlation to compute the rank correlation.[7]

We compute the rank correlation between the average correlation (or average distance-to-default) and the systemic risk index. Note, however, that it is difficult to adequately reflect the complete correlation structure (or distance-to-default structure) in one single measure such as the average. In particular, it is possible that the systemic risk index might be mainly influenced by extreme values of correlations or distance-to-defaults (that is, by banks that are extremely commonly exposed or extremely close to default). To account for this, we also use the 75 percent (25 percent) and the 90 percent (10 percent) percentiles of the correlations (distance-to-defaults). The rank correlation between the systemic risk index and these different measures are presented in Table 1.

In line with Figure 3, the results for the rank correlation show that the link between systemic risk and banks' common exposure (that is, AD ratio correlation) is ambiguous. A positive relationship is identified in the long sample, while the same relationship appears to be negative in the short sample. The link between systemic risk and distance-to-default is, on the contrary, always negative. Moreover, the rank correlation between systemic risk and distance-to-default is always stronger than the one between systemic risk and common exposure. We thus draw the following main conclusion: low distance-to-default is a much stronger and much more reliable sign of systemic risk than high correlation. The effect of banks'

[7] Spearman rank-order correlation coefficient measures the linear correlation between the ranks of each observation. Kendall's tau is even more nonparametric since it uses the relative ordering of the data, without assuming any linear relation at any point of its computation.

Table 1. Rank and linear correlation between the systemic risk index and different factors

Sample	Index	Factor	Average correlation			Distance-to-default		
			Spearman coefficient	Kendall's tau	R-square	Spearman coefficient	Kendall's tau	R-square
1993–2006	World 10%	Average	0.2369	0.1620	0.0396	–0.8587	–0.6833	0.7761
		75% percentile	0.2874	0.1949	0.1271	–0.8549	–0.6752	0.8601
		90% percentile	0.4291	0.2880	0.5599	–0.9046	–0.7429	0.8545
	World 20%	Average	0.3041	0.2254	0.1416	–0.7880	–0.6379	0.8164
		75% percentile	0.3310	0.2464	0.3220	–0.7553	–0.6093	0.8683
		90% percentile	0.4731	0.3518	0.7423	–0.8008	–0.6470	0.7810
1997–2006	World 10%	Average	–0.3510	–0.2339	0.0234	–0.9348	–0.7919	0.8735
		75% percentile	–0.3424	–0.2319	0.0306	–0.9375	–0.7976	0.8908
		90% percentile	–0.3041	–0.2159	0.0473	–0.8984	–0.7256	0.7599
	World 20%	Average	–0.0618	–0.0472	0.0001	–0.7630	–0.5939	0.8830
		75% percentile	–0.0579	–0.0429	0.0001	–0.7730	–0.6097	0.8935
		90% percentile	–0.0470	–0.0401	0.0000	–0.6837	–0.5238	0.7650

common exposure to shocks on systemic risk is weaker and may even change direction, depending on the period considered.

We next run a linear regression of the (inverse logit of the) systemic risk index on the AD ratio correlation and on the distance-to-default. Not surprisingly, the results coincide with those obtained from the rank correlation analysis. The coefficient of the distance-to-default is significantly negative in all specifications. The degree of correspondence (coefficient of partial correlation R^2) between the index and the estimated regression is very high (mostly over 80 percent, cf. last column of Table 1). The results from the regression with correlation are less convincing: we have very low coefficients of partial correlation (with the exception of the 90 percent percentile in the long sample) and, in the short sample, most coefficients are not significant. Hence, common exposure (that is, AD ratio correlation) seems to be a poor predictor of the systemic risk index and the direction of their relation changes depending on the period. The distance-to-default, by contrast, explains the systemic risk index well.

However, while the distance-to-default seems to be the main factor driving the systemic risk, the common exposure might account for the portion of the systemic risk index that is not explained by the distance-to-default. To check this, we compute the rank correlation between the common exposure and the residuals of a regression of the systemic risk index on the distance-to-default. The idea is to check whether a positive residual (that is, an "excess" of systemic risk, given the estimate provided by distance-to-default) is associated with a high or a low common exposure. The corresponding rank correlations are presented in Table 2.

The results show that the residuals are positively correlated with common exposures. For example, the Spearman rank correlation between the average AD ratio correlation and the portion of systemic risk left unexplained by the mean distance-to-default (residuals of the regression of the systemic risk on the mean distance-to-default) is 0.65. This degree of correlation is significantly higher than that between common exposures and the systemic risk index (cf. Table 1), suggesting that the effect of common exposures on the unexplained part of systemic risk is greater than on the systemic risk itself. We also find that rank correlations are all positive and significant. This means that, once the distance-to-default is taken into account, a higher common exposure always induces a higher systemic risk.

To conclude, we find that the systemic risk dynamic does not match the dynamic observed for banks' common exposure. This indicates that

Table 2. Rank correlation with residuals

Sample	Residuals from equation using	Factor	Spearman coefficient	Kendall's tau
1993–2006	Mean distance-to-default	Average of AD correlation	0.6468	0.4638
		75% perc. of AD correlation	0.5845	0.4142
		90% perc. of AD correlation	0.5158	0.3677
	10% percentile of distance-to-default	Average of AD correlation	0.3944	0.2752
		75% perc. of AD correlation	0.3476	0.2366
		90% perc. of AD correlation	0.3079	0.2079
1997–2006	Mean distance-to-default	Average of AD correlation	0.6509	0.4540
		75% perc. of AD correlation	0.6185	0.4166
		90% perc. of AD correlation	0.5300	0.3683
	10% percentile of distance-to-default	Average of AD correlation	0.4914	0.3428
		75% perc. of AD correlation	0.4630	0.3211
		90% perc. of AD correlation	0.3757	0.2565

common exposure is probably not the main factor explaining systemic risk. Indeed, further analysis reveals that the banks' distance-to-defaults, which describes banks' individual risk-taking, is the main driving force. However, we find that the explanatory power of common exposure with respect to the part of systemic risk left "unexplained" by the distance-to-default is relatively high. We also find that, once the distance-to-default is taken into account, higher common exposure induces higher systemic risk.

Note that we have also tried to disentangle the effect of the distance-to-default between the level of the AD ratios — which represents the buffer that the banks can use to absorb shocks — and its volatility, which measures the risk of their investments. We found that both elements are of equal importance in explaining the evolution of the systemic risk. The volatility plays a significant role in explaining the observed peaks, whereas the level of the AD ratios is more relevant at other times.

7. Conclusion

The first question addressed by this paper is: how have banks' common exposures to shocks changed over the last decade in response to the changes in the environment in which the international banking sector operates? To answer this, we estimate the correlations between large international banks' asset-to-debt (AD) ratios over 1993–2006 with the flexible M-GARCH approach developed by Ledoit *et al.* (2003). We find a decreasing trend until 2000, followed by an increasing trend. This suggests that, during the 1990s, banks (or at least some of them) took advantage of the new technologies and markets available to them to pursue their own business strategies and to differentiate themselves from other banks, thus reducing their areas of common exposure. Since 2000, however, banks' areas of common exposure to shocks have increased rapidly, which could indicate that they are adopting increasingly similar strategies and moving into increasingly similar markets. This finding is also robust for different sub-groups of the sample.

The paper's second question concerns the impact of these trends on systemic risk in the banking sector. From a theoretical point of view, ongoing financial market integration and increasing cross-border activities may have both favorable and adverse effects on the stability of the banking system. To explore this question empirically, we construct a systemic risk

index based on Lehar (2005), for which systemic risk is defined as the probability of a joint failure of a critical number of banks. As opposed to the correlation analysis, no clear trend emerges. Instead, we observe two peaks, one at the end of 1998 (LTCM and Russian crisis) and the other in 2002–2003 (stock market downturn), with the latter mainly doing damage to European banks.

The different patterns observed for banks' common exposure and for systemic risk contradict the widespread view that systemic risk increases with banks' co-movement. Our results confirm that the correlation between AD ratios is not a reliable measure for systemic risk. Instead, we find that the distance-to-default is the main driver of the systemic risk index. Once this distance-to-default is taken into account, however, correlation is positively associated with systemic risk.

These findings have two direct consequences for supervisory authorities. First, they show that systemic risk cannot be viewed as a pure correlation phenomenon. Instead, they highlight the danger of high and volatile leverages. According to our results, the main driver of systemic risk is the size of the risks taken by each bank individually (reflected by their distance-to-default) and not their common exposure to shocks (that is, AD ratio correlation). Thus, supervisors concerned by systemic stability should first concentrate on making sure that banks are not taking disproportionate risks before trying to reduce interlinkages or enforcing diversification in the banking sector. Second, from the monitoring point of view, co-movements between banks appear to be a spurious measure of systemic risk. Taken individually, this measure gives, in the best case, a weak indication about systemic risk and, in the worst case, may even point in the wrong direction. To be useful and unambiguous about the evolution of systemic risk, co-movement must be interpreted in combination with distance-to-default.

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The Systemic Risk Implications of Originate and Distribute

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1. Introduction

This paper considers some structural trends within the financial system and explores their implications for systemic risk. These structural characteristics are long established but have grown in importance over the past decade:

- Increased *integration* of financial balance sheets;
- Increased *securitization* of financial exposures;
- Financial *innovation* — for example, in structured financial products; and
- The *incentive* effects of credit risk transfer.

These structural features have common roots. Each could be said to be part of a broader structural shift in banks' business model, from "originating and holding" to "originating and distributing" underlying risks (Bank for International Settlements, 2005; International Monetary Fund, 2006). On the face of it, a compelling case can be made for these structural developments having enhanced the stability of the financial system. For example, they allow the diversification of previously lumpy and concentrated risk positions to a wider clientele of investors. In this way, previously missing markets have been completed, allowing some agents to

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expand their insurance possibility set, while others simultaneously expand their investment possibility frontier.

The point of departure in this paper is to highlight some of the unintended, and potentially adverse, consequences of these same structural developments. In particular, all four structural trends can be shown to generate a greater degree of "fat-tailedness" in the underlying distribution of outcomes for the financial system. Fat tails emerge as an equilibrium response to the "originate and distribute" model. Because of this, systemic crises may be becoming less likely (in the language of risk management, a lower default probability), but their impact greater (a higher loss given default) than in the past. This is a world where the financial system is supple at its center, but potentially brittle in its tail.[1]

By its very nature, historical evidence may be of limited use for testing an essentially (fat-) tail hypothesis. Events in financial markets over the past few months have, however, provided a test-bed for some of the ideas in this paper. At various times, all four of the channels generating fat-tailed outcomes for the financial system appear to have operated (Figure 1). The turbulence had its roots in an incentive problem which prompted overlending to questionable credits, such as US sub-prime

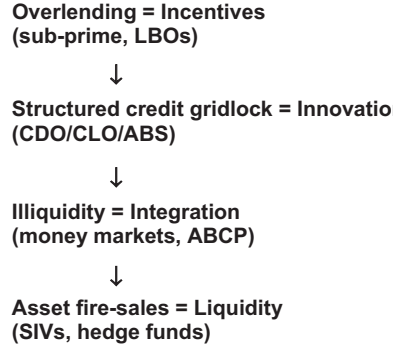

Figure 1. Chronology of a crisis

[1] Gai and Haldane (2007) call this "super-systemic" risk, to denote a more virulent strain of an age-old virus. Others have termed these "Black Swan" events (Taleb, 2007); or have asked "Has financial development made the world riskier?" (Rajan, 2005).

mortgages (Section 5). This in turn raised uncertainty about the true risks associated with, in particular, innovation in structured credit instruments (Section 4). This uncertainty about balance-sheet impairment then led banks to withdraw liquidity to counterparties, whose collective effects were amplified by interconnections within the financial network (Section 2). In consequence, some funds and firms had to dispose of assets to meet funding requirements, thereby adding to downward pressures on asset prices (Section 3).

If the central thesis in this paper contains even an ounce of empirical truth, it would be worth a pound of effort in trying to prevent such fat-tailed events materializing. And because the systemic fault-lines highlighted here are either sourced in market frictions, or have externality-like characteristics, public policy may also have a role to play. So in the final section, we ask what could be done to address tail risk, either by private financial institutions or public policy-makers.

2. Integration and Systemic Risk

One of (perhaps the) key characteristic of globalization has been the sustained and significant increase in financial integration. One measure of financial integration is the degree of interconnection between the balance sheets of financial institutions, both within and between financial systems; or, put differently, the rise in the degree of complexity of the global financial network.

What implications do these trends have for systemic risk? Some theoretical analyses point towards a positive conclusion. For example, in the context of a four-bank system, Allen and Gale (2000) argue that network completeness — interconnection between all nodes — serves as an insurance device, which increases system resilience. The logic here is that losses within the network can then be mutualized and thereby diffused. In effect, links within the financial system serve as shock absorbers, enabling improved risk-sharing. In this way, financial integration lowers the *probability* of systemic risk arising.

Models of complex, interconnected systems caution us, however, against too linear a perspective on system stability.[2] Often, these models tend to produce highly nonlinear, and sometimes knife-edge, dynamics.

[2] For example, Newman (2003).

More specifically, these models suggest that, conditional on contagion having got underway, connectivity may actually increase the potential for default cascades, with balance-sheet impairment transmitted around the network. In other words, integration may raise the *impact* of systemic crises, at the same time as it lowers the probability.[3] Gai and Kapadia (2007) call this the "robust-yet-fragile" tendency of networks. These features support the underlying hypothesis — a lower probability of systemic crisis, but with potentially greater impact.

Figures 2 and 3 illustrate the results of a simulation of idiosyncratic bank failure in a hypothetical bank network, whose degree of interconnectivity is allowed to vary.[4] The simulation in Figure 2 focuses on the tail of the distribution of outcomes for the system where over 5 percent of banks default (as measured on the *y*-axis), as this is where counterparty contagion is most acute. It highlights the nonlinearity of crisis dynamics. As the degree of financial interconnection rises, the *probability* of contagion at first rises but then begins to fall. The latter effect is due to the

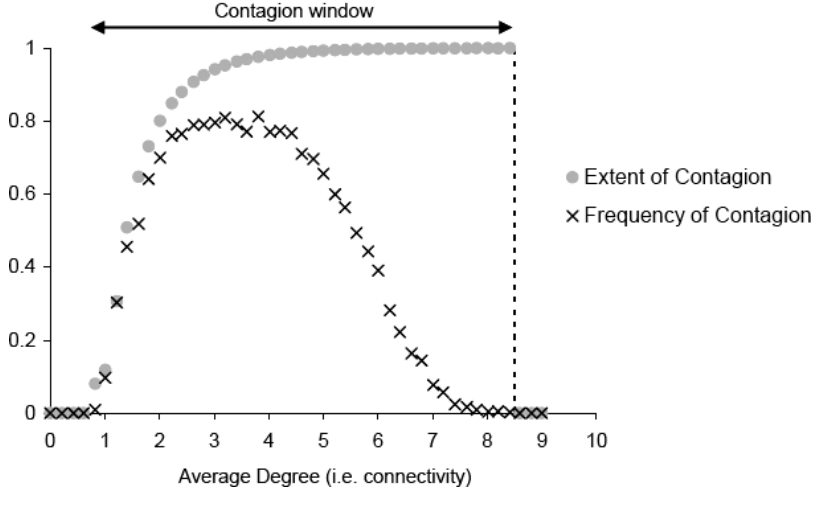

Figure 2. Contagion and connectivity

[3] For example, Nier, Yang, Yorulmazer and Alentorn (2007).

[4] The example is taken from Gai and Kapadia (2007) and is calibrated to roughly match balance-sheet positions (interbank asset shares, capital ratios) in the UK. It is solved using the network algorithm described by Eisenberg and Noe (2001).

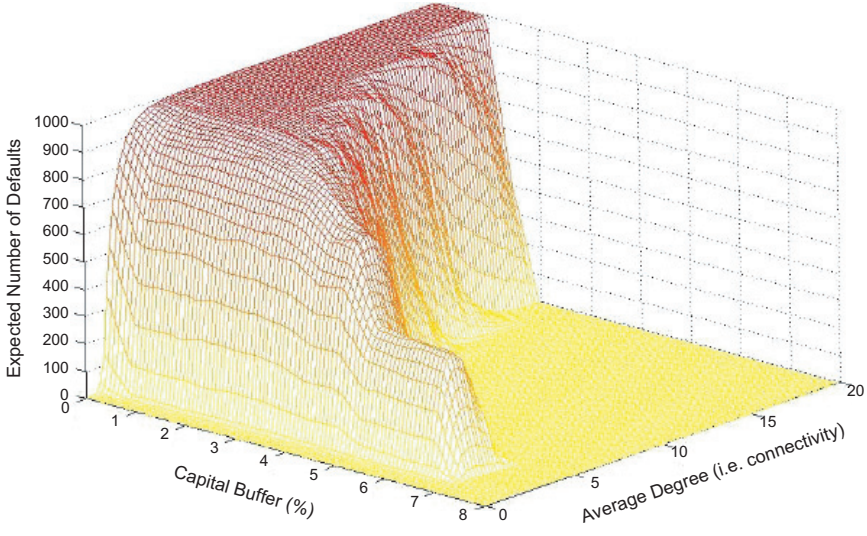

Figure 3. Systemic risk and financial integration

risk-sharing benefits of financial integration. A problem shared is a problem halved.

Or is it? The *impact* of counterparty contagion, when it does occur, is monotonically increasing in the degree of financial integration. Idiosyncratic failures can, in consequence, cause most of the network to fall into default when interconnections are significant. So risk-sharing gives way to risk-spreading; a problem shared may be a problem doubled. In Figure 3, banks' capital ratios are allowed additionally to vary (along a third axis); it illustrates essentially the same nonlinearities, especially when banks' capital buffers are low.

Network simulations can also be calibrated using empirically estimated measures of shocks to banks' balance sheets and actual data on the network distribution of their balance sheets.[5] Figure 4 shows some estimates of the distribution of potential defaulted assets for the UK banking system using Merton-style measures of individual banks' default probabilities. The mean of this distribution can be interpreted as the fair value of the insurance premium necessary to insure against tail risk to the financial

[5] A number of studies have looked at the stability of estimated interbank networks in the face of idiosyncratic default, including Furfine (1999) and Wells (2002).

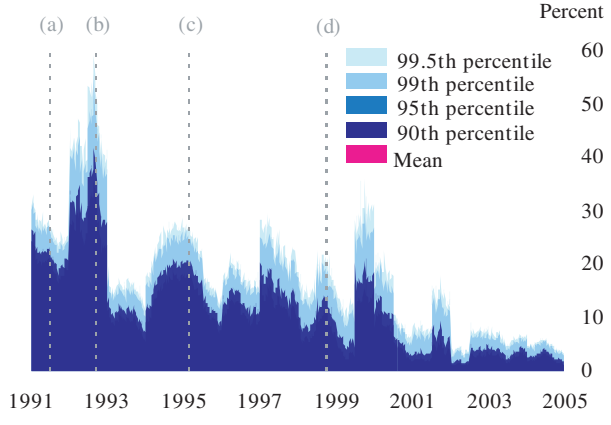

Figure 4. Expected asset shortfall as percentage of total banking system assets

system. Over the whole sample, this premium averages over 5 percent of annual UK gross domestic product (GDP). This premium is large because of the fat tail of systemic risk implied by the distribution. For example, at the 99th percentile, the cost of crisis is around 20 percent of annual UK GDP over the sample. The average measures of risk fall over the sample, owing to the fall in aggregate uncertainty. But the contribution of network contagion rises over the sample, accounting for over a third of the premium since 2000.

3. Securitization and Systemic Risk

A second key structural feature of the global financial system over recent decades has been the increasing securitization of financial instruments. A range of potentially illiquid assets on institutions' books, which previously would have had only "shadow" prices, now have explicit market prices. Securitization of loans began in earnest in the 1980s, but has grown dramatically since the turn of the century. Securitization has in turn boosted the role of nonbank investors in loan and other markets.

It is not difficult to build a strong case for these developments having enhanced the stability of the financial system, by allowing otherwise lumpy risk exposures on banks' balance sheets to be distributed to nonbank

investors. These risk-sharing benefits are discussed in Rajan (2005), while Allen and Carletti (2005) and Wagner and Marsh (2004) provide a theoretical exposition.[6] As with financial integration, however, securitization and enhanced liquidity may have a dark side if shocks to the system are sufficiently acute. Under conditions of stress, "fire-sales" of assets by struggling institutions have the potential to drive asset values below their fundamentally-based values. In effect, an illiquidity discount can get built into asset prices.[7] The systemic consequences of these fire-sale premia are potentially significant. The balance sheets of all institutions marking asset portfolios to market are affected by these fire-asset premia, potentially triggering further distressed selling by a wider set of participants. In other words, there can be asset price contagion, which amplifies (as well as being amplified by) the default contagion discussed in Section 2. Default cascades and asset price spirals coexist and positively feedback.

The network framework developed in Section 2 can be used to illustrate these dynamics. As Figures 5 and 6 illustrate, liquidity effects tend to heighten the nonlinearity of the system's response to acute stress. And, as a result of the interaction of the default and asset price cascades, the tail of the distribution is further fattened.

Using actual data on the distribution of macroeconomic shocks and on balance-sheet positions, Figure 7 shows the tail of a calibrated distribution of outturns for UK banks' assets.[8] Three distributions are shown, one where only default cascades are incorporated (as described in Section 2), another where only liquidity effects are included (as described in this section), and a third which combines these effects. All three distributions are fat-tailed. But in the third case, the tail is fatter than in the first two cases combined, as a result of feedbacks between default cascades and asset price spirals. Liquidity, like integration, can be a double-edged sword, particularly in the tails of the risk distribution.

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[6] More broadly, collateralization of debt may support higher levels of financial intermediation and leverage, by mitigating agency problems (Jermann and Quadrini, 2006; Brunnermeier and Pedersen, 2007).

[7] Micro-founded models of this phenomenon have been provided by, *inter alia*, Cifuentes, Ferrucci and Shin (2004), Allen and Carletti (2007) and Gai, Kapadia, Millard and Perez (2007); while Pulvino (1998) and Coval and Stafford (2006) provide supporting empirical evidence on fire-sale effects in asset markets.

[8] This is based on a rough prototype model for calibrating systemic risks to the UK financial system which is being developed by the Bank of England. This modeling approach is described in more detail in Section 6.

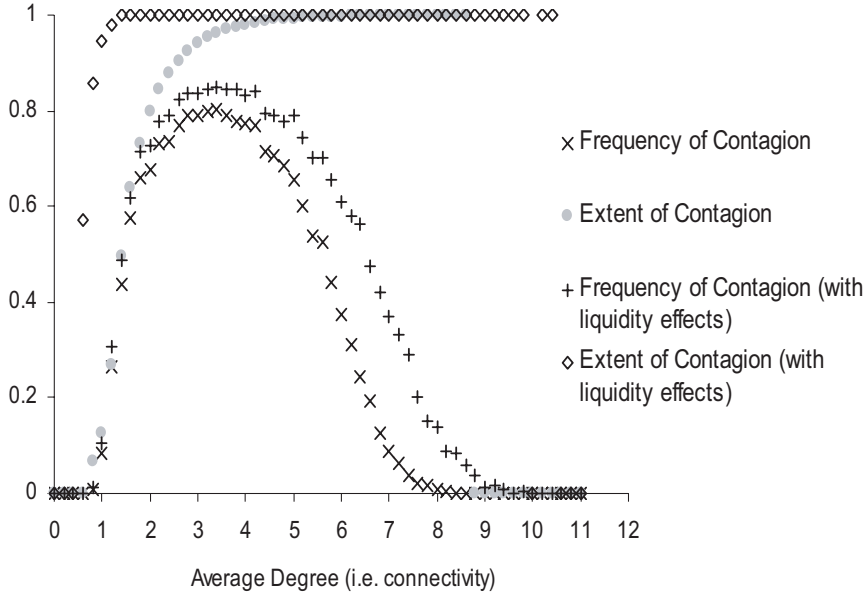

Figure 5. Contagion, connectivity and liquidity

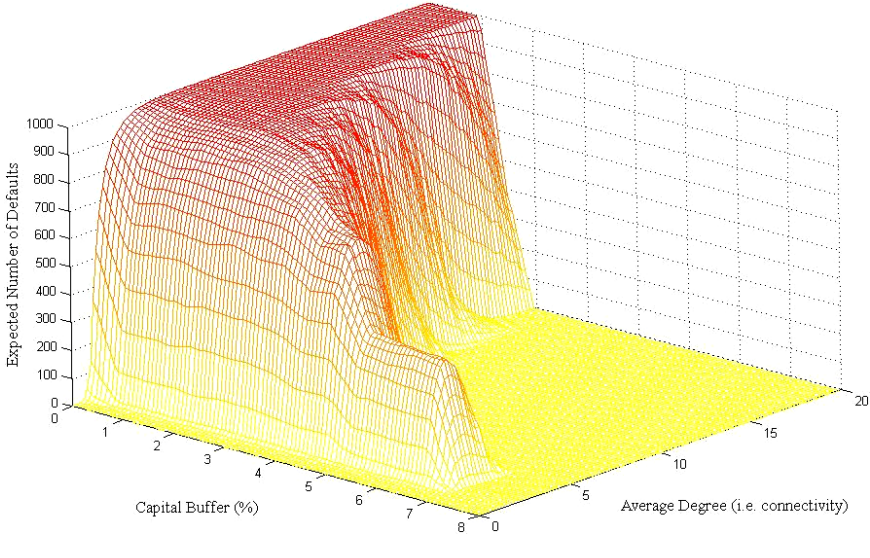

Figure 6. Systemic risk and financial integration (with liquidity effects)

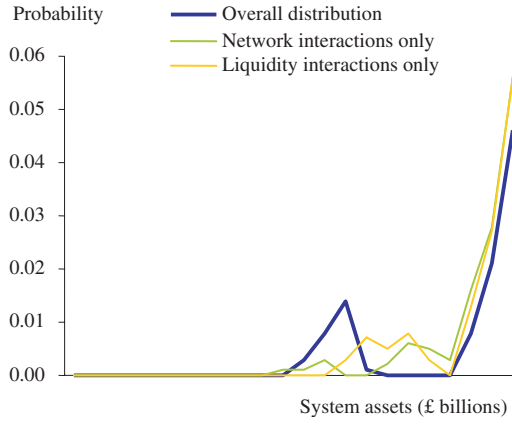

Figure 7. The distribution of banking system assets

4. Innovation and Systemic Risk

Sections 2 and 3 considered how structural changes in the financial system may have affected systemic risk. By increasing information asymmetries, these developments may also affect risk-taking incentives in ways which can amplify these effects. Over the recent past, there has been rapid growth in financial products which embody a high degree of nonlinearity, or tail risk, in their payoff structure. Any defaultable security embodies a kink in the distribution of returns at the default point. That nonlinearity is more pronounced, the riskier the asset. In general over the recent past, there appears to have been a movement down the risk spectrum by investors. Growth has been even more rapid in instruments or trading strategies whose payoff structure would tend to amplify these nonlinearities, such as collateralized debt and collateralized loan obligations (CDOs and CLOs), which tranche up the loss distribution of the underlying portfolio of bonds or loans.[9]

[9] Other examples of fat-tail products would include catastrophe bonds, which pay regular coupons to investors, but which surrender the principal if a pre-defined event occurs, such as a large claim or natural disaster. The total market is around $4 billion. A second example would be constant debt proportion obligations (CPDO) which are (leveraged) sales of credit protection, whose investment strategy is to increase leverage when the underlying portfolio falls in value — "when in trouble, double". This flattens the return profile most of the time, but increases tail risk (at least potentially, the loss of all principal) if the portfolio performs sufficiently badly. The first CPDO was issued in 2006 and issuance to date is around $5 billion. A third example would be deeply out of the money options.

There are a number of reasons why financial engineering of this type might be beneficial from a risk and efficiency perspective. For investors, these instruments are a potential means of better matching their risk/return preferences. An alternative, less benign interpretation is, however, that these developments have been driven by potential misperceptions of the risk/return tradeoff by at least some investors. These less sophisticated investors might find it difficult to monitor, price, and hence manage the tail risks embodied in these products. Faced with this, sophisticated investors may have sought to create or engineer products which exploit their greater capacity to price and manage tail risk. In Rajan (2005), this phenomenon is described generically as beta (excess) returns being dressed up as alpha (market) returns. The resulting risk allocation would be sub-optimal from a welfare perspective, with those agents least able to manage tail risk being the ones bearing it.

4.1 *Using past asset returns*

One potential informational friction between investors arises from the difficulty of making inferences about tail events based on a limited sample of data which is unlikely to contain much, if any, data on the tail. This problem will have been exacerbated over the past decade or so because of the low level of global macroeconomic volatility. If investors are inferring risk/return tradeoffs for assets based on recent historical experience, this may expose them unwittingly to significant tail risk. Figure 6 illustrates this general feature in a capital asset pricing model (CAPM) framework.

Assume agents are using CAPM to infer the risk characteristics of their assets, specifically the asset's alpha and beta. But, as shown, the returns to the product are highly nonlinear. If the price of the underlying asset remains in the range $x - y$, a CAPM investor using historically generated returns would infer $\alpha = \alpha^*$ and $\beta = 0$. In other words, the asset would appear to offer significant excess returns and to be unrelated to systematic risk. As soon as we have a drawing from the tail of the distribution of returns to the left of the $x - y$ range, however, the same CAPM-based inference would yield an updated $\alpha = 0$, $\beta = \beta^*$. In other words, excess returns disappear once the full range of possible outturns is revealed.

Recent events usefully illustrate the potential for return profiles like those in Figure 8 and the accompanying inference problems this may

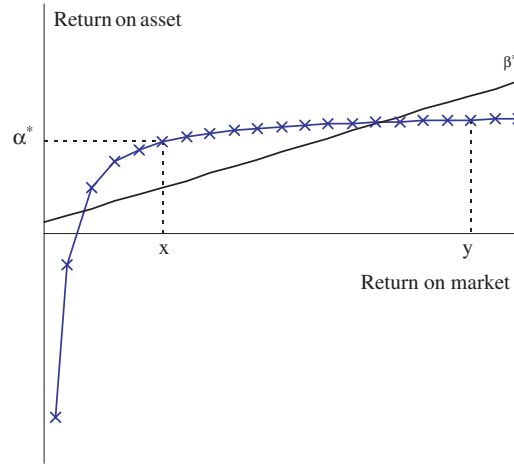

Figure 8. Apparent alpha in the presence of tail risk

pose for (extrapolative) end-investors. Consider investors in AXA Investment Managers' Fixed Income Investment Strategy US LIBOR (London Interbank Offered Rate) Plus Fund. The fund aims to "outperform Euribor by 50 basis points with volatility in line with the benchmark". Imagine investors in this fund making CAPM inferences on their investment, using the S&P 500 as a measure of the market portfolio. Figure 9 plots actual returns over this window based on observations over the full sample, July 2004–July 2007. It also plots two estimated capital market lines, the first estimated up to May 2007, the second over the full sample.

An investor making CAPM inferences up until May 2007 would have estimated $\beta = 0$, $\alpha = 0.1$ percent per month (or 1.3 percent per annum) on this portfolio.[10] So up until that date, the fund appears if anything to have exceeded its aims, in both a risk and return sense. Adding to the sample the last two observations suggests, however, a rather different picture, with $\beta = 0.14$, $\alpha = -0.14$ percent per month. Inferences from past returns would have been spectacularly uninformative about the true tail risk in this portfolio.

[10] While this may not sound like a huge amount, over the same period Euribor was yielding around 3 percent per annum, so the fund was in effect offering an almost 50 percent premium over safe rates.

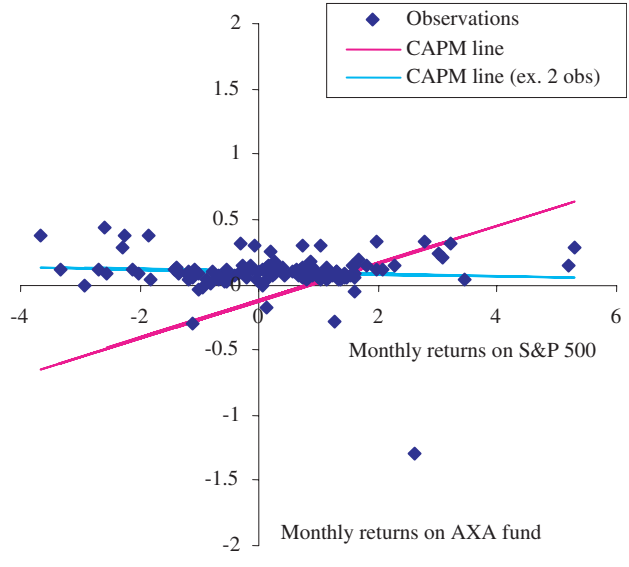

Figure 9. Estimating capital market lines (zoomed in)

4.2 *Using linear asset-pricing models*

A second type of mispricing may arise from investors using CAPM, or linear CAPM-like, models to price tail risk products. For example, imagine an investor in the asset with the returns shown in Figure 6. A linear CAPM model fitted to this return profile would give $\beta = \beta^*$ which, while correct on average, will tend to underprice tail risk, or, equivalently, to overprice the asset if the investor is risk-averse.

Why might investors (mis)price instruments in this way, effectively linearizing a payoff distribution which is, in reality, highly nonlinear? One plausible explanation is that investors often rely on rating agency assessments of risk. Indeed, some institutional investors have explicit ratings-based investment mandates. This reliance is likely to be especially important for structured products, where the pricing is complex and there is no real history of returns. This reliance on ratings is potentially problematic because ratings are based on measures of expected loss (Moody's) and/or default probability (S&P). As such, the use of ratings is exactly

analogous to using a simple linear model, like CAPM, to price these instruments.

How great is the potential misperception problem? Consider a collateralized debt obligation (CDO)-like instrument with three tranches (equity, mezzanine, and senior), corresponding to loss ranges of 0 percent to 9 percent, 9 percent to 22 percent, and 22 percent to 100 percent, respectively. Assume there are two investor types — sophisticated and naïve. Both sets of investors observe common information on the risk-free rate, the maturity of the instrument, the expected payoff on each of the tranches, the return on the market portfolio, and the distribution of the underlying assets. They differ only in respect of the pricing model they use, with the sophisticated investor knowing the true (nonlinear) pricing model, while the naïve investor uses a simple linear extrapolation of the payoff profile for each tranche (in effect, a fixed but tranche-specific beta).

The pricing model for the naïve investor is very primitive and it is a particularly poor approximation of payoffs for the riskier tranches. Nonetheless, it is interesting to calculate the extent of the mispricing and the implied alpha (excess return), as perceived by the naïve investor. These are shown in Table 1, for a range of tranches.[11] The mispricing and implied alphas are large, perhaps implausibly so for the equity tranche. But even for the senior tranche, they imply a significant mispricing and implied excess return. Given potential differences in price perception on this scale, it is easy to see why naïve investors may have sought these assets on excess return grounds — and, equivalently, why sophisticated investors may have had incentives to manufacture them for onward sale.

5. Incentives and Systemic Risk

Changes in the structure of, and hence risk allocations within, the financial system are likely to affect incentives — for example, incentives to screen and monitor risk exposures. Rajan (2005) discusses a range of potential

[11] These estimates assume a beta for the underlying assets of unity, but the results are not altered materially by changing this assumption.

Table 1. Illustration of overpricing/excess return on CDO tranches*

Tranche	Attachment/ detachment	Underpricing perceived by naïve investor (%)	Excess return perceived by naïve investor (%)
Senior	22–100%	2.1	2.0
Mezzanine	9–22%	25.3	22.7
Equity	0–9%	57.0	45.1

* Example calibrated by setting: the risk-free rate at 5.59 percent (one-year UK nominal spot rate); the maturity of the European-style derivative tranches at one year; the expected payoff of the tranches (arbitrarily) at 100; the return on the market portfolio at 7.17 percent (average return on the FTSE 100 since 1984); the width of the distribution of the underlying asset returns at 24.23 percent; and the forward-looking CAPM beta between the underlying asset and the market portfolio, as used by the naïve investor, to one.

such incentive problems. Among the wide set of potential information problems, two familiar failures are focused on here — free-riding and lemons. These are illustrated using a simple framework recently developed by Mora and Sowerbutts (2007), only the barebones of which are sketched here.[12]

Firms initiate net-present-value-positive projects yielding a return (R). Managers of these projects have an incentive to shirk, however, lowering the probability of the project's success (p). Banks alone finance these projects and so subject the project to screening and monitoring. These actions raise the probability of project success (lower the probability of shirking), although at a fixed cost (K). The act of monitoring gives the bank private information about the project's success. The key decisions for the banks are whether or not to monitor loans (discussed in the next sub-section) and whether or not to sell them on (discussed in the following section). A final section looks at the decision tree when these actions are combined.

[12] Other papers have explored different incentive effects of credit risk transfer — for example, Allen and Carletti (2007), Parlour and Plantin (2005) and Morrison (2005). The Mora and Sowerbutts (2007) paper is closest in spirit to Parlour and Plantin (2005).

5.1 *Free-riding*

Given the set-up of this game, the decision to monitor by an individual firm hinges critically on the monitoring actions of other parties; it is a strategic decision. The greater the number of others believed to be monitoring, the lower the probability of me monitoring because of incentives to free-ride on the fixed cost. But if these incentives hold individually they also hold collectively, thereby raising the possibility of no one monitoring.[13]

These behaviors give rise to the potential for noncooperative equilibria in which either everyone monitors or no one monitors. In the former case, we have inefficiencies because there is duplication of monitoring effort which could otherwise be saved by appointing a single "delegated monitor", such as a rating agency (Diamond, 1984). In the latter case, if monitoring becomes the responsibility of everyone, it is possible it becomes the responsibility of no one. In that event, the fundamental probability of project success falls, as does the number of viable projects, below its socially optimal value.[14] Or, put differently, the price (cost) of loans lies below (above) its fundamental value because of the heightened probability of default resulting from free-riding. The greater the number of potential monitors (n) — that is, the greater the dispersion of risk around the system — the greater the potential for sub-optimally low monitoring and sub-optimally high default probabilities. This, in turn, carries a welfare cost.

5.2 *Lemons*

Consider now the decision of banks on whether to sell their loans. For simplicity, assume that banks have undertaken monitoring and hence have private information on loan quality relative to potential investors. This, in turn, provides them with an incentive to sell-on poorly performing loans in the secondary market ("lemons").[15] But if individuals know that banks will be selling only bad credits, there will be no secondary market for loans in the

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[13] Formally, the probability that anyone monitors is $1-(1-s)n$, where s is the probability that an individual bank monitors. This probability is falling in the number of monitors, n.

[14] The probability of project success falls from p to $(1-(1-s)n)\,p$.

[15] This distortion might be mitigated somewhat by requiring that the bank hold onto a piece of any securitization, particularly (for structured products) the first-loss or equity tranche. It is unclear whether this provides sharp-enough incentives, not least because banks may be able to offload or hedge these exposures, for example using the CDS market.

first place. To overcome this, banks are assumed, realistically, to be subject to funding constraints, which are also private information for the bank. These provide an alternative rationale for selling loans.

This combination of assumptions, incentives and constraints can support a secondary market in loans. If investors could observe either or both of the banks' sources of private information — on loan quality and liquidity shocks — they would be able to infer perfectly the banks' actions and the banks would not then be able to sell lemons. As it is, investors face a difficult signal extraction problem when they see a loan being sold: is the sale motivated by liquidity or profit motives? Faced with that, investors discount the price of that loan — there is an adverse selection discount — to below its fundamental price if the project were to be successful.[16] This adds a further downward distortion to market prices relative to fundamentals. An additional adverse side-effect is that banks are unable perfectly to insure themselves against liquidity shocks (balanced against which is banks' increased ability to sell lemons).

5.3 *Combining the frictions*

Now consider the effects of the two frictions combined. Assume we begin from a position where investors believe banks are being diligent in their credit assessment; we are in a "monitoring" equilibrium. These beliefs underpin secondary market prices for loans.

The existence of the secondary market also, however, provides incentives for the banks to shirk on their costly monitoring effort. Should they do so, in time this will raise the equilibrium default probability of the project and hence of the loans backing them. At some point, investors will infer this (absence of) monitoring from realized defaults. Beliefs about monitoring then shift. In the "no-monitoring" equilibrium, the secondary market for loans dries up completely because everyone fears a lemon.[17] The price of loans undershoots fundamentals and a tail risk is generated.

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[16] Formally, the secondary market price, r, is:

$$r = pq/(1 - p + pq),$$

where p is the fundamental probability of project success and q is the probability of a liquidity shock.

[17] Mora and Sowerbutts (2007) do not model this learning process by investors, but in principle a learning rule could be specified and the switch-point identified more precisely.

Liquidity is drained until such time as trust in monitoring can be restored and a new "monitoring" equilibrium can be established.

This analysis carries some implications for banks' "originate and distribute" model. First, it suggests that this business model could potentially be fragile given its reliance on a functioning secondary market in loans which may be eroded over time by free-riding incentives. It suggests a credit cycle of rising volumes, progressively falling credit standards, gradual evidence of rising defaults and, eventually, a collapse in the secondary market for loans and a sharp over-adjustment in loan prices.

There are formal means of testing these hypotheses, but informal evidence drawn from the US sub-prime episode is certainly illustrative. Figure 10 looks at delinquency rates on several vintages of US sub-prime loans, illustrating the progressive relaxation of credit standards up until 2006.[18] Figure 11 plots delinquencies against the secondary market price of sub-prime loans.[19] The response of loan prices to the rise in delinquency

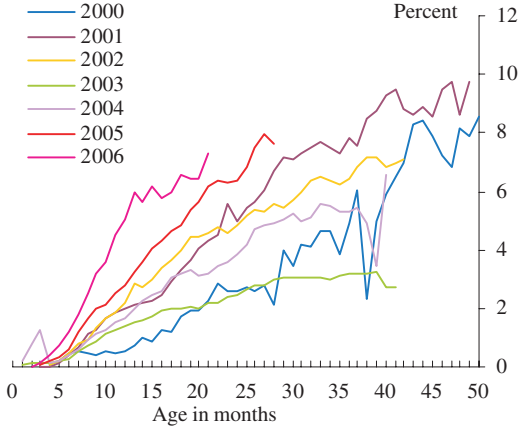

Figure 10. Arrears of 60+ days on US second-lien sub-prime home equity loans[a]

Source: JP Morgan Chase & Co.

[a] Year refers to year of securitization.

[18] Other evidence on declining lending standards exists in the corporate credit market — for example, with the emergence of "Cov-lite" loans (those without maintenance covenants which track performance during the term of the loan). More of these loans were issued in the first half of 2007 than in the whole of the preceding decade.

[19] More precisely, it is the price of CDS on a portfolio of sub-prime loans.

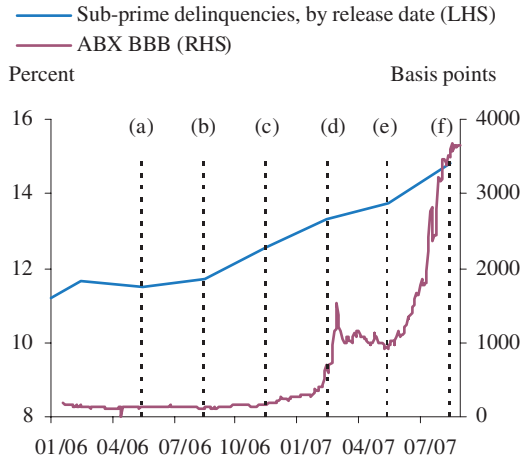

Figure 11. US sub-prime delinquencies and the BBB ABX index
Source: JPMorgan Chase & Co and Bloomberg.
Notes:
(a) Q1 2006 sub-prime figures released.
(b) Q2 2006 sub-prime figures released.
(c) Q3 2006 sub-prime figures released.
(d) Q4 2006 sub-prime figures released.
(e) Q1 2007 sub-prime figures released.
(f) Q2 2007 sub-prime figures released.

rates from around the middle of 2006 was, at first, muted — we remained in a "monitoring equilibrium". During March and April 2007, however, a regime switch appears to have occurred as beliefs about credit assessment adjusted sharply in the face of rising defaults; we entered a "no-monitoring" equilibrium. As the model would suggest, since then the secondary market for sub-prime loans has effectively remained closed and prices to date have fallen by over 50 percent.

6. Tackling Tail Risk

The central thesis in this paper is that the financial system may have become more robust most of the time (a more malleable center), but more fragile some of the time (a brittle tail). This hypothesis has important implications for policy-makers. The welfare of a risk-averse policy-maker would be adversely affected by such a development, as they would tend

to weight tail outcomes relatively more heavily. So what public policy measures are potentially available to the authorities?[20]

6.1 *Calibrating tail risk*

Mapping and quantifying systemic risk is an important precondition for designing policies to address it. It is important both as a means of understanding the channels of risk transmission and as a way of quantifying them. Various attempts have been made to construct models which aim to gauge and track systemic risk over time. For example, the Austrian central bank has developed a "Systemic Risk Monitor" which they use as an innovative vehicle for assessing risks to the Austrian financial system and to the participants within it (Boss *et al*., 2006).

Over the past few years, the Bank of England has been developing a quantified, model-based approach to assessing risks to the financial system (Haldane, Hall and Pezzini, 2007; Clark, 2007). The quantitative results from these models have been published in the Bank's (2007) *Financial Stability Report*. Publishing these risk measures can, in an important sense, be a policy tool in its own right, by alerting private sector participants to the potential scale and source of risks to their balance sheets — in other words, helping market participants internalize some of the systemic risk externalities.

But most existing systemic risk modeling suites, including the Bank of England's, are poor at capturing some of the risk channels where systemic externalities are likely to be most acute — for example, the interactions between counterparty risk (discussed in Section 2) and liquidity risk (discussed in Section 3). For that reason, the Bank is developing a new suite of models which aims to capture these effects more comprehensively.[21] In time, this suite ought to be capable of generating, *inter alia*, risk distributions for the financial system as a whole, together with a breakdown of the sources of this risk (credit, market, liquidity, counterparty, etc.).

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[20] On policies to address these risks, see, *inter alia*, Rajan (2005), Knight (2004), and Gai and Haldane (2007).

[21] See Jenkinson (2007).

6.2 *Dynamic stress-testing*

Public provision of improved information on systemic risk is one potential means of improving pricing and management of these risks. Using individual firms' own risk management systems to calibrate these risks is an alternative. Stress-testing practices have improved beyond recognition over the past decade. But existing stress-testing practices within the private financial sector and among public authorities are still effectively static exercises: they consider the quantitative implications of a one-shot, adverse-but-plausible scenario, either on an individual institution's balance sheet or on the system as a whole (Sorge, 2004). As such, these exercises cannot easily gauge the *dynamic* consequences of stress, which arise from the actions and reactions of other participants in the network — for example, by (with)drawing lines of liquidity or selling assets.

To gauge accurately these types of systemic risk, a different stress-testing methodology would be needed. In essence, stress tests would need to be carried out *collectively* and *dynamically* (rather than individually and statically). In practical terms, stress tests would be conducted iteratively on a set of unfolding events, with each iteration conditioned (at least in part) by the reactions of system participants in the previous round. In effect, what we would then have is a hybrid of a conventional stress test and a war game — a dynamic stress test. There are precedents for the public authorities conducting exercises of this sort (De Nederlandsche Bank, 2006).

6.3 *Liquidity policies and practices*

In times of financial stress, liquidity has many of the characteristics of a public good. The shift to an "originate and distribute" business model by banks will, if anything, have tended to increase the importance of liquidity to the effective functioning of the financial system. Most countries already have in place liquidity regulation for many types of financial institutions. But the increasingly cross-border nature of banks' liquidity management has drawn attention to the lack of a common international approach to the setting of liquidity standards. As a first step in that direction, a sub-group of the Basel Committee on Banking Supervision (BCBS) is seeking an improved understanding of the implications of diverse liquidity standards and the scope for greater consistency in objectives. Banks' increased recourse to cross-border liquidity management also highlights the desirability

of central banks improving operational arrangements for pledging collateral held in one country to a central bank in a different country. The Group of Ten Committee on Payment and Settlement Systems (CPSS) is considering means of strengthening cross-border collateral arrangements.[22]

This menu of policy options is incomplete and has been provided without any prices. This makes choosing between the options difficult. But if the costs of tail risk are on the scale outlined in this paper, it is probably cost-effective to seek multiple insurance cover. Like erstwhile end-investors, policy-makers tasked with protecting the financial system would be wise to forsake a bit of short-term alpha to insure against higher future beta.

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[22] See also Institute of International Finance (2007) for a private sector perspective.

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Quantitative Modeling of Systemic Risk in a Globalized Banking System: Methodological Challenges

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1. Introduction

The development of the international financial system during the past three decades was characterized by a wave of financial globalization with increasing integration of capital markets and strong internationalization of banking activities. Obstfeld and Taylor (2004) give an overview of the evidence and put the facts into historical perspective. Rajan (2005) identifies technological and institutional change as well as deregulation as the main drivers of financial globalization. Of course, these developments also have spurred a heated debate on the benefits and costs of financial globalization and its role in recent financial crises (see Isard, 2005 for an overview; and Kose *et al*., 2006 for an empirical assessment of the arguments in this debate).

As a consequence of globalization of capital markets and the banking system, systemic risk today has a significant international dimension. This is evident for the international financial crises of the 1990s, such as Mexico (1994), Thailand, Indonesia, Korea and Malaysia (1997), Russia and Brazil (1998). In these crises, huge inflows of foreign capital and the sudden reversal of these flows curtailed external credit and simultaneously raised doubts about the domestic intermediaries' balance sheets. Domestic institutions were impaired to attract domestic savings and provide domestic credit. The real consequences of these mechanisms were strong adverse effects on employment, incomes and living standards (see Isard, 2005). To take a more recent example of

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the international dimension of financial crises, we can take the US sub-prime crises. Commercial banks and mortgage lenders originated risks in the US, internationally active investment banks repackaged these risks into securities and sold these securities to investors in Europe and other parts of the world. When the sub-prime risks began to materialize suddenly, institutions all over the world were affected. As a consequence, a crisis of confidence brought trade in markets for structured products to a near standstill and affected indirectly, money markets, interbank markets and other debt markets. The initially local US problems were suddenly felt throughout the financial system and across the globe.

These crises experiences have led to a strong interest at central banks and international financial institutions to develop quantitative models of financial instability. The development of quantitative models has raised high expectations: they should provide not only a coherent framework and an accurate quantitative description of a financial system, they should on top of that be able to assess the resilience of the financial system to extreme events and situations of stress. In this paper, I argue that these expectations are perhaps too ambitious. While some progress has been made in quantitative modeling of systemic risk, it is fair to say that the literature is still in the very early stages. A key problem is that a core ingredient of financial crises, the inability of people to honor their financial promises and the economic consequences of it, is usually not considered in most theoretical macroeconomic models. While some attempts have been made to bring default back into macroeconomic modeling (see Zame, 1993; Kiyotaki and Moore, 1997; Dubey *et al*., 2005; Goodhart *et al*., 2006), there is not a well-established body of modeling frameworks one can build on.[1]

[1] Of course, there is a large body of historical and recent literature on financial crises and its consequences, which has contributed strongly to our understanding of the deeper issues. Kindelberger (1978) is, for instance, a classic historical account, and the macroeconomic literature on the Great Depression (see Bernanke, 2000) has analyzed the issues. Many more references could be given. When I talk about modeling frameworks, I have a narrow focus on mathematical models that dominate the modern macroeconomic literature and the literature on risk management and risk analysis.

The evidence on financial globalization suggests that any attempt to develop quantitative models of systemic risk[2] in the banking sector have to think about how to conceptually take account of the fact that banks are today operating in a global environment.

In this paper, I discuss a framework I have been working on with my colleagues Helmut Elsinger and Alfred Lehar over the last few years. This framework addresses the systemic risk problem from a quantitative risk management angle, where applications to real banking data are an important part of the analysis. The focus of my paper will be a critical assessment of how well this framework is suited to provide a quantitative framework in which some of the issues of banking and systemic risk in a global context can be addressed. I want to point out some of its major limitations and provide some ideas on how the model could be improved.

2. Networks of Debt and Contagion of Insolvency: The Eisenberg–Noe Model

Eisenberg and Noe (2001) have analyzed an abstract allocation problem of bankruptcy in a system of debt contracts. Their ideas provide concepts and tools that allow a combination with both banking system data and ideas from risk management to generate quantitative assessments of potential future problems of systemic risk. Systemic risk in this context is defined as the risk of simultaneous failure of institutions and the risk of contagion of insolvency. Such an extension of the Eisenberg–Noe model to a quantitative risk assessment tool was first developed by Elsinger *et al*. (2006a,b). The applications are to domestic banking systems.

[2] The notion of systemic risk is perhaps one of the most popular terms used in connection with the discussion of crises in the banking system, both by regulators and in the academic literature. It is used as a description of many different phenomena as has been pointed out by Dow (2000) and by DeBandt and Hartmann (2000). It is used to describe crises related to the payment system, to bank runs and banking panics, to spillover effects between financial markets up to a very broadly understood notion of financially-driven macroeconomic crises. Despite the lack of a precise definition, when the term, "systemic risk", is used in connection with the banking system, it seems that most authors have in mind the problem of simultaneous failures of many institutions with significant consequences for the real economy.

In principle, this is a framework that can be applied to an international context as well. A big limiting factor for such an endeavor is, of course, the availability of data. More importantly, however, the framework has certain conceptual limitations that need to be addressed to analyze issues that have been of concern in the context of international financial crises or the impacts of globalization on systemic risk. It is this conceptual (rather than the data) aspect I want to concentrate on in my paper.

Let me first introduce the Eisenberg–Noe model and explain how it can be applied for the risk assessment of banking systems. The model of Eisenberg and Noe (2001) considers a set of N debtors. Each debtor i holds debts against other debtors j with face value l_{ij}. In addition to these debt claims, each member of the system is characterized by a net worth position of e_i.

The total value of each member of this system is the value of e_i plus the value of all debts minus the debts owed to others. If for a given pair (L, e) the total value of an agent becomes negative, then he is insolvent. In this case it is assumed that claims are rationed proportionally. Let d denote the vector of total obligations of an agent toward the rest of the system, i.e., $d_i = \Sigma_{j \neq i} l_{ij}$. Define a new matrix Π which is derived from L by normalizing the entries by total obligations:

$$\pi_{ij} = \begin{cases} \dfrac{l_{ij}}{d_i} & \text{if } d_i > 0, \\ 0 & \text{otherwise.} \end{cases} \tag{1}$$

Using this notation, the total net worth of agents in the system, given the financial promises defined by the system of debt contracts, is given by the vector:

$$\omega = \Pi' d + e - d. \tag{2}$$

This is the value of interbank claims under the assumption that all interbank debt contracts are fully honored plus the net value of noninterbank positions minus the individual interbank debt owed to others. Given the possibility of default, the problem is to find a system of net values for all agents that respect limited liability and proportional sharing in case of default. Eisenberg and Noe (2001) call this a clearing payment vector. It denotes the total value of the members in the system under the clearing

mechanism. It is defined as the vector p^* fulfilling the system of inequalities given by

$$p^* = \min[d, \max(\Pi' p^* + e, 0)]. \tag{3}$$

where max and min denote the component-wise maximum and minimum. From Equation (3), one can immediately see that the actual value of debts (in contrast to the promised value) depends on the whole system of debt contracts. The clearing payment vector immediately gives us two important insights: for a given structure of liabilities and bank values (Π, e, d), we can identify insolvent banks ($p^*_i < d_i$) and derive the recovery rate for each defaulting bank $\left(\frac{p_i^*}{d_i}\right)$.

Clearing payment vectors can be calculated using the fictitious default algorithm developed by Eisenberg and Noe (2001). The fictitious default algorithm starts with an initial estimate of the actual value of debts in the system. A typical starting value would be that all debts are worth their face value. If a member in the system is insolvent under this assumption, its remaining value is proportionally distributed among the other creditors and the procedure is started again under the adjusted debt values. Eisenberg and Noe (2001) prove that under mild regularity conditions, a clearing vector always exists and that this procedure converges to a unique clearing vector.

This algorithm creates additional interesting information with respect to systemic stability. Default of agent i is called fundamental if i is not able to honor its promises under the assumption that all others honor their promises:

$$\sum_{j=1}^{N} \pi_{ji} d_j + e_i - d_i < 0.$$

A contagious default occurs when agent i defaults only because other agents are not able to keep their promises, i.e.,

$$\sum_{j=1}^{N} \pi_{ji} d_j + e_i - d_i \geq 0,$$

but

$$\sum_{j=1}^{N} \pi_{ji} p_j^* + e_i - d_i < 0.$$

Based on this model, Elsinger *et al*. (2006a) have suggested an application to risk assessment for banking systems along the following lines. Interpret the nodes of the network as banks and the matrix L as the values of interbank debt among them. Let e be the vector of bank's net worth excluding interbank claims and liabilities. Describing the banking system at a particular point in time by (L, e) and modeling e as a vector of random variables, one can model insolvency risk and contagion risk in the system over a given time horizon.

As there is no closed-form solution for the distribution of p^*, given the distribution of e, a Monte Carlo simulation approach has to be used where each draw of e is called a scenario. From Eisenberg and Noe (2001), we know that there exists a (unique) clearing payment vector p^* for each scenario. Thus, from an *ex ante* perspective, one can assess expected default frequencies from interbank credits across scenarios as well as the expected severity of losses from these defaults given that there exists an idea about the distribution of e. Furthermore, insolvencies can be decomposed across scenarios into fundamental and contagious defaults.

3. Applications to Domestic and International Banking Systems

In Elsinger *et al*. (2006a), the model is applied to a domestic banking system, where all banks reporting to the Austrian Central Bank's banking statistics and to the Austrian Central Bank's central loan register are taken into account. L is interpreted as the on-balance-sheet interbank debts and is reconstructed from a combination of the banking statistics, the central loan register and an estimation procedure. The vector e is interpreted as a vector of bank net worth constructed from all bank balance-sheet positions (excluding the interbank positions, which are already accounted for in L), which includes securities, loans and noninterbank deposits. All these components are modeled as functions of risk factors, such as stock prices, exchange rates and interest rates as well as industry sector default rates. The probability law driving the risk factors is modeled statistically based on historical data.

One way to think of this model is as a model of balance-sheet mechanics taking interbank debts and the resolution of insolvency through the debt network explicitly into account. In this sense, the model's logic is a scenario-based accounting exercise. Given a system of bank balance sheets, how would future risk scenarios affect this system in a pure

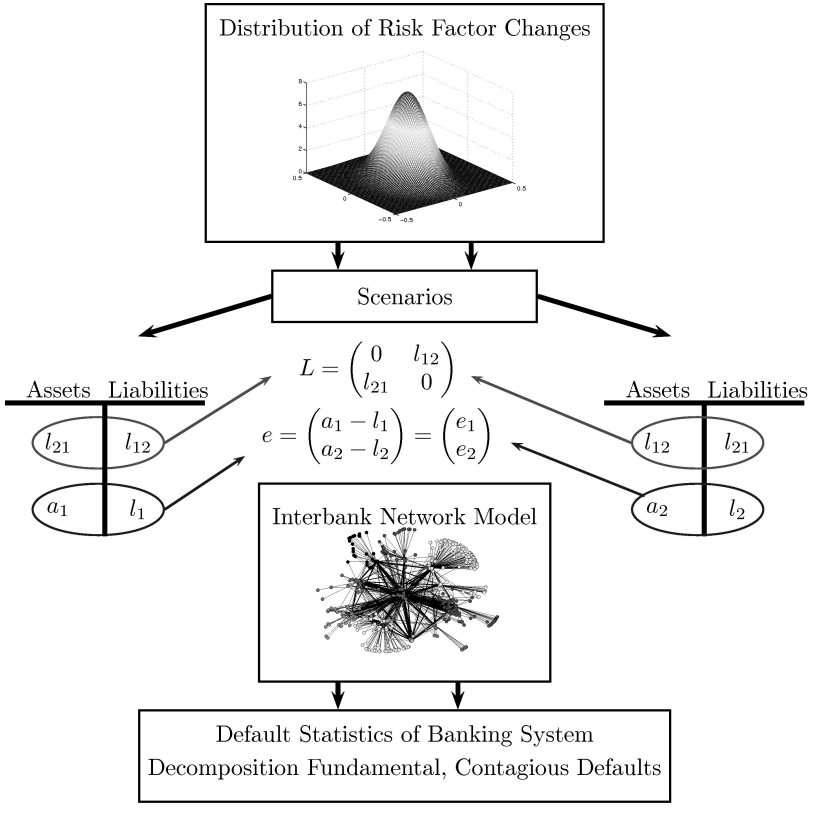

Figure 1.

mechanical way? The effect is mechanical because position values in e are completely determined by risk factors and their probability law. Behavior and reactions of banks are not considered. It is like taking the typical quantitative risk management approach (see, for instance, McNeil *et al*., 2005) from a single portfolio to a system of portfolios interrelated by debt contracts. A graphical overview of the model is given in Figure 1.

How can such a model be brought to data? What is needed in principle are data that allow to draw an as accurate as possible picture of the risks inherent in the bank balance sheet — credit risk from corporate and household exposures as well as from interbank exposures, interest rate risk and foreign currency risk as well as risks connected to securities on the banks balance sheets. In Elsinger *et al*. (2006a), Austrian bank balance

sheet data are used in connection with data from the Austrian central loan register to provide such a mapping. This is a particularly rich dataset and is usually not available in an international context. Still, this does not mean that the general logic of the approach could not be applied to sparser, international datasets.

The following data structure could be considered as a minimal set-up. Since interest rate risk and credit risk are usually among the most important risks borne by banks, it should be possible to map assets and liabilities in the balance sheet data into rough maturity buckets. With such a bucketing, as is shown in Elsinger *et al*. (2006a), interest rate risk over a given horizon can be roughly approximated by a duration-based formula. For the estimation of noninterbank and interbank credit risk, it is necessary to have some structural information about the loan portfolio. For instance, if the total loan volume to corporates and households is given and we have some additional information such as average size of exposures and an estimate of probabilities of default, a loan loss distribution can be calibrated and used in the simulation. For interbank exposures, such structural information combined with an estimation procedure for the distribution of exposures, also suggested by Elsinger *et al*. (2006a), can be used. Estimation of risk factor distributions from historical data is usually no problem from the data side because these are usually publicly available data.

What results does such a simulation provide? It provides estimates of the probability of default of one or more institutions in the system, it provides a decomposition of these defaults into fundamental and contagious insolvencies, and it provides a picture of the aggregate loss distribution of the banking system and decomposition into losses due to the fundamental risk factors and losses due to interbank contagion.

A typical output of such a simulation is, for instance, a table decomposing the default events across all simulated scenarios according to fundamental and contagious default. Table 1 is from Elsinger *et al*. (2006a).

A fundamental default is due to the losses arising from direct exposures to risk factors, while a contagious default is triggered by the default of another bank that cannot fulfil its promises in the interbank market. In Table 1, banks are grouped by fundamental defaults. The probability of occurrence of fundamental defaults alone and concurrently with contagious defaults is observed. As a typical aggregate loss distribution, we give an example from Boss *et al*. (2006).

Table 1. Probabilities of fundamental and contagious defaults in the short run and in the long run

Fundamental Defaults	Total	Decomposition	
		No Contagion	Contagion
0–5	98.268%	98.216%	0.052%
6–10	0.716%	0.546%	0.170%
11–20	0.490%	0.300%	0.190%
21–50	0.402%	0.075%	0.327%
More	0.124%	0%	0.124%
Total	100.00%	99.137%	0.863%

Source: Elsinger *et al*. (2006a).

Figure 2 shows four loss distributions — the aggregate loss distribution of the banking system and three disaggregated loss distributions according to different risk types. From the figures we can see — as in standard quantitative risk management — whether or not the system has enough capital to absorb extreme losses. Therefore, loss distribution figures give a first overview of the shock absorption capacity of the system.

An empirical insight that resulted from Elsinger *et al*. (2006a) is that in simulations of this kind, banks usually default as a direct consequence of risk factor movements. The amount of insolvency contagion or second-round effects that can be created from risk factor distributions constructed from historical data play only a minor role. The contagion of insolvency through the interbank market by the pure balance-sheet mechanics seems to be quantitatively not very significant. An alternative empirical approach that can be applied to publicly traded banks is to use the idea of the Elsinger *et al*. (2006a) framework with tools from asset pricing. This idea is developed in Elsinger *et al*. (2006b). This model builds on the idea of structural credit risk models in the tradition of Merton (1974). Viewing bank equity as a call option on total bank debt, data on bank equity prices and total bank debt can be used in combination with the call option price formula to estimate the parameters of the stochastic processes driving the market value of bank assets. Using a suitable procedure for separating interbank debts from other debts, this approach leads via a different route to a stochastic model for the vector e and can be used in combination with an estimated structure of interbank

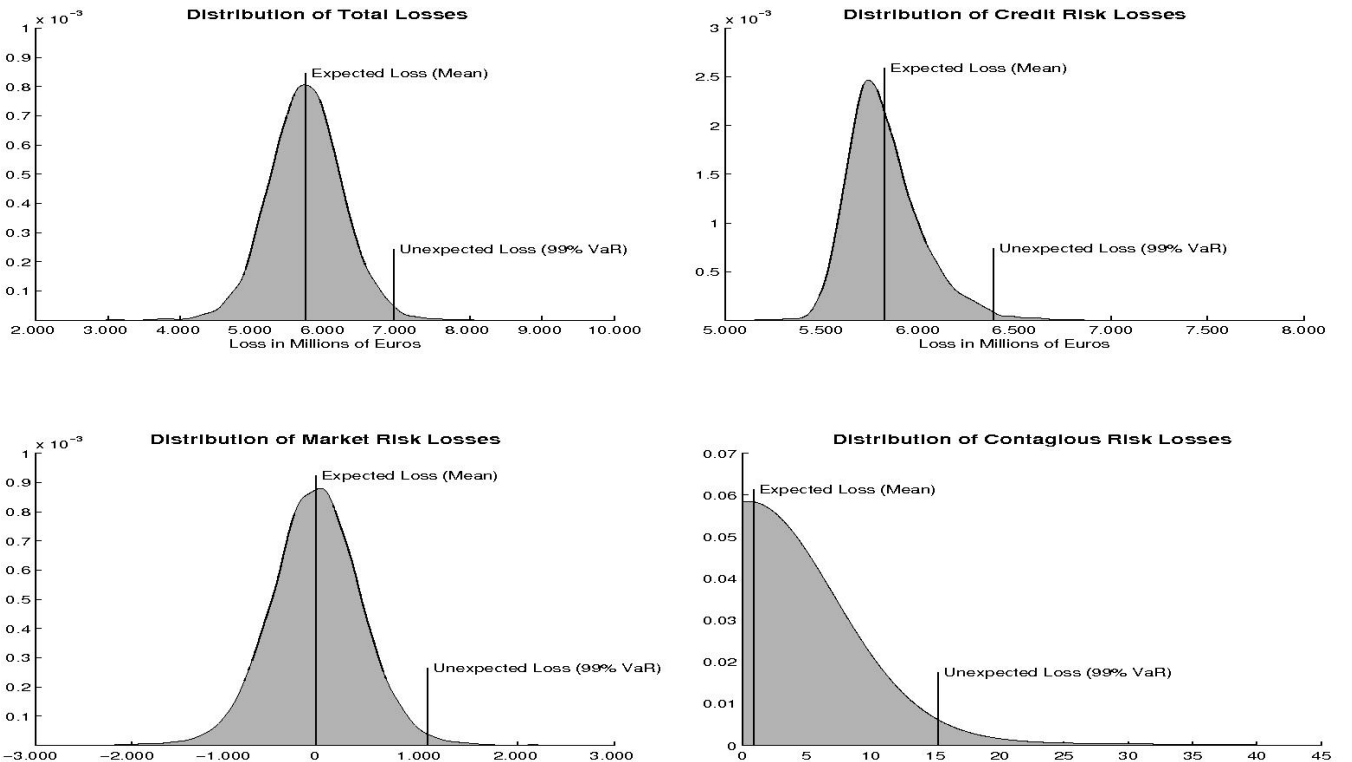
Distribution of Total Losses
x 10^-3
Expected Loss (Mean)
Unexpected Loss (99% VaR)
Loss in Millions of Euros
Distribution of Credit Risk Losses
x 10^-3
Expected Loss (Mean)
Unexpected Loss (99% VaR)
Loss in Millions of Euros
Distribution of Market Risk Losses
x 10^-3
Expected Loss (Mean)
Unexpected Loss (99% VaR)
Loss in Millions of Euros
Distribution of Contagious Risk Losses
Expected Loss (Mean)
Unexpected Loss (99% VaR)
Loss in Millions of Euros

Figure 2.

debt in a network clearing model of the banking system. Elsinger *et al*. (2006c) show how this approach can be applied to an international banking dataset.

While this balance-sheet mechanics approach provided some interesting empirical insights into the nature of mechanical insolvency contagion through the interbank market and its potential quantitative significance, the framework has a number of important shortcomings that limit its usefulness for the quantitative modeling of systemic risk in a global banking system.

First, a quantitative model of systemic risk in a global context has to broaden its perspectives on the financial system to other sectors than banks. In the current international debt crises, it turned out to be of crucial importance how the balance sheets of banks are linked with the balance sheets of special purpose vehicles that banks used to sell and securitize their loan portfolios. It would also be helpful if the balance sheets of sectors to which the banks are exposed were part of the balance-sheet mechanics model.

Second, the model as it has been presented so far is too mechanical. While this mechanical perspective is useful for a short-term analysis of risks that can be seen in the available data of the banking system, clearly it would be desirable to have some aspects of behavior of the major players in the model. This need (in a first step) not necessarily be a fully fledged model of optimizing behavior. Some empirically founded hypotheses about behavior might be a big step forward. Looking again at the current international debt crises, we see that the liquidity problems we see in many different segments of the international capital markets, including interbank markets, are playing a key role. All of these behavioral aspects, such as banks being reluctant to roll over debt because they can't value assets and risks, can by definition not occur in a mechanical model of clearing a system of debts.

Third, the model should be able to take into account the interaction between behavior, balance-sheet mechanics and asset markets. Clearly, in a model of a globalized banking system, exchange rates have to enter the picture, but also asset prices should be part of the bigger picture.

Of course, listing a couple of desiderata is easy; proposing a tractable model that can take these points into account is another matter. I shall make an attempt to give a sketch of a model structure that seems to me a useful extension of the framework described at some length in this section. While this sketch is still not a fully fledged model, I think it is

nevertheless useful to spell out what the major ingredients of a useful framework should be. In a nutshell, one could describe the framework I have in mind as follows: we need a model that provides a macroeconomic perspective on the problem of financial instability. In such an endeavor, it might be useful to keep an open mind towards modeling shortcuts and perhaps also allow — in a first step — for behavioral relations that cannot necessarily be derived within the standard micro-founded modeling paradigm. I think that the Eisenberg–Noe model might provide an interesting building block of such a model.

4. How Could the Model be Improved?

Some ideas that could perhaps lead the way in this direction are developed in Shin (2005, 2006). He suggests a framework that builds on the Eisenberg–Noe model but at the same time extends the framework in a way that incorporates some of the features we found desirable in the previous section. The first important step in Shin (2006) is to think of the system of debts as a network consisting of banks and other sectors in the economy. Bank loans finance real assets that are in positive net supply and lending activities, and the price of these assets are linked by an asset market. Let us take this perspective on the Eisenberg–Noe model.

From a macroeconomic perspective with a focus on financial stability, it is perhaps most useful to think of the nodes in the network as systemically important banks in the system plus some key sectors linked to the banking system. There are additional nodes in the network representing real and financial investors. Real investors use bank loans to finance investments in the real asset that is in positive net supply. The assets and liabilities of financial investors consist of purely financial claims that are in zero net supply.

Let the current value of the real asset be given by v and let θ_i denote agent i's share in this asset. Then the net worth of agents in this system, banks, real and financial investors can be written as the vector

$$\omega = \Pi' d + v\,\theta - d. \tag{4}$$

In contrast to Equation (2), we have now the following differences. All debts between banks and between banks and nonbanks are included in the

clearing network and are thus at the same level of seniority in a clearing procedure. This assumption is for the sake of simplicity and can easily be relaxed. Furthermore, the real asset enters the picture. As in the model before, a clearing payment vector can be determined for a given value of the real asset v. This vector is given by

$$p^* = \min[d, \max(\Pi' p^* + v\theta, 0)]. \tag{5}$$

While in the Eisenberg–Noe model insolvency is resolved in the clearing procedure by a pro rate sharing of given values in the system, Shin (2005, 2006) following Cifuentes *et al*. (2005) link the balance sheet mechanics to a market mechanism by assuming that the value of the real asset v is determined by supply and demand in the market for the real asset. This complicates the clearing problem, because now not only do we need a fixed point for a given v, but we need a fixed point of the clearing procedure that is compatible with a new equilibrium value of v. That this more complicated clearing procedure works mathematically is shown in Cifuentes *et al*. (2005) and it is informally used in Shin (2005) to discuss the feedback loop between liquidity, bank lending and asset prices. Such feedback is now in the model. Assume, for instance, liquidity in the banking system increases. If it is assumed that banks use this additional liquidity to extend credit to the real sector, this will boost asset prices v and strengthen the balance sheets of the real sector, leading to higher credit expansion. In such a system, clearly the feedback mechanisms familiar from financial boom and bust cycles can occur.

At this stage, it becomes clear that it is essential to describe behavior of the major agents in the system. In the framework of Shin (2005), this behavior is included in the supply and demand curves of asset markets and by assumptions about how agents in the system are going to use extra liquidity created by the change in relative asset prices.

To discuss issues arising due to the globalization of banking, an additional feature has to enter the model. The modeling framework of Shin has to be extended to a stylized global system along the lines of international macroeconomic models. The network model of banks, real and financial investors exists now in two countries, domestic and foreign, and all portfolios can have domestic and foreign components and, of course, decisions have to be extended by the allocation between domestic and foreign real and financial assets. A competitive market for foreign exchange can

then be added along very much the same lines as the asset markets determining the equilibrium value of v.

What can such an approach deliver? The approach suggested here combines new ideas about clearing networks with old-fashioned approaches to macroeconomic equilibrium. On the one hand, it is an attempt to focus on the fact that the value of debt and the risk of insolvency and contagion can only be determined in a system context. The network clearing model of Eisenberg and Noe points to a tractable way to model these interdependencies. The work of Shin brings essential economics into this pure balance-sheet mechanics model. Tractability can be maintained by describing behavior of agents in a very coarse way and by modeling some key markets by supply and demand curves. The combination of balance-sheet mechanics and economics does, however, keep the model essentially static. The fixed point problem is more intricate, but the model as sketched above is still not a dynamic model. The main attraction of the framework is that it is formulated with concepts that can — at least in principle — be brought to data. This makes the framework useful to arrive at hopefully more meaningful quantitative models of systemic risk in the future and to address some of the issues arising in a global banking system.

5. Conclusions

In this paper, I have discussed the usefulness of network clearing models of systemic risk in the banking system for the quantitative analysis of systemic risk in a global banking system. I have made an attempt to focus on the conceptual issues in contrast to the rather obvious data issues any modeling attempt of this kind has to face.

I have argued that current examples of network clearing models have some conceptual drawbacks that limit their usefulness in understanding and analyzing major aspects of financial crises in a globalized world. These drawbacks are: too narrow perspective on the banking system and interbank debt, too mechanical approach to bankruptcy and default, and neglect of balance-sheet mechanics and asset market interaction. While these drawbacks limit the usefulness of balance-sheet mechanics models, the clearing network models also have clear strengths. The major strength is that they are formulated in concepts that allow applications of the model with banking data. In this respect, we finally argued that the

work of Shin (2005, 2006) provides a very promising extension that keeps the strength of the clearing network model but at the same time adds some essential economic concepts to the analysis. This extension opens the framework to address the problem of systemic risk in a globalized banking system. Whether and how such a framework would actually work and whether it would provide really useful results must at the moment remain an open issue.

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Globalization and Systemic Risk

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Good morning. It is a long way to come to Chicago from New Zealand, but I think well worth it with the presentations we've had today.

I will comment just briefly on the papers. Then I will talk a bit more about some of the policy issues and the approach to some of those issues in New Zealand. New Zealand was discussed yesterday, and we always seem to come up at conferences even though it is a small country at the end of the world. And maybe it is of interest again in this situation, because New Zealand remains very vulnerable to external financial and other shocks. I will talk a bit about how the Reserve Bank of New Zealand (RBNZ) has been responding to the recent financial turmoil.

Firstly, coming back to some of the common themes in this session, Martin Summer notes that models of financial stability are at a very preliminary stage, particularly in terms of modeling the interaction between bank balance sheets on the one hand and market liquidity and price risk on the other. While there is a fair way to go with this modeling, I believe Martin is making very good progress. We will watch further progress with interest as we are looking to start some financial stability modeling at the RBNZ.

Considering the other two papers in the session — the highlight, I think, was the proposition that it is not actually a simple relationship from increased globalization to increased systemic risk. It is not a simple proposition.

Nicole Allenspach and Pierre Monnin observed that the correlation of exposures across banks is not the main driver of systemic risk, but in effect, the build-up in imbalances, or distance-to-default, is a more important factor.

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In Andy Haldane's paper, he says that the diversification of credit risk through the "originate and distribute" model might have reduced systemic risk at normal times in fair weather, but in foul weather, things can be worse — the fat-tail issue. I think this is a pretty believable hypothesis, particularly in light of events that we have just been observing in the last couple of months. The originate and distribute model has increased the channels for contagion of credit shocks, via repricing in credit markets and liquidity effects.

Haldane talked about the incentive effects where you have asymmetric information, where the originators are quite sophisticated in their approach to repackaging and distributing credit risk and exposure, and distributing it to less informed investors — investors who have less time to monitor these things and who might be more reliant on credit ratings. So what some hedge funds and investors thought was excess return — alpha — was actually turning out to be beta, that is, compensation for risk, in particular, fat-tail risk.

I think that, also, some of these Asian surpluses that we heard about yesterday flowing into debt markets in very large volumes have also been contributing to this overpaying for risk. And while those Asian surpluses have traditionally gone into low risk treasuries rather than credit spread products, there has been an increasing share of these flows looking for yield which has contributed to the compression of spreads and the overvaluation of risk.

And of course we have seen this widespread effect from the shock in the US sub-prime market — very far-reaching effects that no one expected, which presents a prima facie case for the fat-tail proposition. So that leaves the question: what sort of policy response should there be from central banks to forestall the potential impact of such events? In the New Zealand case, there are two areas I would like to talk about: the banking contagion effect in the context of home–host supervision; and the policy response to the liquidity shock in the banking system.

Firstly, and this is the issue we touched on yesterday, New Zealand is a small host country where the banking system is essentially dominated by foreign banks. Indeed, from the graph here, Australian banks actually make up 90 percent of the New Zealand banking system. So New Zealand is vulnerable to a shock in the Australian banking system. And through the late 1990s, in particular, those banks became increasingly global in their approach, and therefore a lot of the core functions and activities were taken out of New Zealand, leading to the development of our "outsourcing policy"

and us thinking more about how to reduce the vulnerability of the New Zealand banks to a shock in Australia.

The first risk mitigant is that which Phil Lowe mentioned yesterday — the change in the banking legislation in Australia and New Zealand which has been designed to ensure that the authorities, in a crisis situation, have regard to financial stability in the other country.

A second action that we took was to require all of the large banks in New Zealand to be subsidiaries, that is, we have not allowed branches for systemically important banks. And this was only finally achieved for all of the large banks last year. So, obviously, that helps to put a fire-wall around the New Zealand bank, giving it some protection against a shock to the parent.

The third element is greater efforts at Trans-Tasman collaboration. For example, RBNZ has been working closely with the Australian Prudential Regulatory Authority (APRA) on the introduction of Basel II, and we will be having joint crisis simulation exercises next year. This year, in November, Reserve Bank of Australia and APRA staff will be participating in a local New Zealand crisis management exercise.

And the final element is the outsourcing policy: core functions in the New Zealand subsidiaries must be under the control of the New Zealand board and management, rather than outsourced to Australia where they may potentially be damaged in the case of a shock to the parent bank in Australia. The main requirement here is that large banks must have the legal and practical ability to control and execute core functions, in particular, the settlement of outstanding obligations in a crisis, including retail New Zealand dollar banking transactions. It is the core banking systems that need to be under the control of the New Zealand subsidiary; also, risk management and financial monitoring systems.

So that's the traditional way we have been thinking about the potential contagion effects of an external banking failure impacting New Zealand. And we have had the outsourcing policy, which is essentially a ring-fencing type policy.

The alternative approach which people were talking about yesterday is a more cooperative approach — create a supranational supervision agency which will help to manage the situation in a crisis, in particular the burden-sharing between the different parties and countries involved. And that may be the right solution, for example, in Europe, or in areas where you have a greater political integration and the ability to share taxes for example.

But in the New Zealand situation, where you have one large party and one small party, the supranational regulator solution is some way off. In the meantime, it is necessary to build one or two fire-walls to help protect the banking system in the smaller country, while at the same time working hard on improving cooperation between the authorities of the two countries.

Now, coming back to the more recent events — and the liquidity issues — what happened in August? There are a couple of factors that make New Zealand particularly vulnerable to the pressures that we saw building up over the past couple of months. The first is that we run a large current account deficit, and most of that deficit is actually funded through the banking system. In fact, our banks are funding about 60 percent of the capital account surplus.

And so when the US commercial paper market and euro dollar markets dried up, that had a major effect not just on the cost of funds to the banks in New Zealand, but actually to the whole country. And when those foreign markets dried up, that put both the banks and the domestic bank bill market under pressure. Bank bill rates shot up, and this is a graph that we saw yesterday and the greatest response there, I think, is the UK. The US here is about 100 points, and New Zealand was not far behind in terms of the spread over overnight interest rate swaps.

I might add that the unwinding of the carry trade, mentioned by Hyun Song Shin yesterday, put additional pressure on New Zealand markets, both in terms of the currency falling dramatically — the graph that Shin showed — and also the withdrawal of liquidity from the foreign exchange swap market, which was the main recipient of NZ dollar carry trade funds. Some further pressure has come from the secondary non-bank institutions, which have been in some strife in New Zealand. We have had about six nonbanks fall over in the past three months. The net result was that the banks were hoarding cash and refusing to buy other banks' paper. The bank bill market essentially became dysfunctional.

So what was RBNZ's policy response? First, it was to increase settlement cash held by the banks by about 10–15 percent, which was the normal response in meeting an additional demand for cash by the banks through open market operations. However, there was this additional issue of the term funding market being illiquid, so the second two actions we took were aimed not so much at bank liquidity levels, but trying to get flow liquidity back into the 90-day bank bill market, which we regard as

a key benchmark market. We did that by agreeing to accept bank paper in our overnight repo facility, albeit at a 100 basis point penalty margin, and we also introduced a tiering system on settlement cash holdings which means that if a bank holds settlement cash over a certain level, the remuneration on the excess drops by 100 points. So in a sense, it was a carrot-and-a-stick policy approach.

What it did was get the flow of funds moving again. The banks began to perceive bank bills as a true liquid asset as they could now discount it in an emergency. They therefore became willing to once again buy bank bills in the market. So liquidity was restored to that market even though the additional discount facility has not actually been used.

In terms of thinking about this policy in response to the recent financial shocks, the role of the central bank in supporting the key short-term markets has turned out to be an important one.

I might just add very briefly that, coming back to the carry trade and the closing out of carry trades in August, even though this put pressure on liquidity and was regarded as an issue for financial stability, if I put my monetary policy hat on, then that was seen as a very welcome thing. From a monetary policy point of view, we have had all this pressure on the exchange rate. We were getting rid of some of that. We were rebalancing our monetary policy between exchange rate and interest rate pressure. This has been a headache for us for the past five years as the carry trade has made the New Zealand market very liquid, pushing mortgage rates down, fueling the housing market and restraining export sales. So the monetary policy view and the financial stability view of the closing out of carry trades were quite different.

So just briefly, on the final slide, I would like to consider some of the policy issues going forward. Recent events suggest that, in order to counter contagion through markets, we must firstly think hard in New Zealand about the banks' funding risk. Our banks have a large exposure to offshore funding markets and we must now recognize that there is a liquidity risk in these markets as well as a pricing risk. So, as supervisors of the banks, we have to go back and look at funding and liquidity risk and see what can be done to mitigate the issue, both from a micro bank perspective and from a macroeconomic perspective. Prudential liquidity policy has tended to be in the background, with capital adequacy front and center. I think we will now see a change of emphasis, with greater attention to prudential liquidity policies going forward.

Second, we will probably see reviews of capital adequacy rules around securitization and the capital that banks need to hold against the residual risk that results when they push assets off the balance sheet. That residual risk now appears to be somewhat greater than we had thought.

Third, there is a need to improve transparency and disclosure around complex debt securities and, as Andy was saying, we must try to understand better the tail risk in the banking system through dynamic stress-testing.

Finally, I think we need to look closely at linkages between the prudential supervisors and market oversight agencies. In these recent events, there was a need for closer cooperation between the central banks and banking supervisors than might have been the case in the past. And so some central banks/FSAs will be looking to improve those relationships going forward.

Thank you.

VI. GLOBALIZATION AND SYSTEMIC RISK — CAPITAL MARKETS

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The Sub-Prime Crisis and Systemic Risk: Evidence from US Securities Markets

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University of Pittsburgh

1. Introduction

The proliferation of hedge funds and their growing importance in asset markets has revived concerns about the level of systemic risk in the global financial system.[1] This issue surfaced prominently in 1998 with the failure of Long-Term Capital Management (LTCM) and the risks that this failure posed for the financial services industry. Last year's failure of Amaranth Advisors and the sub-prime lending "crisis" of this year have intensified interest in this topic. Earlier this year, the President's Working Group on Financial Markets addressed the issue. Congress has held hearings on the topic, and the issue occupied a slot on the agenda at the summit of Group of Eight (G8) finance ministers in Heiligendamm, Germany. A recent search of Yahoo! for stories containing the phrases "hedge funds" and "systemic risk" resulted in 361,000 hits, revealing widespread media coverage of this topic.

The concern about the relation between hedge fund growth and systemic risk is based on the presumption that hedge funds typically are highly leveraged and invested in risky assets, such as credit derivatives, mortgage-backed securities, and commodity futures. Furthermore,

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[1] Systemic risk has been defined by Robert Steel, Under Secretary of the US Treasury Department, as "the potential that a single event, such as a financial institution's loss or failure, may trigger broad dislocation or a series of defaults that affect the financial system so significantly that the real economy is adversely affected". See Testimony of Under Secretary for Domestic Finance Robert K. Steel Before the US House of Representatives Committee on Financial Services, July 11, 2007.

because hedge funds are exempt from Securities and Exchange Commission (SEC) registration requirements, little is publicly known about the composition and risk of their portfolios. As a result, many policy-makers and industry participants are concerned that the failure of one or more large hedge funds would result in liquidations of assets that could create large counterparty losses and set off a chain of failures in the financial services industry, with potential damage to the overall economy.

An alternative view is that the growth of hedge funds has actually reduced systemic risk in the global financial system. According to this view, the growth of hedge funds has diffused risks throughout the financial system, resulting in less concentration of risk among major financial institutions, and, therefore, less systemic risk. For example, in testimony before the House Financial Services Committee earlier this year, Federal Reserve Governor Kevin Warsh stated that "hedge funds have the potential to reduce systemic risk by dispersing risks more broadly and by serving as a large pool of opportunistic capital that can stabilize financial markets in the event of disturbances".[2]

This paper attempts to empirically distinguish between these two views by examining evidence from US securities markets. In particular, we examine three measures of risk that we presume to be directly related with systemic risk.

First, we examine data on the observed volatility of equity returns for a broad-based US stock index and ten publicly traded large financial institutions, including five large commercial banks and five large investment banks. We especially focus on how the observed volatilities of the country indexes and financial institutions changed during two "stress tests": the LTCM crisis of 1998 and the sub-prime lending crisis of 2007.

We also examine two measures of expected volatility estimated from options pricing data: (1) the implied volatility estimated from at-the-money call options; and (2) a skew parameter, which estimates the price of insuring against large price declines with out-of-the-money put options. We examine these measures over the period of January 1996 through August 2007 for US OEX options (that is, options on the S&P 100 index) and options on the nine financial institutions for which we have complete

[2] Testimony of Federal Reserve Governor Kevin Warsh Before the US House of Representatives Committee on Financial Services, July 11, 2007.

options price data from 1998 through August 2007. Here, too, we focus on two sub-periods defined by the LTCM and sub-prime lending crises to determine whether changes in these measures of risk changed differently across the two crises.

2. Observed Volatilities

The first measure of volatility we examine is the standard deviation of daily stock returns. We calculate this measure for the S&P 500, a broad-based US stock index, and equal-weighted indexes of large US commercial and investment banks for the period of 1990 through August 2007. The index of commercial banks consists of Citigroup, Bank of America, JPMorgan Chase, Wachovia, and Wells Fargo, which are the five largest US commercial banks as measured by total assets as of December 31, 2006. The index of investment banks includes the five

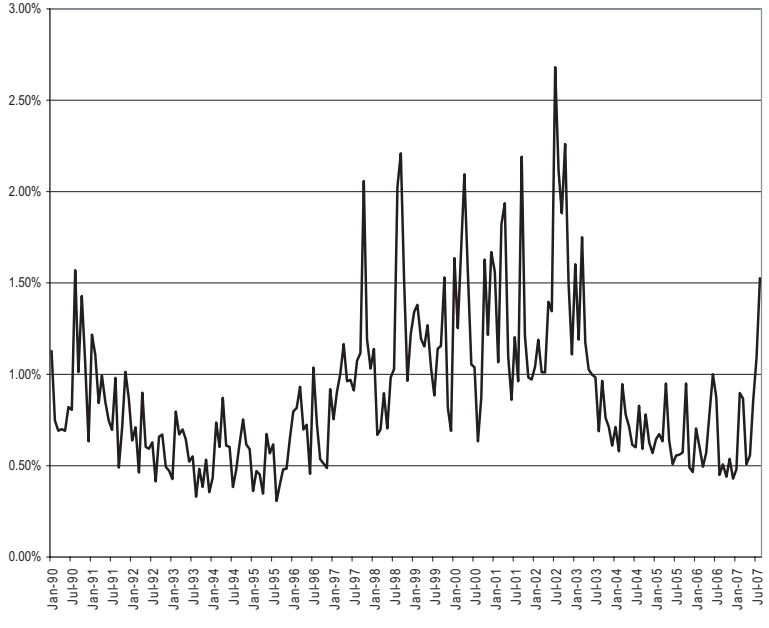

Figure 1(a). Standard deviation of daily returns on S&P 500 Index, 1990 to August 2007

Source: The sources of data on the daily values of the S&P 500 are Yahoo! Finance and the CRSP database.

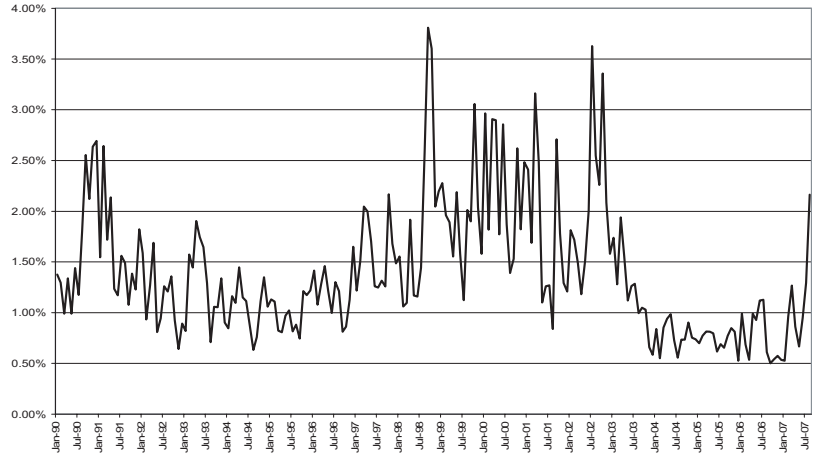

Figure 1(b). Standard deviation of daily stock returns for five large US commercial banks, 1990 to August 2007

Note: This figure graphs the standard deviation of daily stock returns on a monthly basis for an equal-weighted index of five large US commercial banks (Citigroup, Bank of America, JPMorgan Chase, Wachovia, and Wells Fargo) from January 1990 through August 2007.

Source: The sources of data on daily stock returns are Yahoo! Finance and the CRSP database.

largest publicly traded US investment banks, including Morgan Stanley, Merrill Lynch, Goldman Sachs, Lehman Bros., and Bear Stearns.[3] The source of the stock price data for the ten financial institutions is the CRSP database through 2006 and Yahoo! Finance for January–August 2007.

Figures 1(a)–(c) show the standard deviation of daily returns on a monthly basis for the S&P 500, the commercial bank index, and the investment bank index, respectively, from 1990 through August 2007. The figures reveal that the observed volatility of equity returns for the S&P 500 and the two financial institutions indexes has been unusually low in recent years, which are years in which hedge funds have been growing substantially. They also show that the standard deviation of

[3] Lehman Bros. and Goldman Sachs did not start trading publicly until 1994 and 1999, respectively. Therefore, they are not included in the index of investment banks until they became publicly traded companies.

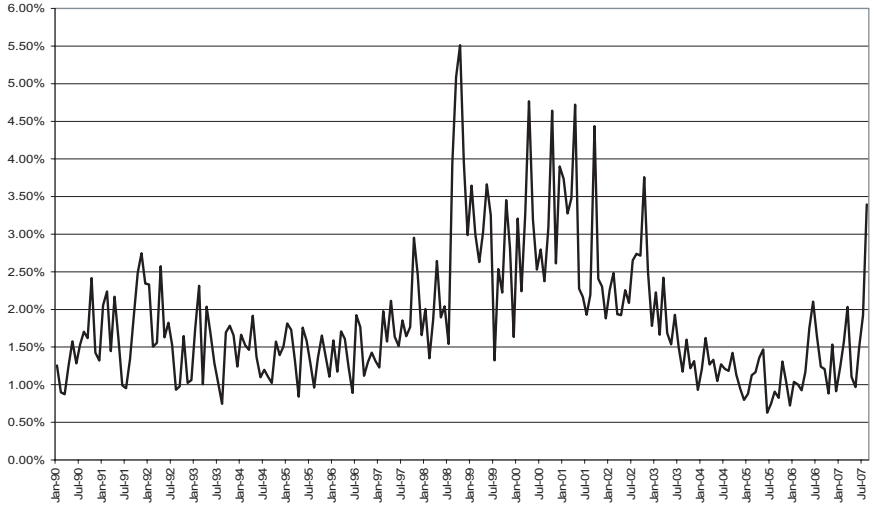

Figure 1(c). Standard deviation of daily stock returns for five large US investment banks, 1990 to August 2007

Note: This figure graphs the standard deviation of daily stock returns on a monthly basis for an equal-weighted index of five large US investment banks (Morgan Stanley, Merrill Lynch, Lehman Bros., Bear Stearns, and Goldman Sachs) from January 1990 through August 2007.

Source: The sources of data on daily stock returns are Yahoo! Finance and the CRSP database.

returns for both the S&P 500 and the two indexes increased by substantially more during the LTCM crisis than the sub-prime crisis, at least through August 2007. Hence, based on this measure of risk, there is considerably less uncertainty about the values of large US financial institutions during the sub-prime crisis than there was during the LTCM crisis.

3. Implied Volatilities

A second measure used to track systemic risk is the implied volatility calculated from at-the-money 91-day call options for the S&P 100 index (that is, the OEX option) and the nine financial institutions comprising the two bank indexes. We collected the daily values of the interpolated

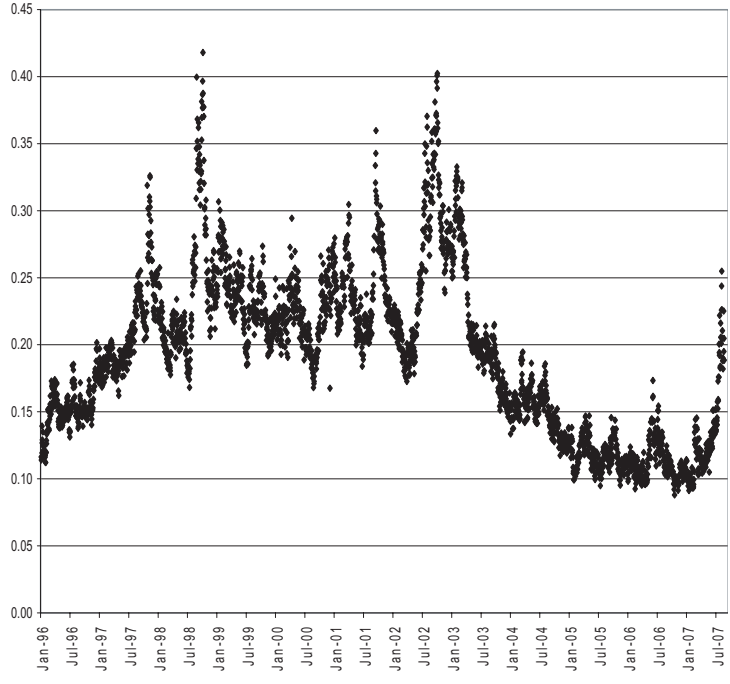

Figure 2(a). OEX implied volatility

Note: This figure graphs the implied volatility on a daily basis of the at-the-money 91-day call options on the OEX index for the period January 1, 1996 to August 31, 2007.

Source: The OptionMetrics database is the source of the interpolated volatilities.

implied volatilities from the OptionMetrics database, which contains data from 1996 through the present.

Figures 2(a)–(c) plot the daily implied volatilities for the OEX, commercial bank, and investment bank indexes on a daily basis from 1996 through August 31, 2007. The figures show that all three indexes show a substantial decline in implied volatilities over time, with a sharp increase in August 2007 related to the sub-prime turmoil. The figures also allow for a direct comparison of the changes in implied volatilities around the times of the LTCM and sub-prime crises. All three figures show that the increases in the implied volatilities of these indexes were substantially greater during the LTCM crisis than the sub-prime crisis, at least through August 31, 2007.

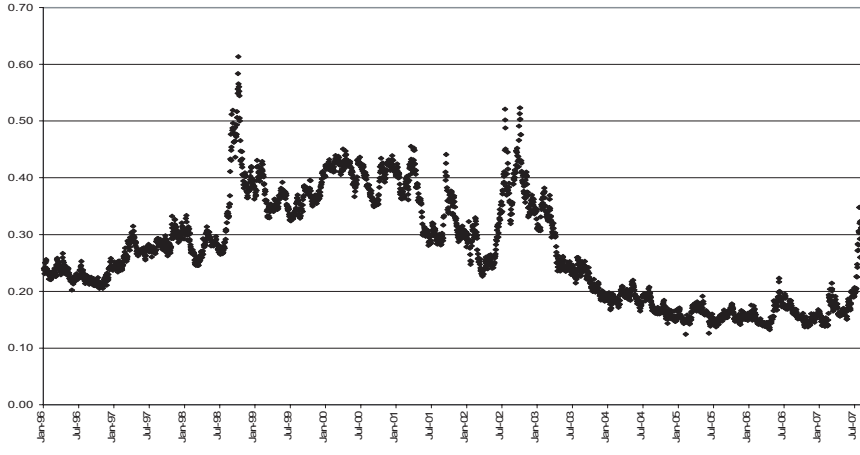

Figure 2(b). Commercial banks' implied volatility

Note: This figure graphs the equal-weighted average of the implied volatilities for the at-the-money 91-day call options of five commercial banks (Citigroup, Bank of America, JPMorgan, Wachovia, and Wells Fargo) for the period January 1, 1996 to August 31, 2007.

Source: The OptionMetrics database is the source of the interpolated volatilities.

4. Skew

The third measure of risk we examine is an estimate of skew in expected equity returns, which is calculated from the OptionMetrics database. We calculate skew as the difference in the implied volatility of the −20 delta put and the implied volatility of the 50 delta call.[4] This measure effectively estimates the cost of insuring against large stock price declines through the use of out-of-the-money put options. Increases in this measure, therefore, reflect increases in the cost of this insurance.

Figures 3(a)–(c) plot skew for the OEX, commercial bank, and investment bank indexes, respectively, over the period of 1996 to August 2007. The graphs show that skew increased sharply for the OEX in 2007 during the sub-prime turmoil, and by an amount comparable to the corresponding increase during the LTCM crisis.

[4] A similar measure of skew is used in Xing, Zhang and Zhao (2007).

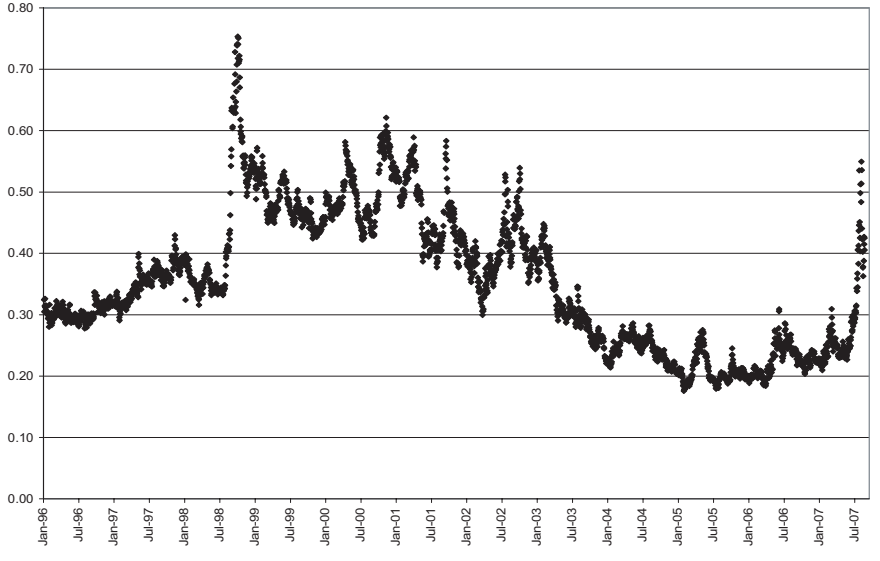

Figure 2(c). Investment banks' implied volatility

Note: This figure graphs the equal-weighted average of the implied volatilities for the at-the-money 91-day call options of four investment banks (Morgan Stanley, Merrill Lynch, Lehman Bros., and Bear Stearns) for the period January 1, 1996 to August 31, 2007.

Source: The OptionMetrics database is the source of the interpolated volatilities.

Figures 3(b) and 3(c) show that skew also increased sharply for the commercial and investment bank indexes in 2007, by an amount larger than the corresponding increase during the LTCM crisis. The fact that skew has risen more for large US financial institutions as compared with the OEX during the sub-prime crisis than it did during the LTCM crisis suggests that the risk of the ongoing crisis is more confined to the financial sector with less risk to the stock market as a whole. The next section presents results from regression analysis that attempt to test this conjecture.

5. Regression Results

We estimate two sets of regression models. In the first, we estimate daily values of implied volatility for the OEX during 1996 through August 31,

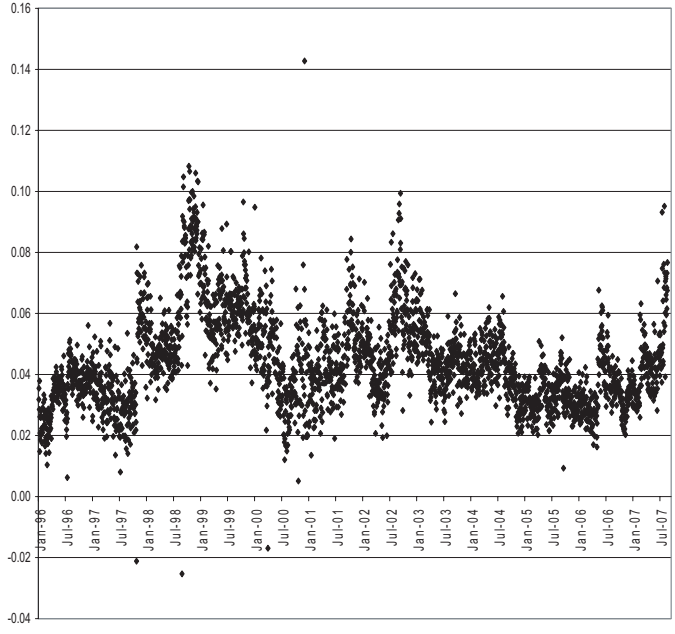

Figure 3(a). OEX skew

Note: This figure graphs the skew of the OEX index on a daily basis for the period January 1, 1996 to August 31, 2007. The skew measure is the implied volatility of the 91-day -20 delta put option minus the implied volatility of the 91-day 50 delta call option.

Source: The OptionMetrics database is the source of the interpolated volatilities for each option.

2007, as a function of the corresponding values of the implied volatility for the financial institutions in the two indexes and two interaction variables: (1) the interaction of the implied volatility of the banks and a dummy variable that takes the value of 1 during the LTCM crisis (that is, during July 26, 1998 through October 31, 1998); and (2) the interaction of the implied volatility of the banks and a dummy variable that takes the value of 1 during the sub-prime crisis (that is, during August 2007). The coefficients on the two interaction variables capture whether the relation between the implied volatilities of the OEX and the banks change systematically during the two crises.

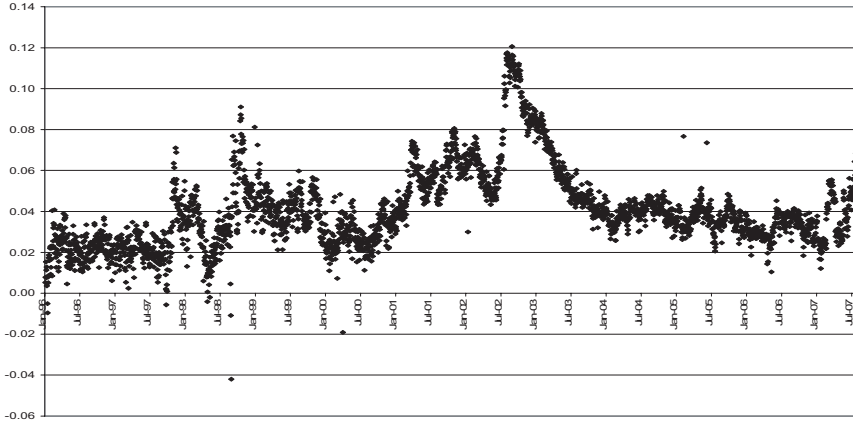

Figure 3(b). Commercial banks' skew

Note: This figure graphs the equal-weighted average of the skew of five commercial banks (Citigroup, Bank of America, JPMorgan, Wachovia, and Wells Fargo) on a daily basis for the period January 1, 1996 to August 31, 2007. The skew measure is the implied volatility of the 91-day −20 delta put option minus the implied volatility of the 91-day 50 delta call option.

Source: The OptionMetrics database is the source of the interpolated volatilities for each option.

In the second set of regressions, skew for the OEX is regressed on the corresponding skew for banks and two interaction variables: (1) skew for the banks interacted with the dummy variable for the LTCM crisis, and (2) skew for the banks interacted with the dummy variable for the sub-prime crisis.

The regression results are contained in Table 1. Panel A of the table reveals that the covariance of the OEX implied volatility with the banks' implied volatility is highly significant. The coefficient on the banks' implied volatility with the LTCM dummy variable is positive and significant for the commercial bank index, but not significant for the investment bank and combined indexes. The coefficient on the banks' implied volatility interacted with the sub-prime dummy is positive and not significant for the commercial bank index, and negative and significant for the investment bank and combined indexes. Notably,

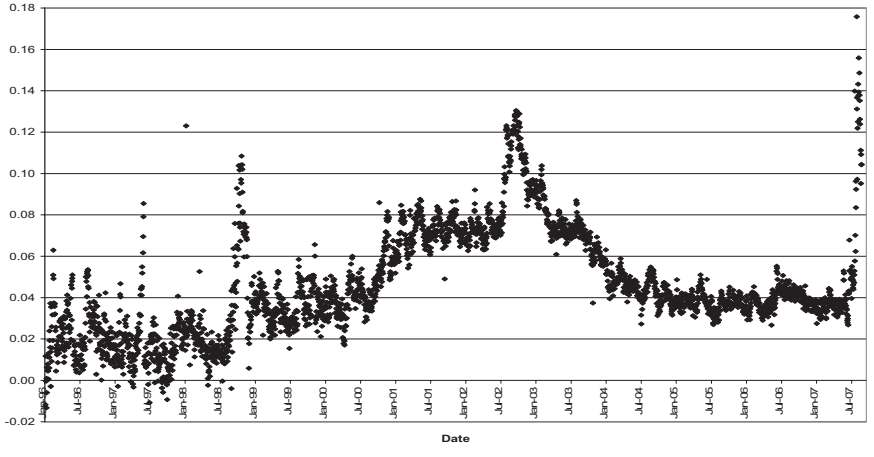

Figure 3(c). Investment banks' skew

Note: This figure graphs the equal-weighted average of the skew of four investment banks (Morgan Stanley, Merrill Lynch, Lehman Bros., and Bear Stearns) on a daily basis for the period January 1, 1996 to August 31, 2007. The skew measure is the implied volatility of the 91-day -20 delta put option minus the implied volatility of the 91-day 50 delta call option.

Source: The OptionMetrics database is the source of the interpolated volatilities for each option.

the coefficient on the first interaction variable is significantly higher (at the 0.01 level) than the coefficient on the second interaction variable in all three equations. This result is consistent with the view that risks to the financial sector during the sub-prime crisis have had less impact on the risk to the stock market as a whole than they did during the LTCM crisis.

Panel B of Table 1 contains the corresponding results on skew. The results are generally similar to the results on implied volatility. The covariance of the OEX skew with the banks' skew is highly significant across all three equations. The coefficient on the interaction of skew with the LTCM dummy is positive and significant across all three indexes, indicating that the covariance between OEX skew and banks' skew increased significantly during the LTCM crisis. In contrast, the coefficient on the interaction of banks' skew and the sub-prime dummy is

negative across all three indexes and significantly negative for the investment bank and combined indexes. The difference in the two coefficients on the interaction variables is highly significant in all three models. This result is consistent with the view that the spillover effects of increased risk to the financial sector on the stock market as a whole has been significantly less during the sub-prime crisis than it was during the LTCM crisis.

Table 1 (Panel A). Ordinary least squares regression of implied volatility of at-the-money OEX call option on the corresponding implied volatility of major US financial institutions and the interaction of this implied volatility with dummy variables for the LTCM "crisis" (August 1998–October 1998) and the sub-prime "crisis" (August 2007). The regression is estimated over the period 1996–2007. Dummy variables for each year during 1997–2007 are included. The regression is estimated using the implied volatility for the 5 largest commercial banks (Citigroup, Bank of America, JPMorgan Chase, Wachovia, and Wells Fargo), 4 large investment banks (Morgan Stanley, Merrill Lynch, Lehman Bros., and Bear Stearns), and the 9 institutions combined. *T*-statistics are in parenthesis

	Commercial Banks	Investment Banks	Commercial Banks Plus Investment Banks
Intercept	–0.000 (–0.25)	0.001 (0.2)	–0.016 (–6.03)
Implied Volatility of Financial Institutions	0.667 (73.25)	0.498 (52.72)	0.642 (69.88)
Implied Volatility of Financial Institutions × LTCM Dummy	0.024 (3.63)	0.001 (1.60)	–0.005 (–0.75)
Implied Volatility of Financial Institutions × Sub-Prime Dummy	0.004 (0.26)	–0.025 (–2.22)	–0.041 (–3.42)
N	2,934	2,934	2,934
Adjusted R^2	0.914	0.876	0.909

(*Continued*)

Table 1 (Panel B). Ordinary least squares regression of skew from OEX put and call options on the corresponding skew of major US financial institutions and the interaction of this skew with dummy variables for the LTCM "crisis" (August 1998–October 1998) and the sub-prime "crisis" (August 2007). The regression is estimated over the period 1996–2007. Dummy variables for each year during 1997–2007 are included. The regression is estimated using the skew for the 5 largest commercial banks (Citigroup, Bank of America, JPMorgan Chase, Wachovia, and Wells Fargo), 4 large investment banks (Morgan Stanley, Merrill Lynch, Lehman Bros., and Bear Stearns), and the 9 institutions combined. *T*-statistics are in parenthesis

	Commercial Banks	Investment Banks	Commercial Banks Plus Investment Banks
Intercept	0.024 (32.56)	0.027 (33.34)	0.023 (29.67)
Skew of Financial Institutions	0.451 (26.97)	0.336 (18.74)	0.510 (26.90)
Skew of Financial Institutions × LTCM Dummy	0.196 (6.91)	0.079 (2.78)	0.096 (3.36)
Skew of Financial Institutions × Sub-Prime Dummy	–0.002 (–0.05)	–0.050 (–2.11)	–0.106 (–4.16)
N	2,934	2,934	2,934
Adjusted R^2	0.539	0.475	0.535

6. Conclusion

This paper examines evidence from US securities markets to shed light on whether systemic risk has increased over time with the dramatic growth in hedge funds. We find that both the observed and implied volatilities of equity returns of broad-based market indexes and indexes of major US financial institutions have declined substantially in recent years, which is inconsistent with the view that systemic risk has increased over time. We also find that the skew in expected equity returns, derived from options

data, also has declined over time for both the broad-based market index and the index of financial institutions.

The recent turmoil in the markets related to sub-prime crisis has been associated with an increase in the observed and implied volatilities of the broad-based indexes and major US financial institutions, but this increase has returned these volatility measures to what previously were more normal, "noncrisis" levels. Furthermore, recent levels of observed and implied volatilities are substantially below their corresponding levels during the LTCM crisis in 1998.

In contrast, the skew parameter has increased substantially for major financial institutions during the recent sub-prime crisis, well in excess of its historic levels, which is consistent with the view that the sub-prime issue has created concerns about large losses in value to major US financial institutions. However, the increase in the skew measure for a broad-based market index has been far less pronounced, suggesting that the market believes that the potential problems faced by financial institutions because of the sub-prime crisis are more likely to be confined to the financial sector than they were during the LTCM crisis in 1998.

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Systemic Risks in Our Global Marketplace

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1. Introduction

This essay discusses the recent nature and causes of systemic risk in our marketplace. The article begins in Section 2 with a discussion of the role of hedge funds — their importance in lessening arbitrage opportunities, the role and nature of managerial compensation and the types of agency problems that arise under this ownership form. Various sources of systemic risk in the current capital market context are discussed in Section 3. The role of such factors as common strategies, lack of transparency, counterparty risk, common assessment of the sub-prime mortgage asset class by the credit rating agencies and failures in regulatory coordination are all potential contributors. Systemic risk is a global rather than a national issue. The paper concludes in Section 4 by highlighting issues associated with regulatory competition and coordination, which are essential towards understanding systemic risk and regulatory decisions in our global environment.

2. Hedge Funds[1]

2.1 *Arbitrage, information, and hedge funds*

I begin by offering an economic perspective on the role of hedge funds, as they are an important topic of broad interest in our capital markets. I also

* Chester S. Spatt is the Mellon Bank Professor of Finance at the Tepper School of Business at Carnegie Mellon University and director of its Center for Financial Markets. These comments were prepared for presentation at the "Globalization and Systemic Risk Conference" at the Federal Reserve Bank of Chicago on September 27–28, 2007. I wish to thank the paper discussant, Liliana Rojas Suarez, and conference participants for helpful comments.
[1] This section of the paper builds upon Spatt (2006a).

want to emphasize the importance of the efficiency of our capital markets. The relatively efficient price signals that prevail in the marketplace are crucial for enhancing productive efficiency and economic growth through superior capital allocation and facilitating the ability of relatively uninformed investors to make suitable portfolio choices.[2] Consequently, these uninformed investors benefit from the arbitrage process and enhance competition in the financial markets. While the asset valuations in our marketplace reflect considerable information, at the same time it is important for there to be a strong incentive to engage in the costly analytic and trading activities that result in such information being embodied in prices. The high-powered incentives possessed by many hedge fund managers serve to enhance the quality of asset valuations by encouraging such activities.[3] While economists tend to focus upon the efficiency of the marketplace and the competitive paradigm, in recent years there has been more attention paid to the arbitrage process and the limits to arbitrage,[4] emphasizing the role of arbitrageurs and hedge fund investors with high-powered incentives. Even my own experience as an academic economist who strongly believes in the efficiency of America's capital markets has pointed to potential violations of efficient markets pricing.[5] Given the apparent abundance of hedge fund capital, it would be surprising if attractive investment opportunities were not substantially competed away. One especially interesting impediment to the arbitrage process and efficient risk-bearing is the desirability to many limited partners of precise benchmarks to control agency problems.

A key ingredient in producing relatively efficient prices is the competitive market forces of large investment pools and the tremendous sums of capital in the marketplace. The ability of "hedge funds" to operate across different market sectors makes hedge funds useful for ensuring the fairness of prices across different market contexts and various margins for pricing as well as for transferring risk across market sectors.

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[2] A formal analysis of the Capital Asset Pricing Model under rational anticipations by investors who learn from asset prices in equilibrium is provided in Biais, Bossaerts and Spatt (2009).

[3] A recent analysis of the value of costly information acquisition by investors that builds upon the rational expectations framework is Van Nieuwerburgh and Veldkamp (2006).

[4] This is illustrated by Shleifer and Vishny (1997).

[5] For example, Dammon, Dunn and Spatt (1993) document large mispricings among high-yield RJR Nabisco debt during the period from 1989 to 1991.

2.2 *Managerial compensation and performance*

While the competitive pricing paradigm is a very useful and powerful one in financial economics, hedge funds and arbitrage capital play a crucial role in the process through which relatively efficient prices emerge. High-powered incentives are crucial to ensuring sufficient search and analysis to limit the extent of mispricing prevailing in the marketplace. Indeed, to the extent that there are sophisticated asset managers that can predictably earn superior risk-adjusted returns, those managers should be able to earn much of the associated economic rents. An interesting theoretical analysis that focuses upon (mutual) fund flows, diminishing returns to scale in investing, competition in the managerial labor market and the ability of managers to capture the rents from scarce superior skills was recently offered by Berk and Green (2004).[6] Competition among investors for the manager's services on an *ex ante* basis prevents the investor from benefiting at the margin from the manager's identifiable skill under this theory. While these authors focus upon mutual funds, the same paradigm is applicable to hedge funds and potentially even more relevant there due to (1) the greater sophistication of investors in this arena and the focus of these investors upon managerial skill, and (2) the attractiveness of the hedge fund compensation structure to the most skillful managers. Of course, in practice, the structure of hedge fund compensation allows the general partner to share significantly in the economic rents that he creates. The limited downside (floor) on the general partner's compensation reflects his limited wealth and risk aversion about his performance compared to the capital market as a whole.

One factor that limits in practice the ability of managers to collect the economic rents from their strategies is the difficulty of determining and documenting truly superior risk-adjusted performance. As a result of the considerable variability (noise) in the cross-section of fund returns, it is well-known in some contexts, such as for mutual fund investing, that it is difficult to detect truly superior performance — in technical parlance, there is insufficient "power" to distinguish superior performance.[7] To a degree, this limits the ability of a manager to appropriate his past track record — does the superior historic track record simply reflect chance

[6] This paper was co-recipient of TIAA-CREF's 2005 Paul A. Samuelson Award for the best publication on Lifelong Financial Security.

[7] For example, see Harris (2003, pp. 454–457).

variation?[8] Even were the manager's skills stationary, a large number of years of data would be required to detect realistic skill differences. The discussion of statistical power and historic track records also emphasizes the importance of "selection" and "survivorship" effects in interpreting historic returns. Empirical estimates of historical hedge fund returns substantially overstate prospective investible returns as a result of such effects.[9] The precise magnitude of such biases depends upon how returns are being measured and the underlying data generation process, but this does suggest, even apart from the importance of properly adjusting for risk, the need for caution in interpreting historical returns.[10] This conclusion complements the observation in a paper by Getmansky, Lo and Makarov (2003) that liquidity issues in the underlying holdings of hedge funds tend to smooth their returns and consequently, understate their risk and overstate their attractiveness.

The discussion above relates to the economic question of why hedge fund managers are compensated as they are. For example, what is an optimal contractual structure?[11] What are the cross-sectional characteristics of the observed contracts? Of course, the dramatic difference in orientation between the typical mutual fund and hedge fund manager reflects the differences in the fee contract, such as the substantial incentive fee of most hedge fund managers. From a self-selection or signaling perspective, the substantial incentive fee helps hedge funds compete for many of the most talented managers.

2.3 *Agency problems*

One of the important reasons for concern about hedge funds by some policy-makers is the presence of a variety of incentive conflicts in which

[8] Hence, many managers articulate their "story" to explain how they add value and the sources of their superior skill.

[9] A similar theme is emphasized in a *Wall Street Journal* editorial page column by Malkiel and Saha (2005).

[10] Indeed, individuals participating in institutional investment selections are struck by the lack of connection between the historic and prospective manager presentations and subsequent realized performance.

[11] An interesting discussion of optimal incentive contracting for private equity management is Axelson, Stromberg and Weisbach (2007). Similar arguments apply to hedge fund management.

the incentives of the principal and the agent, who acts on his behalf, diverge. Of course, only in certain instances does the resulting behavior violate acceptable norms and become problematic. There are several natural illustrations of the divergence in incentives and the principal–agent conflict that seem relevant in the case of hedge funds.[12] For example, the asset manager receives option-like payoffs (he shares in the upside above a basic contractual return, but not the downside) and in that sense has incentives to assume relatively more risk than limited partners (and perhaps too much incentive); of course, this helps overcome the manager's natural risk aversion.[13] Given the investment adviser's interest in the fees that he might receive over time, many advisers are quite naturally very interested in growing their businesses, possibly beyond the size that their investment ideas might support. Of course, the form of the general partner's compensation can limit this incentive. Along related lines, financial economists have often observed that the relationship between investment flows and therefore, also both the size of a mutual fund and the total fees paid by a fund, are convex in the investment performance (for example, Chevalier and Ellison, 1997; Sirri and Tufano, 1998). In other words, the marginal benefit and payoffs to a mutual fund adviser of improved performance is especially great when the base level of a manager's performance is already strong.

However, a clear implication of this perspective is that advisers may possess incentives to add substantially to the risks that their funds bear, if those risks are not fully understood or detected in the marketplace. This reflects the value in the competitive marketplace of new investments and assignments to those whose performance wins the tournament among funds of various types. It also illustrates the importance and value of trying to create "track records" for new products, why some advisers discard less successful ones and why the track record of products being evaluated by institutional clients often exceeds substantially the subsequent realized performance.[14]

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[12] The author applied the principal–agent paradigm to asset management in Spatt (2005).

[13] These option-like payoffs are similar to features of the typical executive compensation structure as discussed in Spatt (2006b), reflecting somewhat analogous tradeoffs induced by the manager's limited wealth.

[14] Note that the phenomenon of the track records of products being evaluated often exceeding substantially the subsequent realized performance reflects (in part) what statisticians term "regression to the mean".

An additional dimension to the agency problem with fund management is that in some contexts, the fund adviser (that is, the agent) works for many principals at the same time. In particular, there often is an allocation problem when the same securities are being purchased or could be purchased for many different vehicles. In a situation with separate accounts, this can arise as a by-product of the separate account structure if these are not treated equivalently. For example, in a situation with identical incentives, proportionate allocation would be appropriate. However, in some contexts, such as the example of a fund manager working for a variety of products in the same fund family, there can be situations in which there are different sensitivities to various accounts due to such factors as incentive compensation, differential management fee rates as in the case of a manager investing for both a hedge fund and traditional mutual fund, the effect of past performance within a particular product and the convexity of the flow for performance relationship, and spillovers from "Star" funds. In such circumstances, it is very important for the manager to have an objective, fair and well-defined process for allocating positions, because the potential for problematic conflicts of interest is considerable.

Of course, it is often very appropriate for the asset manager to have multiple clients or work with multiple funds. There are natural scale economies in the generation of information and in portfolio decision-making.[15] However, the role of the manager's self-interest in such decisions across clients can be of potential concern. It is striking that at times, even using relatively aggregate data, academics have been able to identify situations in which the agent's self-interest appears to drive decisions.

For example, Massa, Matos and Gaspar (2006) document strategic cross-fund subsidization of "high family value" funds compared to lower value ones within a mutual fund family. Their study links the differential performance within a fund complex to both preferential allocation of initial public offerings (IPOs) and the extent of cross-trading within a complex. Of course, there are other illustrations of potential types of incentive conflicts in asset trading. For example, even on an *ex ante* basis, the early trades in a program will tend to obtain more favorable executions and less price impact. Perhaps more fundamentally, it is important for managers to avoid exploiting the (illegal) "lookback" option they possess in trade assignment and instead make contemporaneous assignment to avoid inherent conflicts of interest.

[15] Of course, these scale economies may be limited because of the price impact in acquiring mispriced positions.

Agency theory is potentially fundamental to understanding the behavior of the general partner and the relationship of his incentives to that of the limited partner. This would have ramifications for the extent of leverage in the fund, the timing of flows, what investments are allocated to separate pools (depending upon differences in marginal ownership and timing of the pool) and shutdown decisions. Agency theory suggests that the volatility selected by the general partner would be state-dependent, which would affect the potential measurement of the evolution of volatility and suggests that constant volatility could be rejected if imposed as an over-identifying restriction.

Of course, the preferences of the general partner and limited partners about supplemental monitoring (or direct regulation) can diverge and the perspective of the limited partners may depend upon the context. The limited partners would bear much of the cost and derive much of the benefit for monitoring focused upon conflicts in incentives between the general and limited partners. Such monitoring might be attractive to the limited partners to the extent the associated monitoring costs are below the benefits of the conflicts of interest that are avoided. Of course, other reasons for enhanced monitoring, such as the externalities associated with the systemic effects, could make enhanced monitoring or direct regulation desirable from a societal perspective, while the limited partners, who ultimately bear much of the cost, would not be favorably inclined.

These are not only agency issues that arise from the hedge fund's performance and contracting environment. For example, hedge funds can help resolve agency aspects of corporate governance. Due to their concentrated ownership stakes, hedge funds can overcome the free-rider problem that often paralyzes shareholders seeking to restrict an entrenched management. Another potential manner in which hedge funds can enhance governance is by potential ownership of financial claims that provide estimates of the fair value of a firm's potential financial liabilities (for example, Dumas and Syz (2005) discuss the trading of pension claims; and Spatt, Alexander, Nimalendran and Oldfield (2005) discuss market-based approaches to employee stock option valuation).

3. Systemic Risk

While in the prior portion of this article I have focused upon both some of the benefits created by hedge funds and conflicts of interest that can result

from them, systemic risk or the possibility of correlated defaults across the economy is an important reason hedge funds have received attention from policy-makers.[16] Despite the name, "hedge funds" often follow aggressive rather than hedged strategies. Many hedge fund managers often invest on the same side of a position. For example, they tend to be on the long side of the credit spread across markets. As the example of Long-Term Capital illustrates, there can be strong external effects across hedge fund investors due to price effects when a major player needs to liquidate significant positions. Of course, hedge funds do undertake a broad range of strategies reflecting their diverse expertise. These strategies tend to be profitable most of the time. Nevertheless, for a variety of reasons, there is correlation in these models and strategies and their outcomes. For example, this reflects hedge funds bringing common training, expertise and tools to evaluate the pricing signals prevailing in the marketplace. Interestingly, in the 2007 sub-prime mortgage turbulence, hedge funds are frequently (and remarkably) blaming their peers for following the same strategies, resulting in substantial price impact when particular funds (and their peers) decide to adjust their positions. This is potentially an important source of systemic risk in our current marketplace. The willingness and interest of funds in bearing substantial risk reflects the form of the general partner's compensation structure, the leverage and default option in its financing and perhaps even the perceived past willingness of the Federal Reserve to cut interest rates in response to prior episodes of market turbulence (recently, some have been referring to this as the "Greenspan put").[17]

Central bankers in recent years have taken comfort that the liquidity formerly concentrated in banks is now more diffused through hedge funds, as their aim is to limit the adverse consequences to the financial system of systemic risk.[18] Indeed, some of the hedge fund liquidations have occurred in a very self-contained fashion, as illustrated by the liquidation of Amaranth. Nevertheless, the change in the structure of risk-bearing does not eliminate the potential problem of systemic risk; indeed, the problem may be even larger in our current system. First, note that banks and prime brokers extensively lend to hedge funds. Second, the indirect

[16] Chan, Getmansky, Haas and Lo (2005) suggest that systemic risk has been increasing.
[17] The issue of whether Federal Reserve rate cuts act as a bailout is hotly debated (for example, see Meltzer, 2007; Summers, 2007).
[18] For example, see Bernanke (2006).

role of banks and brokers in providing liquidity may make these exposures less transparent than when they were provided directly by regulated financial institutions, many of whom are subject to prudential regulation. The 2007 sub-prime turbulence at least suggests that the lack of transparency greatly contributes to systemic risks.

The relative lack of transparency is a central underpinning of the systemic risks in our marketplace. This is illustrated by a variety of aspects of the sub-prime mortgage liquidity turbulence during 2007. For example, it was difficult to ascertain the allocation of these losses across financial institutions. This has been a real source of uncertainty during the recent turbulence — investors found it difficult to ascertain who possessed the losses that arose. Counterparty risk is potentially an important source of systemic risk. The absence of reliable and verifiable prices for the illiquid instruments has been important. Many market participants recognize that there were substantial defaults and losses in adjustable-rate sub-prime loans, but these losses spilled into more fundamental instruments. Investors were reluctant to sell the instruments with the largest losses because of their judgment that those securities would be unreasonably depressed on sale due to the liquidity problems. The lack of transparency points to the difficulty in assessing credit risk and the potential for heightened volatility.

Another important source of systemic risk recently in our markets is the role of credit rating agencies. While traditionally a rating agency could misjudge the creditworthiness of an individual credit, the nature of sub-prime financing resulted in the agencies misvaluing an entire class of loans. The nature of the errors was not about the idiosyncratic risk of an individual loan, but the valuation of a significant class of financial instruments. Because many participants in the marketplace rely upon the assessments of ratings agencies, this potentially could be a significant source of systemic risk relative to a situation in which the assessments were more independent.

Faced with losses during the 2007 turbulence, many hedge funds decided to reduce their overall exposures. Otherwise, the sensitivity of its value to future valuation movements would increase substantially due to reduced effective equity capital and greater implicit leverage. Often, this was not feasible to accomplish effectively in practice by selling those instruments that declined the most. Instead, these players were anxious to reduce their broad-based exposure and implemented this by selling relatively more liquid instruments, leading to substantial selling pressure and

price declines on the instruments being liquidated across portfolios. In effect, the problem in less liquid instruments spilled over to those whose value would otherwise have little reason to change. Many funds were forced to make analogous sales of their more liquid assets (again on the same side). The resulting valuation changes were reflected in the transmission of liquidity problems from the sub-prime market to other markets, such as traditionally collateralized jumbo loans, triggering a credit crunch.[19]

Yet another potential source of systemic risk is the regulatory response to multinational financial institutions during a crisis. While not advocating "bailouts", I consider the case of an institution where many of whose customers are in one country, but whose regulatory authority is in another.[20] Will that regulator pay for a bailout, most of whose benefits would be external? Who would pay? This example illustrates how globalization and issues of regulatory coordination can contribute to systemic risk.

To summarize, among the important factors contributing to systemic risk in our global marketplace are the incentive structures and common strategies followed by hedge funds, the lack of transparency in hedge fund valuation and the valuation of some of their underlying assets leading to substantial counterparty risk, the role of credit rating agencies in misassessing the valuation of an entire asset class (sub-prime mortgages and the related CDO structures) and regulatory coordination across countries. [Since the time of the Federal Reserve Bank of Chicago conference for which this paper was prepared, a variety of situations such as Bear Stearns, Fannie Mae and Freddie Mac, and short-term reset auctions, also have highlighted the important role of "maturity mismatch" between assets and liabilities in creating systemic risk.]

4. Regulatory Coordination and Competition[21]

Hedge funds are often multinational, exploiting strategies across markets and exchange rates. Many operate across platforms around the globe. Consequently, the nature of systemic risk reflects a strong international

[19] This ties back to limits to the arbitrage process and the temporary potential breakdown of it.

[20] This example was discussed earlier in the conference.

[21] This section of the paper builds upon Spatt (2007).

component, and the relevant regulatory actions would need to be taken by multiple regulators as the problem of systemic risk spills across markets in our global economy. This has been a key characteristic of the 2007 subprime mortgage turbulence.

In this section, I want to focus upon current challenges in the regulation of our capital markets, highlighting the nature of regulatory coordination and competition. This is a broad-ranging and important issue for securities and banking regulation, given the evolution of technology and the greater integration of the financial marketplace in our global economy. The turmoil during 2007 illustrates closely the extent of interaction among our national markets and consequently, has illustrated the importance of a coordinated regulatory response and why systemic risk is fundamentally intertwined. Of course, ordinarily, risk-sharing across countries is beneficial[22] as it reduces the international risk premium, but it simultaneously enhances systemic risk on a global basis.

The nature of our marketplace has changed substantially in recent years. As a result of both technological innovations and the greater advantages to specialized skills, the financial markets have become much more integrated, as illustrated by a number of recent exchange mergers and merger proposals. Recent regulatory implications of these trends have manifested themselves in such diverse forms as the interest in cross-border security exchange mergers and related regulatory consequences, the demutualization of a number of securities markets, the competition among self-regulatory organizations (SROs) and platforms, the importance of derivatives and the Internet, and the recent Securities and Exchange Commission (SEC) rule change broadening the conditions under which foreign issuers can delist from the United States markets and deregister themselves from the United States regulatory environment. But these contexts also raise fundamental issues about regulatory goals and the interaction among government regulators. After all, in the global environment, policy determinations can reflect the actions of multiple regulators and decision-makers, and the decisions of individual regulators lead to "external" effects on investors in other countries.

Regulatory coordination and competition raise important new challenges for regulators and the financial community. Both derivatives and the Internet point to a variety of inherent difficulties for regulation in this new era. We now often observe situations in which transactions of

[22] Global risk-sharing is less than complete, as reflected in the "home country bias".

differing forms need not have the same regulation, despite the substance of the transactions being similar. There are even new technical challenges to the regulatory environment. For example, to ensure that the specialist on the NYSE does not trade ahead of other traders and investors, there was an attempt to delay the specialist's trades by a fraction of a second to compensate for the shorter electronic path required for the specialist's execution. The appropriate offset is a difficult issue to scale appropriately and points to a new challenge in the current era.

Within the United States, the focus of regulation by the SEC is motivated by the goal of investor protection and promoting capital formation. However, even with a well-articulated objective, there is ambiguity about the appropriate policy as different policy-makers operationalize the objective in different manners. But the goals of all securities regulators around the world do not coincide for both cultural reasons and because of the diverse political settings in different countries.[23] Even within the United States, the focus of banking regulators on "safety and soundness" tends to be quite different than that of the SEC.

While the most basic textbook analysis of regulation in economics focuses upon situations associated with a single regulator, for a number of issues, competition or interaction among regulators is important.[24] A classic example of government policy with multiple jurisdictions is the competition among political jurisdictions in tax and spending policies. For example, in settings in which there are diverse preferences for public goods and services, economists have addressed the competitive aspects of provision of goods in models in which different jurisdictions compete by offering different levels of public goods and taxation with the size of the political jurisdictions adjusting to clear the market in what economists often term the "Tiebout equilibrium" (for example, see Tiebout, 1956). One of the benefits of decentralized policy-making and allowing for local provision of public goods is that this facilitates accommodating the diverse or heterogeneous preferences in the broader society. For example, different societies have varied perspectives on the costs to be incurred to protect unsophisticated investors.

[23] The importance of culture for defining business ethics is discussed in a recent paper by Statman (2006).

[24] Regulatory competition and the tradeoff between coordinated and decentralized regulation are examined in a banking context by Dell'Ariccia and Marquez (2006).

Regulatory competition can make it difficult to sustain a high level of regulation and manifest itself as a "race to the bottom", making it difficult to address some contexts that would benefit from strong regulatory intervention. To the extent that there are multiple competing jurisdictions, there could be a "race to the bottom" to attract activity and avoid substantial regulatory costs. Consequently, there may be difficulties in sustaining high regulatory standards, even when appropriate to do so. An illustration in a tax and spending context is the willingness of many United States localities to subsidize the building of sports arenas because of the competition from other jurisdictions. It is hard to articulate a plausible case for public provision of sports arenas absent the pressure from rival localities, which do not currently possess a franchise in the sport.

However, in other situations, regulation may be perceived as beneficial, which would be reflected in higher asset value in settings in which the asset is bundled with greater regulation, leading to a "race to the top". An example where strong regulation has broad support is the desirability of strong rules and actions against securities fraud. When regulation is desired by the market, there can be a "race to the top"; Tafara (2006) highlights some features of Sarbanes–Oxley that have been mimicked abroad.

Inherently, regulatory competition can lead to "regulatory arbitrage". The introduction of new regulations is often oriented to specific types of markets or investment agents. For example, suppose that cash markets are more heavily regulated than over-the-counter derivatives markets and that some types of market participants, such as mutual funds and broker/dealers, are more heavily regulated than others, such as hedge funds. The introduction of new regulations, if they are perceived as burdensome, can lead to the unintended consequence of transactions substituting towards the less regulated markets and toward investors who themselves are less heavily regulated. The form of transactions potentially responds to the system of regulation in place. Regulation itself may not be sustainable when it creates incentives for transactions to be organized in a manner to avoid the impact of the regulation. By channeling transactions to hedge funds, as in the above example, we reduce the transparency of risk-bearing, which itself can heighten systemic risk.

Along related lines, some US firms have argued in recent years that aspects of the current regulatory environment place them at a competitive disadvantage. For example, some US financial institutions have strongly criticized the Patriot Act, whose "know your customer" rules require financial institutions to proactively investigate the source and legitimacy

of customers and their funding rather than simply identifying for the government the specific transaction or party. Critics of these rules from the financial services industry suggest that they place US-based financial institutions at a competitive disadvantage, even relative to its many allies in the "war on terror". Part of the difficulty is that the ability to pass along the resulting costs to customers would be limited for customers in the global arena because the financial institution's global competitors do not face similar costs. Indeed, that suggests the importance of trying to define and negotiate these rules and obligations on a more global basis. For example, to the extent that these types of rules are useful, they should be promoted to a country's allies, and the unwillingness of other nations to adopt such standards could be relevant to their domestic evaluation.[25] One way to summarize the overall point is that the relevant domestic policy margins are impacted by the global economy.

An interesting issue for which multiple regulators are central is the appropriate form of accounting standards. There are obvious advantages to greater commonality and standardization to avoid duplication of cost, but yet there still may be some heterogeneity of regulatory objectives. For example, there are different perspectives as to whether US Generally Accepted Accounting Principles (GAAP) or International Financial Reporting Standards (IFRS) is a preferred accounting approach. The SEC has recently adopted a rule allowing foreign issuers to not reconcile IFRS accounting to US GAAP. But this raises the question of whether US domestic firms also should be allowed to file in IFRS, about which the SEC may move forward. More broadly, should firms be allowed to choose their accounting system? How much discretion in accounting standards is too much and to what degree would discretion lead to adverse selection?[26]

There also has been extensive discussion recently about the Sarbanes–Oxley framework, especially the certification of material weaknesses required under its Section 404, including whether that places the US at a competitive disadvantage. Critics of Sarbanes–Oxley have noted the movement of initial offerings to other parts of the world and have suggested that the costs of the US regulatory structure are at the core. Of course, it's plausible that if the United States regulatory framework placed the US at a disadvantage, that global firms would respond by instead

[25] This comment may reflect an unrealistic perspective about the potential for cooperation. The history of the Corrupt Foreign Practices Act is a relevant case in point.

[26] Arguably, reconciliation itself acts as a control.

listing in other markets. The issue is not simply one of comparable cost, but of net benefits: which regulatory arrangement do investors value the most net of the costs? The listing decision is a crucial margin for firms to respond to the differences in regulatory regimes across jurisdictions. Of course, changes in listing behavior can relate to other causes as well, such as the high IPO fees in the United States, greater integration and liquidity of the European markets in recent years and cultural causes related to the origin of the firm. Consequently, changes in listing decisions by European and global companies can reflect a number of considerations, besides the regulatory costs of the US structure.

The foreign issuer deregistration context indirectly raises the issue of the goals and objectives of the regulator. This is especially germane in situations when multiple regulators are potentially relevant, as in the case of foreign issuers. It seems reasonable to suspect that the goals of different regulators could diverge because of differences in objective and philosophy. The recent SEC action to broaden the set of foreign firms that could deregister from the United States and its regulatory regime reflects some of the related tensions. The motivation for this proposal should be viewed in terms of the interests of United States investors as the mission of the SEC is defined in relevant part in terms of the best interests of these investors. Allowing greater departures from the United States regulatory system in the long run may increase the *ex ante* willingness of firms to subject themselves to these regulations, which may lead to benefits in terms of protection of US investors and reductions in net costs by the firms' that choose to exit. Cross-listing in the United States affects foreign investors due to spillovers of both benefits and costs from the US investor protection regime.

The Sarbanes–Oxley framework appears to be unfavorably regarded overseas. At the heart of the issue could be differential assessments among countries of the benefits and costs and the underlying goals of regulation. There even was considerable public discussion of the merger of the New York Stock Exchange and Euronext in the context of the Sarbanes–Oxley framework. European regulators and European-listed firms publicly sought assurance that the merger would not by definition scope European firms within the United States regulatory framework. From an exchange perspective, the trans-Atlantic merger also highlights the nature of the impediments to international access to securities trading, such as the ban on general solicitation of nonregistered securities and foreign trading screens in the United States, the lack of developed

clearance and settlement mechanisms in at least some markets and differences in the regulatory environment for security trading. The international barriers to investment are arguably declining faster than the regulatory barriers. For example, intermediaries may wish to trade international products to compete — which would limit the degree of regulatory competition.

In economic theory, regulation often is motivated by attempts to internalize the effects of externalities or to limit the exercise of monopoly power. As an example, consider the case of specialists on the floor of the New York Stock Exchange, who traditionally have had both special rights and responsibilities in the trading process. In the hybrid design that the New York Stock Exchange has implemented, there were major changes to the role of the specialist and the fundamental character of the platform as there was an effort to integrate a fully electronic system with the trading floor. The design changes have emerged as a by-product of the exchange customer's demands, the exchange's demutualization and the dramatic changes to its ownership structure and governance, the evolution of technology and regulatory pressures. Historically, the motivation for regulation of the behavior of the specialist reflects an attempt to limit the scope of the residual market power that they possess. As a result of demutualization, exchanges are more oriented toward enhancing the value of their platforms rather than the profitability of individual trading market professionals. There is at least some advantage to differentiating the platform's products. The optimal regulation would be tailored to the precise form of the trading mechanism, the nature of the market power possessed by the specialist and the goals of the platforms. More broadly, while regulation can be very useful to ensure that market power is not excessively exploited, the appropriate regulatory approach should be guided by the specific context.

The exchange merger context raises broad issues about what does an exchange merger mean? What types of synergies can be exploited under various regulatory structures? Ultimately, scale economies play a key role in fueling exchange mergers. Are these confined to technology and know-how? Could these extend to the clearance mechanism or even to reciprocal access? How do the markets plan to evolve? Should (and if so, how should) regulators innovate in response?

In concluding the discussion of regulatory competition and coordination, I should emphasize that the globalization and integration of our markets and new ownership and market structures pose important challenges to regulators about the objectives and underpinnings of regulation and the

constraints that individual regulators face. Reflection about the nature of our regulatory framework and its application to new contexts suggest important issues facing both regulators and academics. For example, from an academic perspective, models of local public goods may help shed new light on the nature of regulatory competition and regulatory arbitrage. Focusing upon the specific underlying frictions and constraints also may help identify ways to enhance regulatory coordination and strengthen regulatory practices.

To the extent that systemic risk is now a global phenomenon, it is important to understand regulator competition and coordination within a global context as the action of regulators globally will influence the nature of systemic risk. The 2007 sub-prime turmoil illustrates that systemic risks are not restricted to individual countries.

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What Can Central Bankers Learn from Hedge Fund Replication Strategies?

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1. Introduction

Systemic risk has always been a major concern of bank regulators. Until the Long-Term Capital Management debacle in the fall of 1998, bank regulators had not been overly concerned with systemic risk stemming from hedge funds (see Eichengreen *et al*., 1998). With the recent rapid growth of the hedge fund industry, regulators are now growing weary of the possibility that hedge funds may cause systemic risk. One potential scenario is a "bank run" type of stampede towards an exit, resulting from too many players converging on the same trade, then trying to unwind their positions at the same time. When markets are suddenly dislocated, traders can suffer large losses, taking down with them other traders, prime brokers and counterparties who trade with them. The cascade can spread across the banking industry.

Without direct authority to regulate hedge funds, it is difficult for regulators to monitor their activities to check for such "convergence" in bets. Even if regulators can see every position of every hedge fund, it is not obvious that they can discover a dangerous "convergence" in bets. Take, for example, the case of Long-Term Capital Management (LTCM). In 1998, this $5 billion hedge fund allegedly controlled over $1 trillion of notional amount in off-balance-sheet derivative transactions, along with $200 billion of on-balance-sheet assets and liabilities. Even if regulators had access to all these transactions, it would be quite a challenge to uncover the major source of risk in LTCM. Furthermore, even if authorities were

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able to infer the risk of each hedge fund, they still face the difficult task of aggregating these risks.

This paper illustrates an alternative approach to detect "convergence" risks in hedge funds, in terms of asset-based risk factors used in "hedge fund replication strategies". As noted in Fung and Hsieh (1997), hedge funds employ strategies that can be quite different from the typical long-only, buy-and-hold strategies of traditional mutual funds. Thus, standard asset class benchmarks could not adequately capture the risks in hedge funds. More dynamic benchmarks, involving long-short positions, possibly with time-varying exposure, are needed. Furthermore, hedge fund strategies are quite heterogeneous, which means that different replication strategies are needed. Below is a partial list of replication strategies.

Fung and Hsieh (2001) showed that options can be used to replicate trend-following strategies used by commodity trading advisors and managed futures funds. Mitchell and Pulvino (2001) replicated the merger arbitrage strategy, by purchasing shares of target firms and short shares of acquiring firms, after the announcement of an acquisition. Agarwal and Naik (2004) used index options to model the return of equity hedge funds. Duarte *et al*. (2005) studied fixed income strategies of hedge funds. Agarwal *et al*. (2006) showed that a strategy of buying newly issued convertible bonds while hedging out interest rate and bankruptcy risk closely replicated the returns of convertible arbitrage hedge funds. Fung and Hsieh (2004) demonstrated that seven factors, selected from the previously cited research, can explain the returns of the average hedge fund and the average fund-of-hedge funds. Fung and Hsieh (2006b) added an eighth factor — an emerging market index — to model the dynamical exposures of a typical Global/Macro hedge fund.

This paper is a pilot study to show how to use the 8-factor model in Fung and Hsieh (2006b) to estimate and aggregate the exposure of large hedge funds. The specific question we ask is: do large hedge funds have exposure to the sub-prime/low credit/high-yield market, and how has that changed in the fall of 2007, when the sub-prime mortgages came apart? The paper proceeds in five sections. Section 2 discusses the sample of large hedge funds. Section 3 gives more details of the 8-factor model. Section 4 estimates the exposure of large hedge funds using monthly returns. Section 5 provides sharper estimates using daily hedge fund returns. Section 6 offers some conclusions.

2. The Sample of Large Hedge Funds

We use two databases — Lipper TASS (TASS) and Hedge Fund Research (HFR). At the end of 2006, TASS contained 1,952 funds with $415 billion of assets under management (AUM), while HFR contained 3,956 funds with $715 billion of AUM. From each database, we identified the funds that have AUM exceeding $1 billion at the end of 2006.[1] We found a total of 219 such funds. There were 61 funds common to both TASS and HFR. To avoid double-counting, we removed the duplicate. We also deleted 17 funds that did not report their returns in the US dollar, to avoid currency effects in our data. Lastly, we omitted 7 funds that reported their returns gross of management fees. This gave us a sample of 134 funds, with $281 billion of AUM.

2.1 *Style distribution of large funds*

Table 1 provides a style breakdown of the 134 large funds. There are 12 styles. The largest styles are Equity Hedge & Long/Short Equity,

Table 1. Style distribution of large funds

Style	No. of Funds	% of Total
Convertible Arbitrage	2	1
Distressed Securities	2	1
Emerging Market	16	12
Equity Hedge & Long/Short Equity	34	25
Equity Market Neutral	4	3
Event-Driven	27	20
Fixed Income	9	7
Global/Macro	12	9
Managed Futures	13	10
Merger Arbitrage	1	1
Multi-Strategy	9	7
Relative Value Arbitrage	5	4

[1] If the AUM is missing in December 2006, we use the average of the highest and lowest AUM during 2006 to proxy the AUM in December 2006.

accounting for a quarter of the large funds, Event-Driven (20 percent), Emerging Market (12 percent), and Managed Futures (10 percent).

2.2 *Principal component analysis*

Fung and Hsieh (1997) used principal component analysis to provide a gauge for the number of trading strategies employed by a group of funds. The idea is quite intuitive. If two funds use the same trading strategy, their returns should be correlated. Principal component is a quantitative way to measure how many different trading strategies there are in a group of funds. Fung and Hsieh (1997) found substantial heterogeneity in hedge fund returns — the first five principal components explained less than 45 percent of the cross-sectional variation of hedge fund.[2]

Interestingly, Table 2 indicates that the first principal component from our sample of 134 large hedge funds explains more than 35 percent of the cross-sectional variation. This indicates that the large hedge funds exhibit considerably less heterogeneity than the general population of hedge funds. There can be a number of potential explanations for this phenomenon. Perhaps hedge fund strategies have decreasing returns to scale — as a fund grows, it finds less and less attractive opportunities in its primary strategy. Perhaps fund managers want to diversify their income exposure across multiple strategies, as they become more and more successful. A third possibility is that hedge funds have become more correlated with each other over time — the principal component analysis for all hedge funds using current data would give quite different results than the one in Fung and Hsieh (1997).[3]

Whatever the reason, the data suggest that large hedge funds have substantial correlation to each other, indicating that they are more like "multi-strategy" funds than single-strategy funds. This has potential implications for regulators. If large hedge funds tend to "do the same trade", then the prospect of "convergence" in bets (and the consequence of "stampeding towards the exits") must be taken seriously.

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[2] The first five components in Fung and Hsieh (1997) explained 11.87 percent, 10.00 percent, 9.42 percent, 6.35 percent, and 4.93 percent, respectively, of the cross-sectional variation in hedge funds.

[3] Such an undertaking is beyond the scope of the current pilot study.

Table 2. Principal component analysis: Percent of cross-sectional variation explained by the first five components

Start End	200401 200512	200404 200603	200407 200606	200410 200609	200501 200612	200504 200703	200506 200705
No. of Funds	119	120	122	123	128	127	123
PC1	38%	40%	39%	39%	38%	36%	35%
PC2	9%	9%	8%	8%	8%	9%	9%
PC3	6%	7%	8%	7%	7%	7%	8%
PC4	6%	6%	6%	6%	6%	6%	6%
PC5	5%	5%	5%	5%	5%	4%	5%

3. A Simple 8-Factor Model of Hedge Fund Risk

Given that hedge funds do not disclose their trades, it is difficult to measure the degree of "convergence" in bets directly. An indirect measure of "convergence" in bets can be obtained using the exposure to market risk factors. In this pilot study, we use the 8-factor model in Fung and Hsieh (2006b) to dynamically estimate the risk factors of Global/Macro hedge funds. This consists of the seven factors in Fung and Hsieh (2004) and Fung *et al*. (2008), plus an emerging market factor, which began to show its importance in 2005. These hedge fund "replication" strategies have been discussed in Fung and Hsieh (2006b, 2007). We shall present a brief review here.

3.1 *Equity factors*

In this paper, we use the excess return of the S&P 500, and the difference between the returns of the Russell 2000 and the S&P 500, to represent the main risk factors in long/short equity hedge funds. Fung and Hsieh (2006a) showed these two factors can explain over 80 percent of the return variation in the typical equity hedge fund. This is confirmed in Figure 1. Equity hedge funds are the most popular style of hedge funds. Folklore has it that the first hedge fund was formed by A.W. Jones, employing long and short positions in equities. Nowadays, equity hedge funds are roughly 40 percent of the hedge fund industry, according to

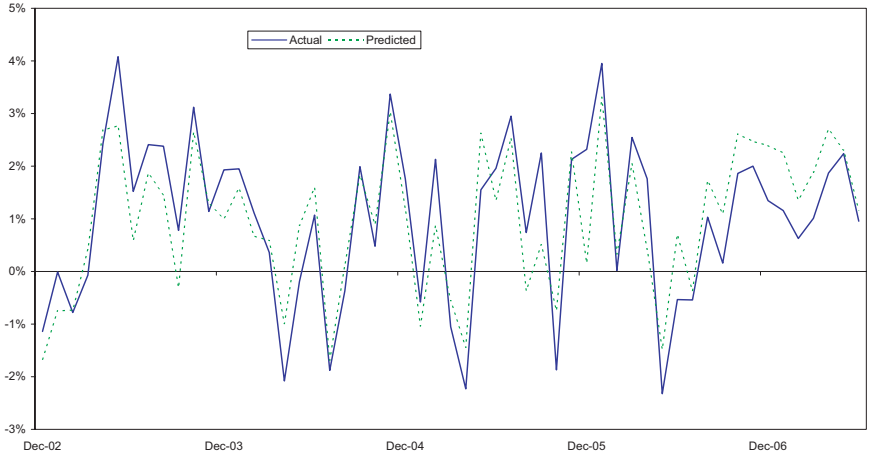

Figure 1. HFRI equity hedge: Actual and predicted

industry analysis in Tremont Capital Management (2006). They comprise a quarter of the large funds in our sample.

3.2 *Bond factors*

We use the excess return on 10-year treasuries, and the difference between the returns of high-yield bonds and 10-year treasuries, to represent the risk factors in fixed income hedge funds.

Fung and Hsieh (2002) and Duarte *et al*. (2005) examined the risk of fixed income hedge funds. They found that fixed income hedge funds are exposed to movements in the general interest rate (typically represented by the change in the 10-year or 30-year bond yield) and a spread between two interest rates, such as corporate–treasury, mortgage–treasury, swap–treasury, or long-term–short-term rates. Since spreads in interest rates tend to be correlated, Fung and Hsieh (2002) used the change in the spread between Moody's Baa rated bonds and the 10-year treasury can explain the returns of fixed income hedge funds. Here, in Figure 2, we use the spread between high-yield bonds and treasuries, since Fung and Hsieh (2006b) show that high-yield bonds are correlated with the returns of event-driven hedge funds, which account for 20 percent of the large funds in our sample.

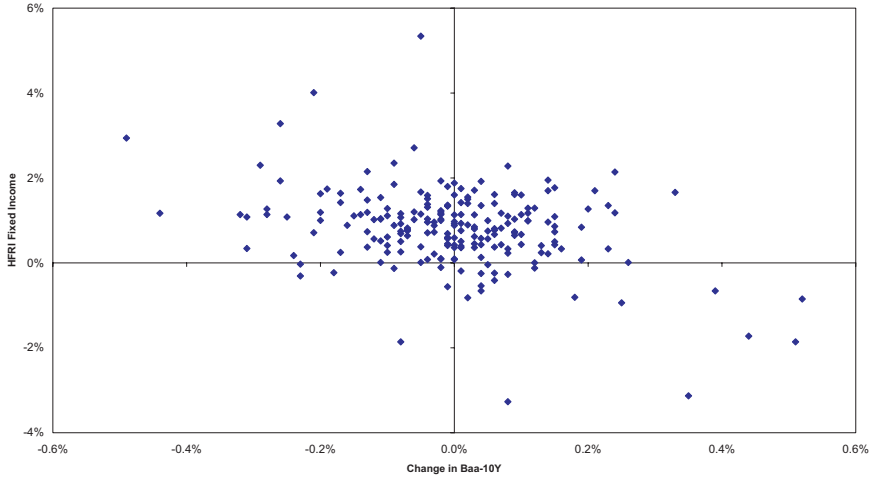

Figure 2. HFRI fixed income and change in credit spread

3.3 *Trend-following factors*

We construct the returns of three portfolios of options (bond options, currency options, and commodity options) to mimic the trading strategy of trend followers.

Fung and Hsieh (2001) followed the argument in Goldman *et al*. (1979), using exchange-traded standard options to replicate the payoff of "lookback" options. A lookback option is a path-dependent option. A lookback call (put) grants the owner the right to purchase (sell) an asset at the lowest price during the life of the option. A lookback straddle, consisting of a lookback call and a lookback put, allows the owner to "buy at the low and sell at the high". Fung and Hsieh (2001) showed that this replication strategy mimics the return of trend followers, about 10 percent of the large funds in our sample. Figure 3 provides an out-of-sample confirmation of this analysis.

3.4 *Emerging market factors*

We include the MSCI Emerging Market Index as the eighth risk factor. Fung and Hsieh (2006b) showed that the returns of emerging market hedge funds (which comprises 12 percent of our large fund sample) are strongly correlated to returns of emerging market stocks, as shown in Figure 4.

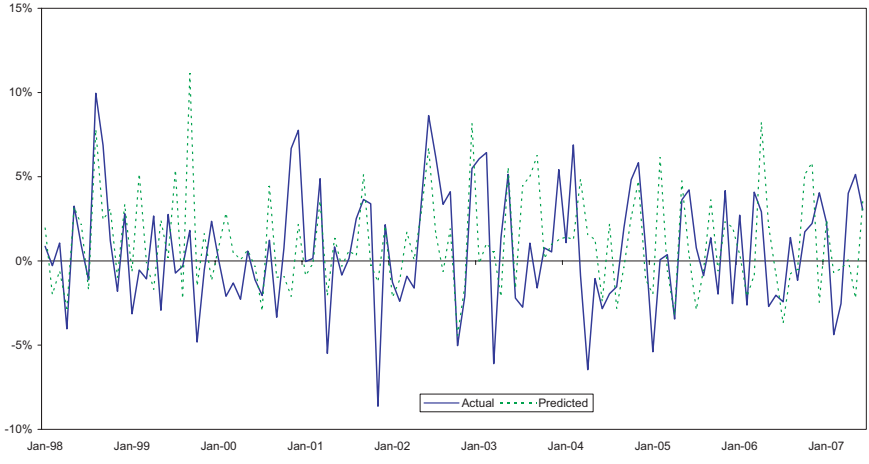

Figure 3. CS/T managed futures: Actual and predicted

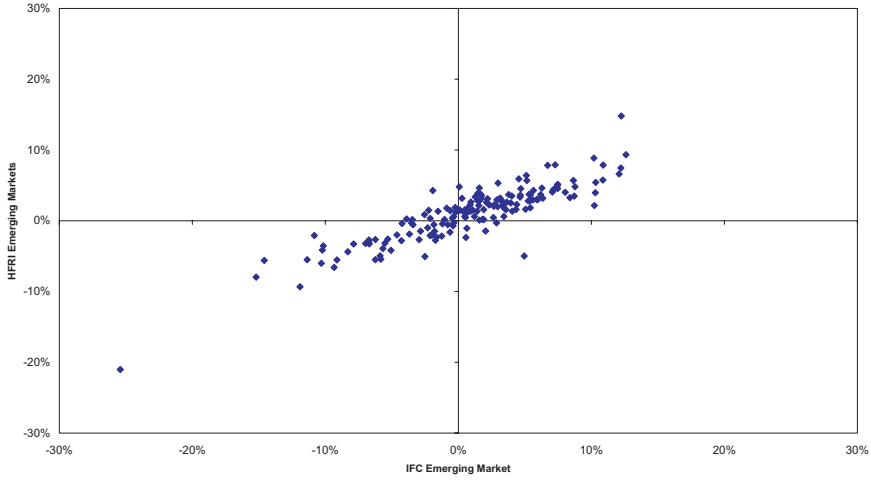

Figure 4. HFRI emerging markets and IFC

4. Exposures of Large Hedge Funds Using Monthly Returns

We first estimate the exposure of each large fund, by regressing the fund's excess returns on the eight risk factors, using the 24 monthly observations from January 2005 until December 2006. The results are presented in

Table 3. Panel A contains the distribution of net exposures. Panel B contains the distribution of the *t*-statistics, based on the Newey–West (1987) covariance estimator with three lags.

The last row in each panel contains the regression results for the average large fund. It indicates that the eight risk factors explain over 90 percent of the return variation in the average large fund. As of December 2006, the statistically most significant exposure is to emerging market stocks. In addition, there is also strong positive exposure to the spread between small cap versus large cap stocks, and a net short position on the S&P 500.

Figure 5 graphs the rolling 24-month estimates of the net exposure to stocks and bonds, from December 2005 until June 2007. "EW" denotes the equally-weighted average of large fund returns, while "VW" denotes the value-weighted average (using the 2006 AUM). For large funds, there is little difference between the two weighting schemes. The net exposure to stocks is relatively stable over time, but the net exposure to bonds varies quite a bit, switching from net short to net long in May and June 2007. Figure 6 graphs the rolling 24-month estimates of the net exposure to the three spread, small-versus-large cap stocks, emerging market-versus-large cap stocks, and high yield-versus-treasury bonds. While exposure to emerging markets has been relatively stable, small cap exposure declined in 2007, and credit exposure increased substantially in the second quarter of 2007.

At this aggregate level, it is impossible to know if hedge funds increased their credit exposure through the sub-prime mortgage market, or through other types of credit instruments.[4] However, this evidence is consistent with the hypothesis that large hedge funds may be supplying liquidity to other investors who are getting out of credit risk.

The net exposures vary quite a bit across funds. Figures 7 and 8 contain the net exposure of the largest fund, while Figures 9 and 10 show the net exposure of the fourth largest fund. Both these funds are classified as "long/short equity funds", yet their exposures are quite different.

4.1 *The effects of serial correlation in hedge fund returns*

The estimate of net exposure can be affected by the autocorrelation of fund returns, as shown in Asness *et al*. (2001). To investigate this

[4] One possibility is for regulators to survey prime brokers on aggregate hedge fund exposures to credit spreads.

Table 3. Individual fund regression on eight factors: 2005–2006

	Coefficients									
Percentile	**Constant**	**SNPMRF**	**RUTMSNP**	**10YMRF**	**HYMTSY**	**PTFSBD**	**PTFSFX**	**PTFSCOM**	**MSCIEM**	**Adj R^2**
0.90	0.0125	0.3048	0.5420	0.2352	0.4932	0.0730	0.0166	0.0370	0.6030	0.73
0.75	0.0081	0.0950	0.2950	0.0655	0.2280	0.0325	0.0055	0.0150	0.2995	0.60
0.50	0.0046	–0.0410	0.1290	–0.0810	0.0480	0.0070	-0.0040	0.0010	0.1100	0.39
0.25	0.0018	–0.2190	0.0125	–0.2670	–0.3030	–0.0120	–0.0140	–0.0085	0.0190	0.13
0.10	–0.0014	–0.5750	–0.0644	–0.6156	–0.7974	–0.0290	–0.0270	–0.0270	–0.0286	–0.06
Fund Avg.	0.0055	–0.0799	0.1826	–0.1621	–0.1172	0.0191	–0.0063	0.0006	0.2306	0.91

	t-statistics									
Percentile	**Constant**	**SNPMRF**	**RUTMSNP**	**10YMRF**	**HYMTSY**	**PTFSBD**	**PTFSFX**	**PTFSCOM**	**MSCIEM**	**D.W.**
0.90	3.97	1.46	3.47	1.76	2.13	2.16	1.21	2.50	8.38	2.35
0.75	2.92	0.54	2.45	0.56	1.25	1.20	0.56	1.56	4.30	2.12
0.50	1.54	–0.41	1.38	–0.58	0.27	0.42	–0.36	0.14	1.83	1.79
0.25	0.41	–1.53	0.26	–1.35	–1.11	–0.60	–1.16	–0.95	0.50	1.55
0.10	–0.51	–3.53	–1.11	–2.72	–2.04	–1.53	–2.28	–1.96	–0.42	1.22
Fund Avg.	7.05	–1.95	7.16	–2.04	–1.01	3.51	–1.89	0.28	12.73	2.49

Notes: *t*-statistics are based on Newey–West (1987) standard errors with 3 lags. The "fund average" is an equally-weighted average of funds.

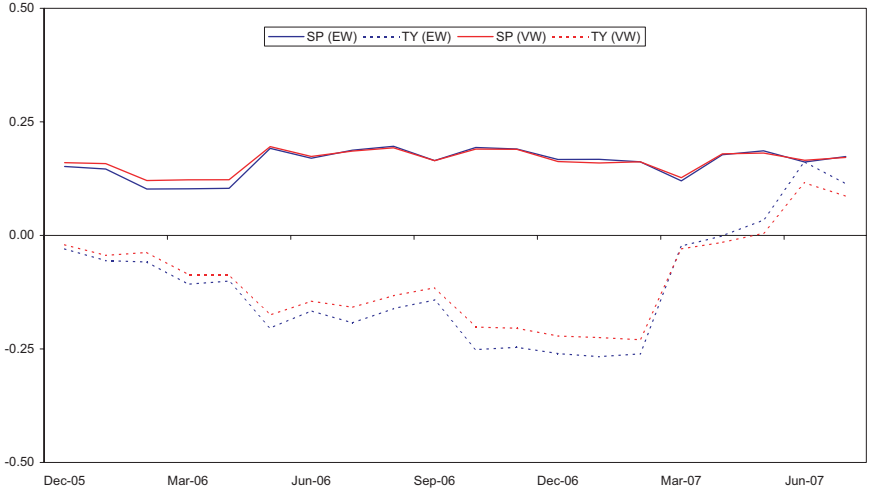

Figure 5. Net directional exposure of the average large funds

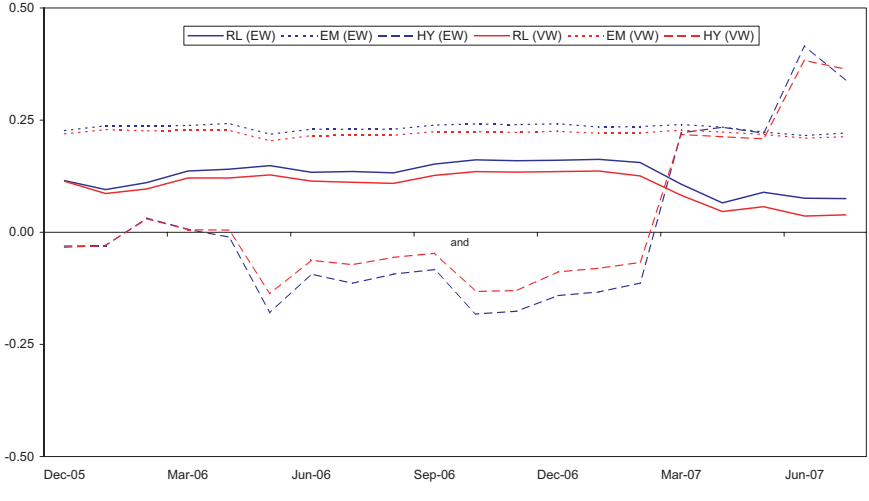

Figure 6. Net spread exposure of the average large funds

possibility, we divided our sample into two groups. The "high autocorrelation" group consists of 52 funds whose first order serial correlation is statistically significant at the 25 percent level. The "low autocorrelation" group consists of the other 82 funds. Figure 11 graphs the net

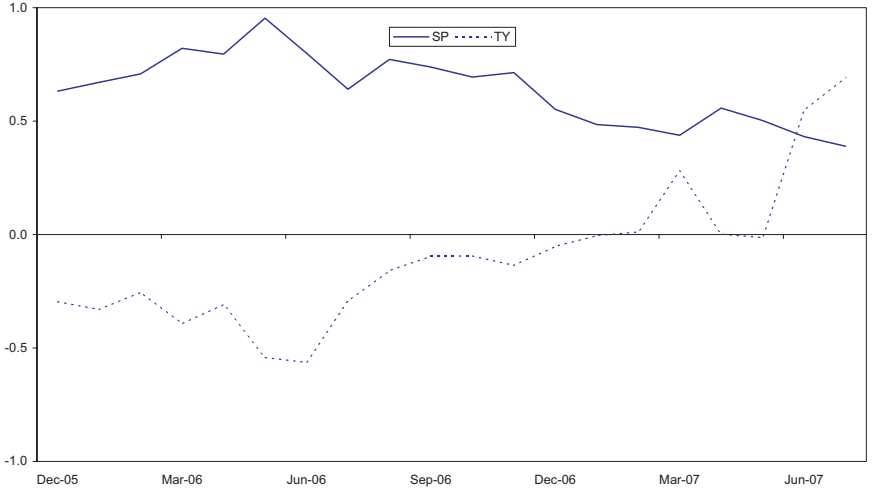

Figure 7. Net directional exposure of the largest fund

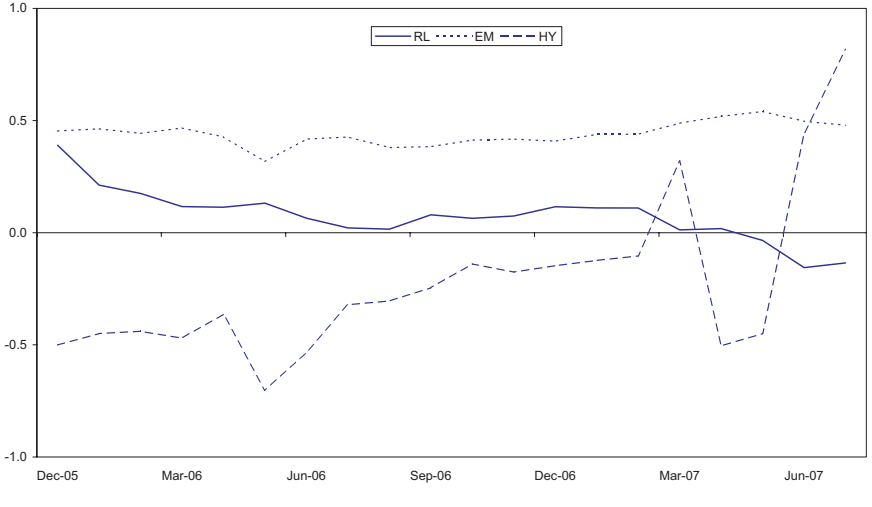

Figure 8. Net spread exposure of the largest fund

exposure to credit spread of the two groups. Both groups have increased their exposure to credit spread, although the high correlation group has increased their exposure more than the low correlation group.

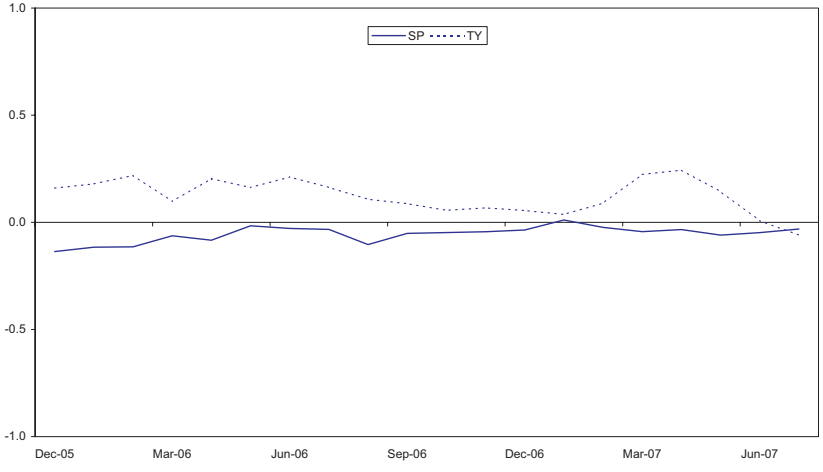

Figure 9. Net directional exposure of the fourth largest fund

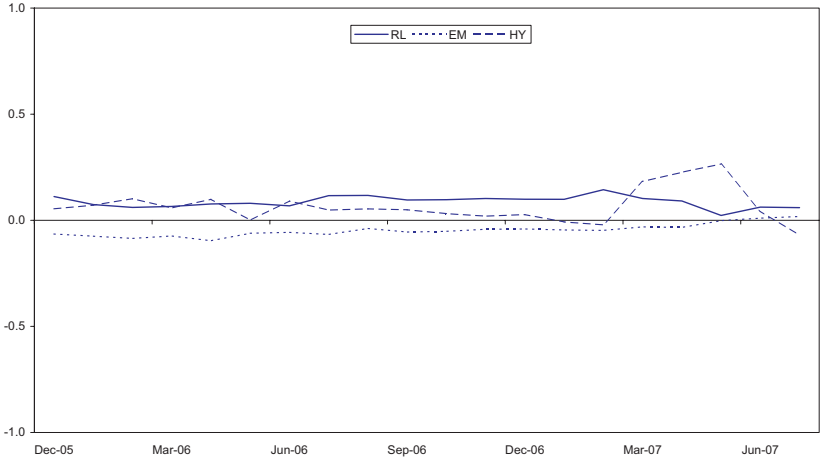

Figure 10. Net spread exposure of the fourth largest fund

4.2 *Exposure of average hedge funds*

The average hedge fund exposure to credit spread can be measured using standard hedge fund indices, such as HFRI (constructed by HFR) and CTI (constructed by CSFB/Tremont). Figure 12 shows that these exposures have also increased in 2007, peaking in June.

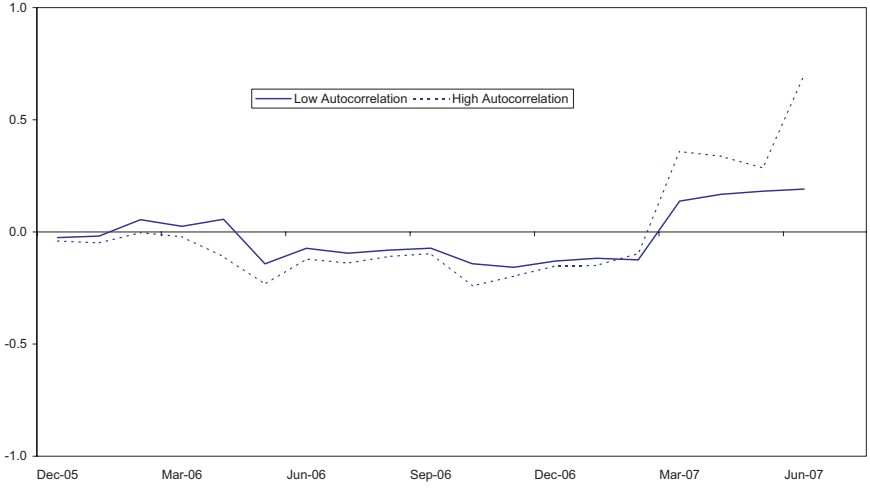

Figure 11. Net credit exposure of low vs. high autocorrelated funds

Figure 12. Net credit spread exposure of hedge funds

5. Corroboration of Exposures Using Daily Investible Indices

Estimating net exposures using rolling 24-month regressions means that there are many overlapping observations, so the estimates are not truly independent over time. Here, we use daily hedge fund indices to corroborate our findings.

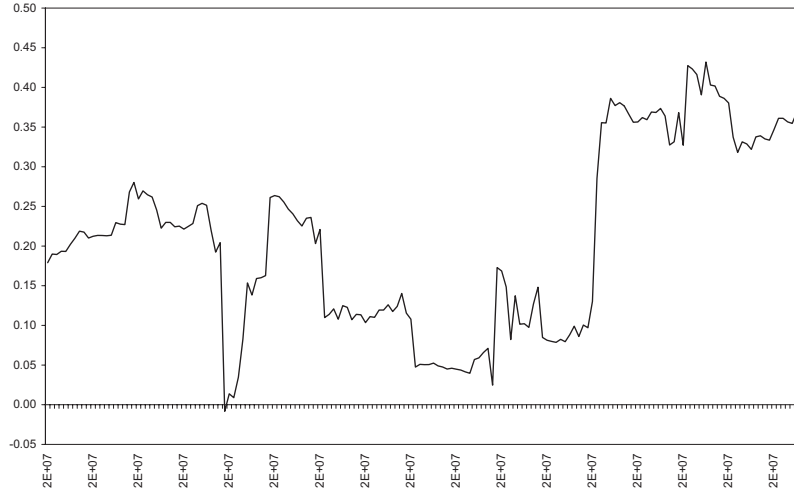

Figure 13. HFRXGL index net exposure to credit

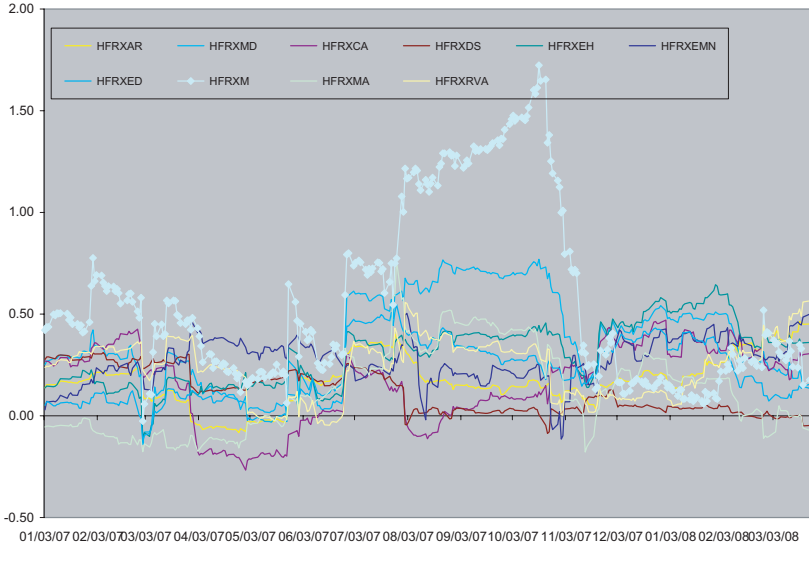

Figure 14. HFRX strategy indices net exposure to credit

We use daily returns of the HFRX Investible Indices, from January 2007 until August 2007. We use rolling 60-day regressions, from the start of 2007 until August 31. As shown in Figure 13, the exposure of the average hedge fund to the credit (high yield-versus-treasury) component

jumped upwards at the end of June. Figure 14 graphs the exposures by strategy. The HFRX Global/Macro index has very high exposure, moving above 1.00 in early August. The daily exposures are consistent with the monthly exposures.

6. Conclusion

In this pilot study, I demonstrate that risk factors in hedge fund replication strategies can be used to estimate exposures of hedge funds. Large hedge funds, in particular, and hedge funds in general, have increased their net exposure to credit spreads in the second quarter of 2007. This is consistent with the view that there is a convergence of bets in credit risk.

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Comments on Session VI: Globalization and Systemic Risk — Capital Markets

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These are three very good papers dealing with different aspects of the relationship between capital market depth and systemic risk. For the purpose of these comments, I will focus on one issue that is common to the three papers: do hedge funds contribute to an increase or decrease in systemic risk? What was their role in the financial turmoil of the summer of 2007?

Throughout my comments, I will raise some important differences in views and conclusions between the papers and will advance my own views on the issue at hand.

Let me start with David Hsieh's paper, which continues the excellent work that he and William Fung started more than a decade ago. In their earlier work, Fung and Hsieh (1997)[1] found that: (1) strategies followed by hedge funds are dramatically different from mutual funds, and (2) hedge funds strategies are highly dynamic. They also found that the use of dynamic trading strategies by hedge funds allows investors to have their risk preferences better represented in the portfolio composition of hedge funds (including cases when investors have high aversion to negative returns). Reflecting different investors' preferences, dynamic trading strategies between hedge funds also differ.

These benefits, however, do not come without risks. As the authors point out, "an important element of risk is that, periodically, the portfolio can become overly concentrated in a small number of markets" (Fung and Hsieh, 1997, p. 300). The authors argue that if a steady upward trend were to develop in one of the markets, there is the possibility that the portfolio

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[1] Fung, W. and D. Hsieh (1997). Empirical characteristics of dynamic trading strategies: The case of hedge funds. *Review of Financial Studies*, 10(2), 275–302.

of hedge funds could converge, in spite of the funds following diverse dynamic trading strategies, and become concentrated in the market where the trend developed. Thus, even though style exposures of hedge funds are diverse, market exposures can converge. If the prices suddenly fall in the market where concentration occurs, hedge funds could incur large losses. The authors named this phenomenon "diversification implosion" and call on investors to increase efforts to avoid such situations (which basically imply exposure to extreme events). These efforts include improved due diligence, portfolio construction and risk monitoring.

An important adverse consequence of convergence of trades among hedge funds is that it can result in increased systemic risk. This results because, facing trade losses, too many hedge funds might attempt to unwind their positions simultaneously. This will impact other traders and hedge funds counterparties.

In a more recent paper, Fung and Hsieh (2007)[2] argued that a potential way to avoid "herding behavior" and, therefore, convergence of hedge funds portfolios and its adverse impact on systemic risk, is the development of hedge funds replication strategies, which have been able to capture up to 80 percent of the average return of many hedge fund strategies. By being rule-based, hedge fund replication strategies are transparent and can be implemented at low cost. Thus, these replication strategies provide a benchmark return against which the skills of hedge fund managers can be measured. Investors will be willing to pay high fees only to those hedge fund managers able to produce significantly higher returns than those produced with a passive replication strategy. The use of these benchmarks might limit entry of hedge funds in the market and discourage herd behavior (free-rider problems) since investors have an instrument to distinguish among managers according to performance.

In the paper in this volume, Hsieh uses a group of eight risk factors utilized in hedge fund replication strategies to estimate the exposure of large hedge funds. The main finding is that, at the aggregate level, large hedge funds increased their credit exposure in the second quarter of 2007. Although the authors cannot conclude whether the increase in credit exposure took place through the sub-prime mortgage market specifically, the evidence indicates that hedge funds may have been supplying liquidity to

[2] Fung, W. and D. Hsieh (2007). Hedge funds replication strategies: Implications for investors and regulators. *Banque de France Financial Stability Review* — Special Issue on Hedge Funds, No. 10, April.

investors getting out of credit risk. Moreover, this result holds for all types of hedge funds, showing convergence in bets.

The author's proposed methodology to "track" hedge fund exposures is quite innovative and powerful. Leaving aside some necessary improvements in the paper's statistical analysis, Hsieh's work provides a very useful tool for policy-makers who cannot directly see through the exposures of hedge funds.

I have a comment, however. In my view, it is not possible to ignore the, at least apparent, contradiction between the results in this paper — the presence of convergence of hedge funds bets in credit risks in 2007, and the conclusion from the author's previous papers, namely that the development of replication strategies has the potential to act as a deterrent for convergence. I call this the "Hsieh's Puzzle".

Why, in spite of sound theoretical arguments, have replication strategies not prevented herd behavior? Rather than acting as a tool to discriminate against weak fund managers, could it be that the relatively cheaper replication strategies simply attracted more investors into the game, exacerbating, rather than reducing, the potential for herd behavior?

Does the above result mean that investors are not willing to undertake appropriate due diligence and more careful risk monitoring of hedge funds activities? Where does the incentive structure fail? I will advance a possible response to these questions later on.

Next, consider the paper by Bargeron, Lehn and Yalin. The authors studied the behavior of alternative measures of risk (including the volatility of equity returns) to assess the evolution of systemic risk. They derived three main conclusions: (1) systemic risk in the US and other major countries has decreased in the past years and this is concurrent with the dramatic growth in hedge funds; (2) the decline in systemic risk applies to broad-based market indexes and indexes of large commercial and investment banks; and (3) the increase in observed volatility of equity returns during July–August 2007 was substantially less than the corresponding increase during the LTCM crisis of 1998.

While I enjoyed the systemic risk analysis in the paper, I have two observations. First, in my view, it is still too early to conclude that the subprime crisis can be characterized by events confined to the authors' period of analysis. There is no certainty that the financial turmoil is over yet (a point emphasized by other presenters in this volume). Thus, I would recommend that the authors repeat their exercise some months from now to check the robustness of their results.

Second, and most importantly, nothing in the paper allows concluding that the decline in volatility in equity returns can be associated with increased activity of hedge funds. Although the authors certainly do not explicitly claim a form of causality, implicitly the reader is led in that direction. I would like to argue that both the decline in volatility and the growth of hedge funds can be endogenous outcomes resulting from policy actions not considered in the paper.[3] For example, some would argue that excess liquidity, associated with low interest rate policies in the industrialized world, lies at the core of causality.

Indeed, if we believe the results in Hsieh's paper, hedge funds contributed to systemic risk in the second quarter of 2007; just before the increase in volatility in equity returns detected by Bargeron *et al*.

Contrary to Bargeron *et al*., the paper by Chester Spatt argues that hedge funds activities increased systemic risk in the summer of 2007. Spatt's explanation is that, facing losses in 2007, hedge funds reduced their overall exposures. As the "troubled" instruments became illiquid, hedge funds sold liquid instruments that led to "contagion" to other markets, such as the collateralized jumbo loans.

While I agree with this explanation, I think that this form of initiating contagion can be found in the reactions of many types of market participants to financial losses during a crisis and, therefore, cannot be attributed particularly to hedge funds. For example, a similar form of contagion took place during the Russian crisis. Facing losses as a result of the crisis, investors attempted to reduce their exposure on Russian paper. As the market for Russian bonds became illiquid, investors sold sovereign bonds from other liquid emerging markets, including Mexico and Brazil. In that episode, hedge funds participated in the sell-off of emerging market assets, but so did a wide variety of investors including banks, investment banks, mutual funds and pension funds.

Thus, what have we learned from the papers? Where do we stand? Do hedge funds increase or decrease systemic risk?

Clearly, much more empirical work is needed to reach definite conclusions, but two factors seem certain: the first is that hedge funds have the *potential* to reduce systemic risk through risk diffusion. The second is that, like all other financial agents, hedge funds respond to incentives created by the environment where they operate, particularly policy and regulatory incentives.

[3] This would suggest the presence of model misspecification in the paper.

In this context, the role of policy-makers is not to arbitrarily regulate hedge funds and deprive financial systems from the potential stabilizing role of these market players. The true challenge is to identify and remove distortions that prevent financial systems from reaping the benefits of hedge fund activities.

The sub-prime crisis that started in 2007 provides a critical lesson about the problems created by inadequate regulation: regulators and current regulations allowed banks to supply new credit instruments to investors (including hedge funds) without ensuring that risks were appropriately assessed. In particular, the pervasive role of allowing banks to outsource risk assessments to credit rating agencies cannot be overemphasized (a point also raised in Spatt's paper). The slow and inadequate response of credit rating agencies has exacerbated crises in emerging markets in the past. That lesson remains to be learned in the sophisticated financial markets of industrial countries.

Why should hedge funds remain among unregulated institutions? Let me cite Callum McCarthy in a paper stating the UK Financial Services Authority opposition to a general requirement for hedge funds to disclose their positions: "[Requiring disclosure would] encourage investors and commentators to believe that some security is being achieved when none is."[4]

By regulating an institution, regulators convey a message of relative safety (or, at least, of adequate pricing of risks). At the start of the subprime crisis, investors, including hedge funds, received a distorted message of safety regarding bank activities. To a certain extent, this can explain the Hsieh puzzle and the convergence of hedge funds portfolios.

[4] McCarthy, C. (2007). Transparency requirements and hedge funds. *Banque de France Financial Stability Review* — Special Issue on Hedge Funds, No. 10, April, p. 82.

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VII. CRISIS RESOLUTION IN A GLOBAL CONTEXT

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Global Crisis Management

John Lane*
Federal Deposit Insurance Corporation

In the US, the Federal Deposit Insurance Corporation's (FDIC) primary role is to maintain the stability and the public's confidence in the nation's banking system. Maintenance of sound risk management practices along with prudent capital requirements is critical toward successfully achieving the FDIC's mission. Given that the FDIC, for almost 75 years has had a successful deposit insurance program and supervisory program to ensure safety and soundness and, above all, appropriate capital levels, we are committed to sharing our framework and to understanding banking risks of other countries to maintain a sound global system. From a global perspective, much has to be considered when we think about crisis management. There have been lessons learned from the issues in the United States, Sweden, Japan, and Mexico. The Basel Committee on Banking Supervision (BCBS) in 1995 met in Halifax, Nova Scotia, and put forth five key areas of reform. These areas included:

- Cross-sector supervisory coordination,
- Strengthening of prudential standards in emerging markets,
- Encouraging transparency in the private sector,
- Improving standards of reporting and disclosure in the area of derivatives trading, and
- Enhancing cooperation and information sharing arrangements among securities exchanges.[1]

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[1] Wood, D. R. (2005). *Governing Global Banking, the Basel Committee and the Politics of Financial Globalization*. Vermont: Ashgate Publishing, Ltd.

To manage a global crisis effectively and mitigate the effects on the global economy, early detection and coordination with all involved parties is critical and has proven effective in mitigating the impacts. The first step in the process is to identify where the problem lies. We have to thoroughly understand if it is one industry, for example the banking industry, or does it cross-over into other markets. We also need to identify those countries involved. For example, a timely issue occurring now is the effect the US sub-prime market has had on Australia, Germany, and France's financial institutions, among others.

Open communication and a formal process for contacts is required to understand each other's concerns and discuss how to best approach the problem. There is a need to communicate our efforts within our national authorities to mitigate the cross-border impact of a crisis. A crisis management contact list has been designed for this use. For the FDIC, the primary contacts are the FDIC Division of Supervision and Compliance (DSC) Division Director Sandra Thompson, and DSC Deputy Director John Lane.

The benefits to a global economy are many. They include the ability to diversify and mitigate risk. Just as there are benefits, there are disadvantages that include difficulty in detecting where the disruption will come from, identifying all the counterparties, and identifying all parties of interest. These parties can include unregulated entities, which poses even greater challenges where communication is concerned.

When a global crisis occurs and we have effectively identified the parties involved, we look for the best possible solution to mitigate the effects of the crisis. For those of us in the banking industry, we know that strong earnings and sufficient reserves play an enormous role in buffering negative economic conditions. Beyond earnings and reserves, we look to the strength of the capital position to weather the storm. Adequate capital levels aid in the maintenance of confidence in the market, and attract liquidity when needed. In the banking system, the Basel II Capital Accord is the driving force to build sound capital frameworks. Going beyond sound capital levels, a deposit insurance system can also mitigate the effects of a global crisis. The FDIC deposit insurance system is a model for countries around the world. 95 countries have a deposit insurance system in place, and while this is progress, most of these countries don't have a regulatory system — that is, a system that provides oversight, the ability to assess premiums and to take action if a bank does not comply with rules and regulations, and a resolution process. If a crisis should occur,

a credible deposit insurance system can mitigate effects. It is crucial, as proven from past banking crises, not only to have the legal system in place to resolve a bank efficiently, but to have a system in place for paying off depositors. Beyond paying off the depositors, consideration must be given to private sector involvement to ease the financial strain of a crisis through asset purchases and to help in the recovery of potential market disruptions.

Legal infrastructure must support the insolvency system: commercial law, institutional system, transparency, and rule of law. An important component of this legal infrastructure is effective and predictable commercial legal rules. A well-developed commercial law is a crucial prerequisite to functioning markets for goods, services and financial assets as well as a reliable business climate. An essential analog to the commercial law is an effective legal and institutional system for enforcing contracts and collateral foreclosure. Similarly, the legal infrastructure should support and enforce financial transparency, effective regulation, the rule of law, and provide independent courts and well-trained professionals. This legal infrastructure provides some of the preconditions for efficient markets and commercial stability — both of which are important if the society is to be successful in recycling financial assets from insolvent companies.

Clear and mandatory criteria include prompt and effective intervention. This includes a receiver with immediate and flexible authority for market-based resolutions. Legal protection for receivership action is also necessary. These legal powers should include independence from undue interference by other governmental bodies, the ability to terminate contracts, the power to enforce contracts, the authority to sell assets, the right to avoid fraudulent or unauthorized transfers, and broad flexibility to design resolution and asset sales structures to achieve the goals of the resolution. There also needs to be immunity or indemnification for receivership or regulatory employees acting within the scope of their duties. A transparent process for determining claims should be in place for the quick and efficient reimbursement of insured depositors, while minimizing costs of the resolution.

There are many complexities surrounding the management of a cross-border crisis. They include the absence of international law; inconsistent national laws; private sector coordination with the industry; diverse regulatory infrastructures and practices; diverse processes for crisis management and insolvency; diverse central bank practices and policies; and diverse deposit insurance systems. In addition to these complexities, there

are home–host issues that must be addressed. These include the effectiveness of the primary supervisor; the availability of information and getting the information quickly; the legal and regulatory powers of the home and host authorities to mitigate and resolve issues in a coordinated manner; and the potential lack of flexibility to continue key functions.

The BCBS has numerous mechanisms and active committees to address some of the complexities around cross-border crisis management and home–host issues. To monitor international banking markets, The Committee on the Global Financial System, chaired by the Vice Chairman of the Federal Reserve System, has quarterly discussions to identify and assess potential sources of stress in the global financial markets.[2]

In addition, jurisdictions with oversight responsibilities of international financial institutions have entered into formal memorandums of understanding (MoU) and information sharing agreements. Informal supervisory working groups have also been established to share perspectives, coordinate supervisory reviews, and establish working relationships. These contacts will facilitate better communication during times of stress and help us understand the scope of the crisis and the international impact of the situation.

The FDIC works with the other federal banking agencies and is an active participant in international discussions on capital, supervision, and crisis management. The FDIC has entered into an MoU with many foreign regulators to facilitate coordination of supervisory efforts. We are building these relationships to enhance international global crisis management planning so that in future crises, the international system and the US system will remain strong and resilient.

The FDIC is one of the founding members of International Association of Deposit Insurers. There are currently 44 member countries that have, together, issued volumes of useful guidance on deposit insurance systems. The organization contributes to the stability of financial systems around the world by promoting international cooperation and encouraging broad interaction among deposit insurers and other interested parties. While preventing all global crises from occurring may not be possible, mitigating the crisis once it develops can substantially reduce the severity of the impact. To do this, continued communication and development of protocols is an important part of the process for global crisis management.

[2] See http://www.bis.org/cgfs/index.htm.

EU Financial-Stability Framework: Analytical Benchmarks for Assessing Its Effectiveness

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1. Introduction

The European Union (EU) is considering reforms of its architecture for safeguarding financial stability, including the management and resolution of cross-border European financial crises.[1] Much of the discussion has considered whether, and how, the costs of cross-border banking problems should be shared. Although this is a concern, European financial-stability challenges are considerably broader and could involve the (re)creation of Europe's architecture to capture the potential benefits of coordinating decisions that allocate resources for providing European — as opposed to national — financial-stability public goods.

The timeliness of these challenges cannot be overstated. In sharp contrast to the nation-oriented architectures for safeguarding stability and the decentralized decision-making processes for allocating resources, cross-border European finance is continuing to grow rapidly and to become more complex and opaque. Moreover, a European financial system is fast becoming a reality, with extensive pan-European markets and the emergence of regional and European institutions. Driving the debate in Europe

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[1] See EU (2007).

is a growing recognition by policy-makers and politicians that, along with substantial benefits, the emergence of a European financial system will most likely be accompanied by a greater propensity for market turbulence, cross-border contagion, and regional and European systemic risk.

These challenges are seen as requiring a framework that balances the need for economically efficient, least-cost resolutions of cross-border financial problems, should they occur, against the desire to prevent or at least minimize the moral hazard that accompanies financial safety nets. Opinions on how to proceed, particularly on fiscal cost burden-sharing of cross-border bank resolution, are lining up along national and regional political lines with less attention paid to safeguarding European financial stability.

Unfortunately, there is a dearth of literature that provides much analytical guidance on these important European issues and, in particular, for assessing the existing architecture's ability to safeguard European financial stability. An important exception is the approach developed in Freixas (2003), which suggests that information asymmetries and country differences in prudential capabilities — such as what presently exists in Europe — will most likely lead to sub-optimal decision-making and outcomes that can be improved upon through cooperative decision-making and centralized information.

This paper applies an alternative approach. It examines model-based benchmarks for assessing the ability of Europe's existing institutional architecture — including its decision-making processes — to efficiently allocate resources to safeguard the EU financial system against systemic threats to stability, such as the insolvency of a pan-European bank. The approach is that of the "economics of alliances", developed by Olson (1965) to analyze the nature of decision-making by a group of countries (NATO) desiring to create a common (military) deterrence against an outside (nuclear) threat. This approach is applicable to settings where collective and cooperative decision-making in the production of public goods could lead to welfare-improving outcomes relative to decentralized decision-making. Differently from NATO, the EU was not created as a "defensive alliance", but both international alliances share two characteristics relevant for our analysis: a large number of member countries and the need for providing multiple public goods. This paper applies this approach to the provision of European financial stability as a transnational public good within the EU (without dwelling on the mathematics of the approach).

The resulting analysis highlights the need to tackle the possible architectural reforms considered in EU (2007) and previously discussed in var-

ious strands of the academic *qua* policy literature.[2] This paper takes the existing European framework as given (in a simplified way) and asks whether it is capable of producing optimal outcomes. In this sense, the paper takes a more "positive" approach when compared to the relatively "normative" literature cited.

The paper is organized as follows. Section 2 briefly describes the existing EU framework for safeguarding financial stability and then outlines the current policy debate, driven in part by the increasing recognition of potential externalities associated with EU cross-border financial activities. Section 3 briefly characterizes in heuristic terms the EU decision-making problem so that it is more amenable to modeling — as one of optimal economic policy design. Section 4 then draws implications for this decision-making problem from two simple models developed and applied in different contexts from a literature known as "the economics of alliances". A final section concludes the paper.

2. Existing Framework for Safeguarding Financial Stability and the Ongoing EU Debate

The EU's institutional architecture for financial crisis management and resolution reflects three principles: *decentralization, segmentation*, and *cooperation* (Lastra, 2003; Schinasi and Teixeira, 2006; Garcia and Nieto, 2007).

First, it is based on *decentralization*, with the performance of financial-stability functions relevant for crisis management based, in large part, on the exercise of national responsibilities by prudential supervisors, central banks, treasuries and deposit insurance schemes. It also largely follows the legal structure of financial groups, and accountability resides primarily at the national level.[3] The European Central Bank (ECB) and the national

[2] For a selective sample of papers discussing possible reforms to the European architecture, see Prati and Schinasi (1999), Goodhart (2000), Holthausen and Ronde (2005), Nieto and Wall (2006), Schinasi and Teixeira (2006), Eisenbeis and Kaufman (2007), and Mayes, Nieto and Wall (2007).

[3] There are exceptions. First, the home country supervisor of a bank parent will exercise supervisory authority over a subsidiary bank incorporated in another country through its supervision of the consolidated banking group, and the home country supervisor may be the sole prudential supervisor if the host country supervisor of the subsidiary delegates its responsibility. Second, the host country deposit insurer of a branch may supplement the coverage provided by the insurer of the home country to bring it up to the host country's level.

central banks (NCBs) of the European System of Central Banks (ESCB)[4] have financial-stability-related responsibilities, notably in the field of oversight of payment systems and contribution to national policies on financial stability and supervision. The performance of the lender-of-last-resort function is likewise a national responsibility. This is also the case in the Euro area, where the provision of emergency liquidity assistance (ELA) is the responsibility and liability of NCBs. This is a unique feature of the Eurosystem in which NCBs have the responsibility of providing ELA without having monetary policy (as opposed to monetary operations) responsibilities. However, information flows within the Eurosystem are such that the potential liquidity impact of ELA operations can be managed in the context of the single monetary policy (ECB, 2000).

Second, financial-stability functions are *segmented* across sectors. Prudential supervision is exercised by single (cross-sectoral) supervisory authorities and NCBs and, in some cases, is shared between the central bank and the supervisor. The prudential framework followed by supervisors is largely harmonized by EU legislation, but the EU Directives that minimally harmonize the financial playing field across the EU have fallen short of creating a common regulatory and supervisory framework as yet. This results in a disparity in the degree of convergence and quality of financial supervision (?ihák and Podpiera, 2006). Supervision of banking groups and financial conglomerates is conducted separately by each of the supervisors that licensed each entity of the group. Coordination between supervisors is achieved by "consolidating" and "coordinator" supervisors that have limited powers to override decisions by individual authorities. In the Euro area, banking supervision and ELA are under the responsibility and liability of the national authorities. Lastly, although some elements of deposit guarantee schemes and banks' reorganization and resolution are harmonized, they have broadly developed in different ways in each Member State.

Third, a number of *cooperation* structures are in place for bridging the potential information gaps of coverage between national responsibilities in safeguarding financial stability. These structures range from legal provisions (e.g., consolidated supervision) to common fora and memoranda

[4] The European System of Central Banks (ESCB) is comprised of the ECB and the NCBs of all EU Member States, whether they have adopted the euro or not. By contrast, the Eurosystem comprises the ECB and the NCBs of those EU countries that have adopted the euro.

of understanding (MoU). There are two MoUs currently in place on financial crisis management of cross-border banks in the EU, one between central banks and supervisors and the other additionally involving treasuries.[5,6] The limitations of MoUs in achieving their goals are analyzed by Nieto (2007).

Against this background, achieving a balance between member sovereignty and financial stability in the EU is becoming increasingly difficult as the European financial system integrates as described in Garcia and Nieto (2007). Integration has been slower in banking, and particularly in retail banking, than in the marketplace (wholesale markets), where integration is far advanced, and in other sectors of the financial system. In banking, integration is occurring, although it has mainly taken place until very recently within regional areas in the EU.[7]

EU national authorities are becoming increasingly aware of the limitations of the existing institutional framework, for example, for resolving EU cross-banking problems. Some of the limitations were acknowledged openly for the first time in 2004 at the highest level by the Council of Economic and Financial Affairs (ECOFIN) comprised of the ministers responsible for EU economic affairs and finance.[8] At their September 9,

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[5] The MoUs consist of sets of principles and procedures that deal specifically with the identification of the authorities responsible for crisis management (central banks, prudential supervisors and ministries of finance) and the required flows of information between all authorities and the practical conditions for sharing information at the cross-border level. In addition to these MoUs, EU banking supervisors and central banks also adopted in 2001 the MoU on cooperation between payment systems overseers and banking supervisors, which sets out arrangements for cooperation and information in relation to large-value payment systems. Press release available at http://www.ecb.int/press/pr/date/2001/html/pr010402.en.html.

[6] Press releases available, respectively, at http://www.ecb.int/press/pr/date/2003/html/pr030310_3.en.html and http://www.eu2005.lu/en/actualites/documents_travail/2005/05/14ecofin_mou/index.html. There are also (generally bilateral) MoUs among prudential supervisors.

[7] See Hernando, Nieto and Wall (2007) for an analysis of the determinants of cross-border bank acquisitions in the EU and comparison with the US.

[8] Council of the European Union 9799/04. ECOFIN 186 EF 25, May 26, 2004. In the Draft Council conclusions of the Financial Services Committee's report on financial integration, the report of the ECOFIN "... stresses the need for Supervisors, Central Banks and Finance Ministers to work together to ensure that appropriate plans and mechanisms are in place to respond to any developing financial crisis which threatens the stability of the financial system. It also […] stresses the importance of promoting financial stability and market integrity, through both legislative and practical initiatives […]."

2006 Informal ECOFIN meeting, EU finance ministers and central bank governors launched an initiative to explore ways to further develop financial stability arrangements in the EU on the basis of the experiences of a crisis simulation exercise. Within this initiative, the starting point is that an effective crisis management framework must evolve, as markets already have done, from a purely national concern to include an explicit cross-border component. The initiative also endeavors to further develop general principles (i.e., minimum cost resolution) and procedures (i.e., assessment methodologies, bankruptcy procedures) for resolving a cross-border financial crisis including the policy issue of *ex ante* burden-sharing agreements on the *fiscal cost* of banking crisis (see EU, 2007 for the way forward on this initiative). Some policy-makers see *ex ante* burden-sharing as a cornerstone of a reformed financial-stability framework; they see it as a requirement for fully internalizing spillovers of domestic policy actions. Others consider *ex ante* cost burden-sharing as premature, in part because cost allocation may ultimately be influenced by other more fundamental reforms of the EU framework; others see it as entailing moral hazard, including forestalling needed reforms of the existing EU framework (IMF, 2007).

Although many in the EU understand burden-sharing as facilitating cooperative cross-country solutions (that is, all countries working toward the objective of EU financial stability), the EU debate has focused on *ex ante* sharing of fiscal costs of cross-border bank resolution. One rationale given for this focus is that in the event of a failure of a large cross-border European bank, home country supervisors, deposit insurance agencies, resolution authorities and taxpayers would be prepared to meet the financial costs of bank restructuring (i.e., recapitalizing a bank in its entirety).[9]

[9] Goodhart and Schoenmaker (2006) aver that an *ex ante* burden sharing scheme would be incentive compatible: fiscal authorities, as principal, will require the optimal level of effort from the supervisor, as agent. Mayes, Nieto and Wall (2007) question whether this would be optimal, doubt that one government agency acting as principal could require another government agency acting as agent to perform optimally, especially in a situation where neither the optimal effort nor the actual effort by the agent are fully observable to the principal, and further argue that the more any such agreement is enshrined in hard law, the more plausible the commitment is likely to be by raising the cost of reneging and/or increasing the benefit of honoring the commitment.

3. EU's Challenge of Providing a Pan-European Financial-Stability Public Goods

It has become increasingly recognized that, for the purposes of financial system policy-making, financial stability should be viewed as a public good.[10,11] The operational significance of this is that achieving and safeguarding financial stability requires both collective decision-making and action, at times involving private stakeholders, at times public stakeholders (including politicians and policy-makers), and at times combinations of both. The crisis management discussion in Europe has focused recently on fiscal burden-sharing, in part because large and systemically important European financial institutions with significant cross-border operations/exposures are emerging. However, this paper takes it as given that the challenge is broader and, as recognized by the ECOFIN, is that of safeguarding EU financial stability. This entails both the prevention of threats to EU financial stability and the effective management and resolution of EU financial problems at minimum fiscal costs.

Safeguarding financial stability is challenging within one legal jurisdiction, because it requires significant resources and collective action. The challenges are greater within a multi-country and decentralized decision-making framework such as the EU's. The added difficulty is that the public-good benefits of EU financial stability arise through the efforts and resources (expenditures) of individual countries whose primary objective is national financial stability and not European. Only recently have cooperation mechanisms been established to promote and to foster close cooperation and information sharing, both on an ongoing basis and within the context of any crisis situation that might arise. These mechanisms are positive initial steps to take account of the potential externalities that may exist across countries and within pan-European markets. Negative externalities could be associated with cross-border financial problems either involving turbulence across European markets or systemically important

[10] Chapter 5 in Schinasi (2006) defines financial stability and provides reasons for seeing it as a public good.

[11] Financial stability can be considered a pure public good in the same way the provision of national defense is considered as one, because it provides nonexcludable and nonrival benefits. Benefits are nonexcludable if the provider/producer of the good cannot exclude others from the benefits without incurring significant costs. The benefits are nonrival if consumption by one agent does not reduce benefits to others. The provision of EU financial stability would have these characteristics for all member countries and their citizens.

European financial institutions with extensive cross-border operations and financial exposures. Thus, the ongoing discussions in Europe to cooperate more closely and to share information can be seen as first steps in an EU's iterative process to internalize some of the potential negative externalities associated with the integration of national financial systems.

In viewing European financial stability as a public good that provides benefits to all EU countries, key questions seem to be: who should provide the public good; and how can its benefits be sustained and safeguarded?

As noted, there is not much formal economic analysis examining these issues, which is understandable given the difficulties of doing so. Particularly difficult to formalize is the existing complex, decentralized, and nationally-oriented EU safety net — albeit with some, mainly nonlegally binding agreements promoting dialogue, information sharing, and convergence in frameworks. In this regard, the centralization of business operations and risk management functions of the European large and complex financial institutions have run far ahead of the institutional structures that are responsible for oversight of these very same institutions and the pan-European markets in which they operate.

To our knowledge, the "economics of alliances" approach has not been applied to analyze the challenges now facing financial-stability policy-makers in the EU. This approach analyzes the nature of "equilibrium" outcomes that can arise when members of a group of optimizing decision-makers share the benefits of a public good (or the costs of its absence) and must decide how to allocate their own scarce resources to contribute to its production. Within this framework, the implications of a variety of decision- and policy-making processes can be modeled and analyzed.

That this can help to sort through some of the difficult financial-stability issues in the EU should be obvious. For example, EU stakeholders that share in the benefits of European financial stability (or who share the costs of its absence) can be viewed as having the option to: (1) continue to make decentralized public-good decisions focusing primarily on national objectives, or (2) to form coalitions that make joint and mutually advantageous allocations of coalition resources aimed at maximizing coalition public-good benefits. In the context of the models, socially optimal decision-making for the EU as a whole would imply the full internalization of potential externalities in the decision-making process (for example, via central databases of banks' financial condition; convergence of prudential regulation and supervisory practices; a common budget authority) without necessarily implying a new centralized European institution. The most inclusive

coalition would be all European countries; less inclusive would be the EU; even less inclusive would be the Euro area countries. Each coalition can have separate yet related objectives. One can also imagine a coalition of large countries or of small countries, or both, considering whether it is to their advantage to design a shared prevention and resolution framework of their own that optimizes the utilization of their joint resources.

It is an advantage of the "economics of alliances" that one can analyze and then compare the characteristics of the optimal outcomes consistent with, on the one hand, a decentralized decision-making process (for example, *Nash equilibrium*), and on the other hand, more cooperative decision-making process, as described in the previous paragraph, which could result in Pareto-efficient equilibrium allocations for the group as a whole.

4. Two Models for Evaluating Current EU Financial-Stability Frameworks

This section examines the implications of two simple models that provide objective "benchmarks" for evaluating aspects of the ongoing debate in the EU, such as the implications of decentralized versus centralized decision-making and the benefits versus costs of *ex ante* burden-sharing agreements for resolving threats to financial stability (or what amounts to the same thing in the models, to producing the optimal amount of financial-stability benefits).[12] The first model examines the implications of decentralized decision-making in allocating resources to the production of a "pure" public good that conveys benefits to all countries and citizens within a group of countries. The second model examines a public good that conveys some exclusive public-good benefits to the country that provides it and some pure public-good benefits to all other countries as well. This joint-public-good model encompasses the pure model and results of the two models can be compared.

4.1 *Decentralized decision-making in providing a "pure" public good (such as European-wide financial stability)*

Consistent with the EU safety net described above, and without getting into the details of mathematical notation, the logic of a simple model can be briefly summarized as follows.

[12] See Nieto and Schinasi (2007) for a mathematical representation of the models and Schinasi (2007) for a mathematical analysis of the "pure" public good model.

Each member of a group of countries (the EU) chooses an allocation of resources to produce a public good that conveys benefits to other countries in the group.[13] The benefits can be seen, for example, as the resolution of threats to the stability of the European financial system, such as the insolvency of a pan-European bank. Each country chooses a resource allocation so as to maximize its own welfare subject to two constraints: (1) its income constraint (say, gross domestic product), which requires that the cost of producing both an index of private goods and the public good does not exceed the nation's income; and (2) the presumption that each country chooses an optimal resource allocation conditional on every other country doing likewise. The second constraint is relevant because all countries contribute to, and share the benefits of, the public good. Each country knows this and makes its decision presuming that all other member countries are also choosing optimal mixes of private and public goods conditional on all other countries behaving similarly. While not an exact indicator, a country's GDP relative to total GDP of the alliance of countries (the EU) can be seen as proxy for the volume of the country's financial activities relative to the size of the European financial system. One can think of noteworthy exceptions, but they are ignored here for simplicity but can be explicitly accommodated in more elaborate models. Thus, in what follows size, can be taken as providing some indication of the potential for (1) spillovers of negative externalities of financial difficulties to the wider European financial system, and (2) "spill-ins" of benefits of country-specific public goods to other countries in Europe.

Characterized as such, the simultaneous decision-making process faced by each member of the alliance of countries has many of the features of a noncooperative mathematical game, the solution of which is a *Nash equilibrium*. The Nash solution is an equilibrium in the sense that no country has the incentive to alter its optimal allocation of resources if all other countries maintain their's. That is, the marginal benefits on other allies are ignored.

Keeping the exercise relatively simple — and consistent with Olson and Zeckhauser (1966) — requires a number of important simplifying assumptions: (1) all countries share the benefits of a single pure public good (as opposed to an imperfect public or club good, with some exclusively private benefits); (2) preferences of citizens in each country can be

[13] In this simplified scheme, "quality" (adequacy of allocation) is considered constant, and the "quantity" (amount of resources devoted) varies per country.

represented in a continuous and twice-differentiable utility function; (3) the cost of producing a unit of the common public good is fixed, valued in terms of the "numeraire"' private good, and is identical in each country; (4) all decisions are made simultaneously; and (5) the public good produced by one country is the same as another (perfect substitutability).

The most relevant implications of this optimization exercise can be shown to be as follows.[14]

First, and as is well-known in other contexts, the (decentralized, non-cooperative) Nash-equilibrium level of resources devoted to European financial stability would be sub-optimal relative to the Pareto-optimal allocation of resources consistent with maximizing EU welfare (rather than each individual country's welfare). Even though each country optimally chooses to allocate resources to produce a private/public good output mix (conditional on optimal "response" choices by others as well), the resulting European equilibrium will be sub-optimal, because no country considers the costs and benefits of its resource-allocation decisions in producing the pure public good for other European countries. Consequently, a sub-optimal level of the public good will be provided by a decentralized process compared to a coordinated one in which even only some of the positive externalities (benefits) from collective action can be internalized and distributed to all European countries.

Second, because of the model's decentralized decision-making process, some countries (smaller ones) may find it optimal to free-ride on the efforts of others (as implied by perfect substitutability in the provision of the public good). This would be reflected in the country distribution of the supply of the public good. More specifically, the optimal allocation of the burden of safeguarding financial stability (for example, the sharing of the costs of resolving a cross-border banking problem) falls disproportionately on the larger (higher income) countries — in the sense that they provide a share of the public good that exceeds their GDP share in the group of countries. That is, in the Nash equilibrium, a large country's share in providing the group's total public good will exceed its GDP share in the alliance.

Third, in the Nash equilibrium, member countries' propensities to provide the public good (that is, their policy reactions to a threat to their financial stability) will depend on four factors: country-specific income, the relative cost of producing financial stability, the aggregate amount of

[14] See Schinasi (2007) for a demonstration of these results.

resources devoted to financial stability by *other* member countries, and the commonly perceived threat of financial instability. If all factors were in fact measurable, these derived *policy reaction functions* would be estimable.

Fourth, if a greater matching of benefits received and costs incurred to preserve financial stability are to be achieved, then at least some form of coordination of resource-allocation decisions, if not full internalization of the externalities, would be required. The mandate of the *ad hoc* EU group to consider cross-border implications for EU financial stability can be seen as a move in this direction if some form of coordination results.

Fifth, addition of new member countries (e.g., EU enlargement) would imply additional marginal benefits to the group as a whole (more contributors) without a diminution in the benefits for existing member countries to the extent that public goods are nonexcludable and nonrival (as the model assumes) and the threat to financial stability is not increased.

These implications are conditional on the assumptions made, and will change if some of the assumptions of the model are relaxed or altered. For example, if one allows for country differences in the marginal cost of producing the pure public good, optimal decentralized decision-making would imply that the more efficient countries would take on a larger share of the EU-wide costs, regardless of their size. Thus, by relaxing this assumption, a country with a comparative advantage in providing, for example, efficient and relatively reliable clearing and settlement services for financial transactions, might end up devoting a greater amount of resources to producing this particular good to the benefit of all Europeans.

4.2 *Decentralized decision-making in providing both "exclusive" (nationally-oriented financial stability) and "pure" public goods (European-wide financial stability)*[15]

Countries in Europe provide financial-stability public goods whose benefits are also country-specific and convey exclusively to agents within the country. For example, countries in Europe have country-specific deposit

[15] Deviations from the "pure" public good model of Olson and Zeckhauser (1966) were first examined in van Ypersele de Strihou (1967) and later generalized by Sandler and Cauley (1975), Sandler (1977), and Cornes and Sandler (1984). This section applies the analysis in these papers.

insurance schemes that protect domestic depositors in segments of the national banking system that are exclusive retail, domestic financial institutions (such as, for example, the Sparkassen in Germany). By contrast, there are elements of the EU safety net such as prudential regulation or parts of financial infrastructures in European countries — such as large-value payments systems — that require domestic public expenditures and public maintenance, but which nevertheless convey public-good benefits to nonresidents across the European financial landscape.

Once the possibility of "exclusive" or "impure" public goods are acknowledged and accounted for, the nature of the decision-making process within a country and among a group of countries changes, as do the country and potential collective implications. In particular, while the set-up of the model is the same as before, the public good conveys two types of benefits: "exclusive" public-good benefits that convey only to the citizens of that specific country, and "fully shared" public-good benefits to all other members of the group of countries. A key parameter in this model is the share of "exclusive" benefits to the producing country relative to total benefits to all of Europe.

The implications of this more complicated model can be summarized as follows. First, the simultaneous decisions of countries still results in a Nash equilibrium. Consistent with the "pure" public-good model, other countries' welfare are ignored in each country's decisions and so the resulting Nash equilibrium is still sub-optimal compared to a centralized decision-making process. Achieving the Pareto-optimal allocation of resources in this decision-making process would require that all other countries' benefits and costs be considered in each country's optimal decisions — a veritable coordinated decision-making process.

The literature on the, economics of alliances, suggests that the existence of joint-products could in reality provide greater incentives for collective action and coalition forming than the case of the pure goods model. As Sandler and Sargent (1995) demonstrated, a joint-products' view may result in a coordination game where one of the Nash equilibrium would have all countries contributing to the collective action. If the "pure" public-good benefits are a sufficient share of total benefits, then contributing to the activity may be a dominant strategy. That is, if coordination allows countries to take advantage of country-specific benefits as well as excludable public benefits, then the payoff pattern may be more conducive to encouraging all countries to make contributions to the "fully shared" public good. Thus, the mix of joint-products

and their publicness can influence how coalitions and alliances are formed.

Second, the greater are the exclusive benefits to a particular country relative to total benefits, the lower will be the extent to which the cost of providing shared benefits will fall disproportionately on larger countries. This is because as exclusive benefits take a greater share of total benefits (and as national financial stability becomes the exclusive benefit), smaller countries may capture fewer shared benefits and devote more of their resources to produce exclusive public goods. In other words, when there are country-specific benefits, small countries have a greater incentive to produce the public good (financial stability).

As the exclusive benefits, relative share to total benefits approaches one, market solutions and the formation of "clubs" or "coalitions" are capable of yielding solutions that achieve more efficient equilibrium outcomes (for example, consider the special coalitions between the Nordic and the Benelux countries to safeguard financial stability). This occurs because when there are exclusive country-specific benefits, more of the benefits of a public good are received by the country producing it. Accordingly, equilibrium outcomes are associated with a greater association between a country's benefits received and costs incurred, which is welfare-improving for all country members concerned.

Third, as the exclusive benefits' relative share to total benefits increases, the benefits of collective action through cooperation and alliances decline. In the limit, when benefits are all exclusive, there are no shared public-good benefits between countries to internalize.

Fourth, countries with a greater likelihood of threats to stability — and of causing EU-wide threats — would contribute more resources to offsetting the resulting externalities.

Fifth, and consistent with an earlier implication, the recognition of joint products should result in decision-making that produces a greater match between benefits received and cost burdens carried — which is similar to a benefit principle of taxation.

Sixth, the extent of sub-optimality is not related to the size of the group of countries if there is a large share of "exclusive" public-good benefits.

Finally, once "exclusive" public goods are admitted, and unlike with the production of pure public goods, the relation between a country's resource allocation to produce the public good and that of other countries can be positive. This has the implication that a higher level of spending on the public good in one country might be associated with a greater level

of expenditure in other countries as well. This would reduce the tendency toward free-riding, and also raise the level of total benefits received by the group of countries. That is, in the joint-product model, there is greater scope for cooperation to move the group to an equilibrium that is welfare-improving relative to the Nash equilibrium.

5. Summary and Conclusions

This paper applies two models of decision-making, drawn from the "economics of alliances" literature, to assess the ability of Europe's existing institutional architecture to effectively (if not optimally) allocate resources for safeguarding EU financial stability. The public goods considered in the paper can be thought of either generally as safeguarding (including prevention and resolution efforts) the EU financial system from systemic financial threats, or specifically as resolving a European systemic financial event, such as the liquidity/insolvency of a pan-European bank or a pan-European market-driven systemic threat to stability. In practice, in the absence of a common fiscal authority in the EU, the EU Treaty limits the possibility of using EU public funds (or ECB monetary financing) to save insolvent banks.

If decentralized decision-making can be taken as a rough approximation of how European decisions are made, then the implications of the 'pure' public good model are instructive for the ongoing debate in Europe. Two implications are most pertinent.

First, decentralized decision making in the provision of shared financial-stability public goods results in an (Nash) equilibrium that is sub-optimal from a European perspective, even though each country views its decision as optimal and has no incentive to change its decision if other countries maintain theirs. In making decisions that do not account for the public-good benefits/costs of other countries, each European country chooses a level of the public good that jointly turns out to be sub-optimal for European stability. While this "fundamental theorem" of welfare economics is well-known, it serves as a timely reminder that greater coordination and harmonization, if not full internalization, of decisions and policies in safeguarding EU financial stability could lead to welfare-enhancing improvements relative to the existing European decentralized architectures and decision-making processes.

In recent years, there has been a growing recognition of this "efficiency" gap, which has led to tangible efforts to capture some of these potential gains through policy coordination via participation in joint fora. The ongoing iterative process of cooperation and coordination through committees and MoUs can be interpreted within the model as having already moved the EU away from the Nash equilibrium toward an improvement in EU stability closer to the Pareto optimum. In this sense, the framework presented in the paper is descriptive of what is going on in the EU; as such, it is potentially useful for considering what might happen in the period ahead as EU countries consider how best to internalize existing externalities.

Second, the equilibrium established in providing shared public benefits has the characteristic that country size — as a proxy for systemic importance — matters. In this context, the larger countries in Europe will end up footing a disproportionately large share of the overall (and socially sub-optimal) burden of allocating resources to the production of the public good relative to GDP (including the financial resources to bail out banks), and there may not be a close matching across countries of the benefits received and the costs incurred in contributing to the shared public good. Within the context of the models discussed, and consistent with other applications of the "economics of alliances", the larger countries might have the incentive to form a coalition and move the equilibrium from Nash to one of the many other welfare-improving equilibria — which could shift some of the burden onto smaller countries.

The paper also considered the provision of financial-stability public goods that convey benefits that are partially "exclusive" (country-specific). In this model, each country's calculus changes and the resulting European equilibrium has different characteristics and implications. The exact nature of the Nash equilibrium and the other socially more optimal ones changes in ways that depend importantly on the extent to which benefits conveyed are "exclusive" relative to total benefits. First, while the Nash equilibrium remains broadly sub-optimal, compared to the Nash equilibrium in the "pure" good case, smaller countries will share more in the cost burden to the extent that benefits are "exclusive" (and do not have implications for the financial stability of the EU).

Second, within a decentralized decision-making process, there are greater incentives for collective action and coalition forming than in the case of pure public goods. Thus, the mix of joint-products and their publicness can influence how the alliances are formed.

Finally, as the share of exclusive benefits to total benefits increases, the gains from collective action through cooperation and alliances naturally decline.

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Crisis Resolution in a Global Context: Regulation and Supervision for Cross-Border Banking

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Global crisis resolution is a very important and timely topic, especially with the ongoing worldwide financial concern over the US sub-prime market. It is obvious that the global financial integration, although economically motivated, poses new challenges for crisis management and crisis resolution. This is particularly true as long as the regulatory framework, supervision, crisis management and crisis resolution continues to be internationally uncoordinated. Cross-border banking and increased specialization within banking groups intertwine operations and link financial markets together. It is time to acknowledge that the days when all financial crises could be dealt with nationally have past. Regulation, supervision, crisis management, and crisis resolution need to be internationally coordinated and, in the end, formalized.

The paper is organized in two parts. The first part addresses the challenges for crisis management and crisis resolution. The second part outlines some possible ways to cope with these challenges. The paper tends to have a European perspective, although financial crisis resolution truly is a global issue. There are several reasons for this narrow focus. The financial integration in Europe is substantial and increasing. There are now about 50 cross-border banking groups in the European Union (EU), of which almost half have significant operations outside their home country. Financial integration is also a clearly stated political objective and many institutional arrangements are in place for this purpose. These arrangements may also be used as a platform for coordinated crises resolution in Europe.

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1. The Challenges for Crisis Management and Crisis Resolution

Over the last decade, we have witnessed the emergence of some major cross-border banks in Europe (see Figure 1). Banks like Barclays, Danske, Dexia, Erste, Fortis, ING, KBC, Nordea, Santander, Unicredit, etc., have considerable operations in a number of countries. Moreover, we have recently seen financial groups opting for a branch structure instead of a subsidiary structure. The economies of scale associated with the retail side of banking in combination with other benefits, such as a reduction in the regulatory burden, means that we will probably see more financial groups making use of the possibility to create a single-unit structure in the form of a European company in the future. This development is very positive. Financial integration stimulates competition and product development across countries and lets the banks profit from economecs of scale and scope. Hence, both consumers and banks benefit from the ongoing process. But the integration is not without problems.

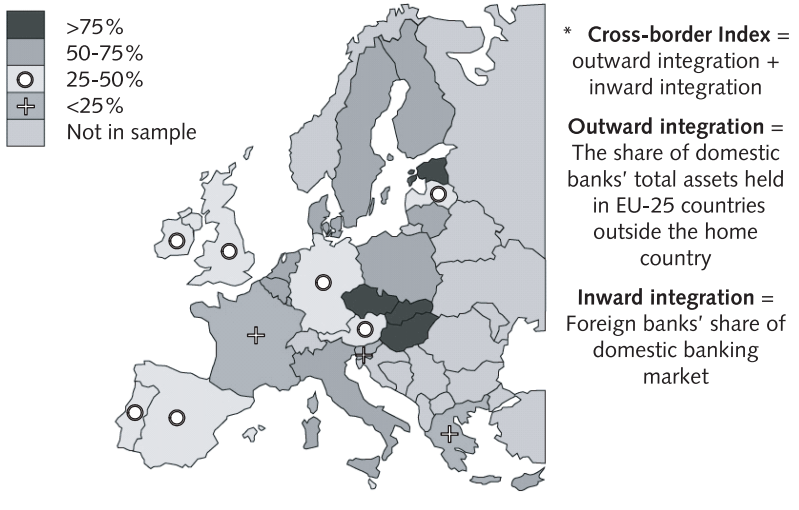

Figure 1. Cross-border integration of the banking sector, EU-25 countries, year-end 2005*

Source: (Non-public) data by the ECB/BSC Working Group on Banking Development of November 2006.

The underlying problem in banking is the existence of negative externalities. A financial crisis will inflict substantial costs for societies — ultimately in the form of lesser output — and these costs are not normally taken into account by the individual bank when it conducts its business. Thus, these costs may have to be internalized by public interventions, normally in the shape of regulatory and supervisory measures. This includes setting up capital requirements and rules for establishment and conduct of business, as well as giving the central bank the role of lender of last resort. In order to secure confidence in the banking sector, a deposit guarantee scheme (DGS) is also usually set up.

With cross-border banking, the negative externalities are no longer confined to a national scale, implying that the national intervention might be insufficient. In the prevailing regulatory structures today, hardly any arrangements for supervision and crisis management are designed for managing externalities with a cross-border impact. This lack of adequate structures makes it easy to identify some challenges.

First, cross-border banking makes it more likely that problems in one country spread to other countries where the same banking group is active. In general, spillover effects increase with financial integration and international exposures. Today, we can see how the crisis in the American subprime market affects other markets, mainly through a shortage of liquidity in those markets. The problem is not that there is no money in the systems. Instead, banks are reluctant to lend to each other until they have worked out the extent of their own and others' risk following the difficulties in the US.

Second, decisions and actions taken by national authorities are likely to have implications for the financial stability in foreign economies, especially if the national banks have branches instead of subsidiaries there. For three decades, home country control has been the general principle for regulation and supervision of banks with cross-border operations in Europe. Home country control means that the home country is principally responsible for regulation and supervision of a cross-border bank and its branches in other countries, whereas a host country is responsible for regulation and supervision of subsidiaries operating within its borders. Also, the home country is responsible for deposit guarantee coverage of depositors in branches outside the home country. This implies a risk of conflicting interests, since national authorities only have a national mandate and only are accountable to their own government or parliament.

Third, the legal distinction between subsidiaries and branches is becoming blurred as bank groups are beginning to organize themselves along business lines instead of entities in order to concentrate various functions to different centers and ease regulatory burdens. This process makes subsidiaries and branches less autonomous and reduces the whole group's survival rate from failure of an entity. It also implies that ring-fencing might be counterproductive since successful ring-fencing of the assets in a subsidiary might cause the failure of the parent bank, which in its turn had all the vital functions necessary for its subsidiary's daily business. Thus, the possibilities for the host country to successfully ring-fence the assets are diminishing with the specialization in bank groups.

Fourth, cross-border banking greatly increases the number of authorities involved in supervision, crisis management and crisis resolution. This implies higher regulatory burdens which both undercuts some of the benefits from cross-border banking and speeds the financial groups' preference for a branch structure. It also constitutes a potential breeding ground for uncoordinated supervision and actions. For example, The European Deposit Guarantee Schemes Directive from 1994 is not adopted for the present scale of cross-border banking and every member state has its own DGS. At present, there are actually more DGS models in the EU than there are member states (since some countries have more than one system). These DGSs differ in every possible respect, such as their scope, coverage and what events should trigger payments to depositors, whether the schemes are operated by the private or the public sector, whether premiums are paid *ex ante* or *ex post*, and whether there is a fund in place and, if so, how large it would be. On top of this, there is also great divergence in the treatment of troubled institutions and uninsured claimants, and how conflicts of interest should be handled.

Conflicts of interest are likely to occur even though EU DGSs, in principle, should be financed by the financial sector. This is because every DGS in practice contains an element of a government guarantee since the funds only cover a fraction of the guaranteed deposits. As it stands today, the current DGSs are inadequate to address a failure of any of the major cross-border groups. The different DGSs affect cross-border banking crises in three ways. First, they may influence burden-sharing schemes. Second, they may affect other key players in the crisis management, such as central banks, supervisors and governments since the DGSs sometimes also provide financial assistance and contribute to a crisis resolution package. Third, they may complicate the search for a solution to a cross-border crisis

due to their diversity. The diversity in, for example the Nordic countries is substantial. In Norway and Denmark, the DGS can, under certain circumstances, provide financial support to a bank in public administration or act as a facilitator of restructuring and mergers. In Sweden and Finland, the DGS has only a pay-box function. Intervention decisions also vary among the countries. In Denmark, Finland and Norway, the DGS can be activated in the event of either suspension of payments or bankruptcy. In Sweden, the DGS can only pay out after the court has declared the bank in bankruptcy. Thus, in a potential crisis in a Nordic cross-border bank, depending on the decisions taken and on the timing of the decisions, in some countries it may be the supervisor that controls the bank, possibly seeking a merger solution or to use the DGS to finance public administration, while in other countries the owners may remain in control for a longer period. If the bank group is integrated and organized along business lines, coordination problems are likely to arise. For instance, even if there is a framework in place to use the DGS in connection with public administration in one country, it may not be possible to rely on it if important functions of the bank are in the hands of other parts of the group.

Another central issue is how this diversity may interact with burden-sharing. Imagine that the Nordic countries agree to share the costs of rescue mission of a cross-border bank. In this scenario, two problems might arise. To start with, Sweden, and to some extent Finland, might be less willing to participate in the sharing of the burden because they would have to devote relatively more public funds since their DGSs only have a pay box function. On the other hand, the banks (maybe even backed up by the authorities) in Denmark and Norway may find it unfair that they have contributed to the DGS (and thus to the rescue of the bank) while banks in Sweden and possibly Finland have not.

But also, if the governments take a direct role in the crisis management, for instance by the provision of capital support or a government guarantee, the differences between the national DGSs could complicate the crisis management. For the sake of argument, assume that all countries agree that the Nordic bank is insolvent. In Denmark, Norway and Finland, such an assessment by the supervisor would automatically lead to the activation of the DGS. In Sweden, it would not. This means that the DGS will be used in only three out of four countries. Diversity in scope, netting rules and activation procedures are then likely to further complicate the crisis resolution and could, at worst, stall any negotiation process.

With different systems and many authorities, the problems tend to stack up. Spillover effects might be overlooked by the national authorities when a bank is of limited importance in the home country, despite some of its branches being of systematic importance abroad. The uncertainty of burden-sharing slows down both the ability and willingness to act in a crisis situation. On top of this, there is always the possibility that strained banks will shop around for the most favorable support among the countries involved. It is also possible that the authorities in a host country refer its depositors to the home country authorities, without taking any responsibility. This raises the interesting question of how far the taxpayers in the home country would be willing to go in order to bail out the depositors in a host country. In particular, if the operations in the host country are very large in relation to the home country's economy, this will indeed be a major problem. Today, there is an apparent risk that the responsibility will fall solely on the country who is most affected by the crisis and the goodwill of other countries. Without common rules, acknowledged forms of cooperation or mechanisms for shared decision-making, international crisis resolution is reduced to a non-cooperative game where every country is looking out for itself. This game resembles at best a chicken race, at worse a Prisoners' dilemma. Significant for these two games is that most players tend to end up as losers.

2. Moving Forward from Today's Framework

In the debate, one can distinguish four commonly discussed solutions to the challenges for crisis management and crisis resolution.

The first solution is to establish supervisory colleges by creating specific standing committees for each individual cross-border banking group with representatives from the relevant supervisors. Although this is a good start, it also generates a very complex supervisory framework and it undermines the likelihood of equal treatment.

The second solution is to enhance the home country's responsibility. One supervisor would, in this setting, get the responsibility for assembling information, formulating a joint assessment and coordinating decisions for all entities in the bank group. A general problem with this solution is that it does not address the conflicts of interest. It is doubtful that the home country's authorities will take the situations in the host countries fully into account when they make their decisions. For example, what happens if host countries do not share the assessment of the responsible supervisor?

The third solution attempts to avoid the conflicts of interest by giving the home country an explicit EU mandate to take the interest of the other relevant countries into account. It is not clear how this will work in practice and the lack of accountability suggests that the national interest will still prevail.

The fourth possibility is the supranational solution. In this case, both the mandate and responsibility for supervision are transferred from the national level to the EU level. This would imply the creation of a European FSA. The relevant argument against this solution is that supervisory power ultimately needs to be backed by financial muscle. Since the EU has no supranational taxing power, some arrangement on burden-sharing would have to be established as well. Clearly, the political obstacles for this solution make it unrealistic in the short run.

Yet, regulation, supervision and crisis resolution must be adapted to the internationalization of banking. The common goal, at least in the European case, must be a framework that can meet both the need for financial stability and the need for continued financial integration. Clearly, there are a few improvements that can be done to gradually reach this objective.

First, the EU should develop common rules that link the supervision responsibility with crisis management. Ultimately, efficient supervision works best with the knowledge that it is oneself who has to take the consequences of falling short in this area.

Second, the EU needs to improve and deepen the exchange of information, cooperation and coordination of authorities in different countries. Over the past years, we have witnessed increased cross-border cooperation among supervisors and efforts to obtain some convergence in supervisory practices and forming supervisory colleges, for example as manifested by the Committee of European Banking Supervisors (CEBS). Moreover, to manage some of the coordination problems that will arise in a cross-border banking crisis, in 2005 a memorandum of understanding (MoU) was signed by supervisors, central banks and ministries of finance in all the EU countries. These arrangements were tested in an EU-wide crisis simulation exercise in April 2006. It was concluded that the arrangements provided a useful basis for coordinated actions in a financial crisis situation at the EU level. However, the ECOFIN council agreed that efforts were needed to further deepen the cooperation among relevant authorities. This incited an intensive work in the EU, and in October 2007, the ECOFIN council agreed on a road map consisting of various actions

both to enhance the cooperation and to review the tools for crisis prevention, management and resolution.

For example, it was agreed to extend the EU-wide MoU on cooperation among finance ministries, central banks and banking supervisory authorities with common principles, a common analytical framework as well as common practical guidelines and operational aspects. On top of this, a number of regional and bilateral MoUs have been agreed upon. Obviously, these arrangements go some way to improve coordination of information, and setting up structures for decision-making. They help establish contact networks and, not the least, a common language, which would be helpful in a crisis. One should, however, acknowledge the vulnerability of these voluntary agreements. There is also the practical issue of coordinating authorities appropriately and in accordance with what is outlined in the MoUs. In the extreme, there could be up to 81 separate entities involved that should be coordinated according to well-intended, but largely vague and not legally binding, MoUs. Therefore, it is important both to set up more specific MoUs on how authorities should act and cooperate, and to ensure that the MoUs are translated into actual cooperation.

Third, we need to focus on lowering the level of gold-plating and national discretions when implementing EU directives. Although national discretions sometimes are called for, they hamper the much-needed harmonization. Thus, a basic rule in the regulatory process should be to always question national solutions.

In the long run, these steps are still insufficient and must be replaced with more formalized arrangements. This could, for example, take the shape of new EU institutions for supervision and crisis resolution of cross-border banks. It can also include a common European DGS for such banks. Obviously, these suggestions are somewhat far-reached and controversial. They imply a shift of power from the member states to the EU that might be hard to accept for some countries. It is vital to stress that the proposed arrangements should only apply to those banks that are truly cross-border and whose size and systematic importance motivates this. The 8,000 or so European banks which mainly operate domestically would remain under the exclusive competence of national authorities. The regionally-oriented banks, active in a few countries, could use a structure similar to that of today, where supervisory colleges deepen the cross-border cooperation. The limited number of truly pan-European banks would on the other hand be dealt with by the new EU institution. With this arrangement, we can

have regulations that are flexible enough to fit all countries reasonably well and yet are "harmonized" enough to support the single market.

The new institution should be independent from the European Commission and ECB and can, given its success, be seen as the starting point of a future EU FSA. In the beginning, it should have limited powers and function more like a nonregulatory central bank than a traditional supervisor, and its tasks should be threefold. First, it should gather information about the cross-border active groups. Second, with the information acquired, it should produce unified risk assessments for the banks subject to EU supervision. The third and final task should be to oversee the activities and risks of these banking groups.

3. Conclusion

During the last decade, the financial integration has deepened and the banking sector has increasingly become cross-border. This development should be embraced as it enhances competition and stimulates economic growth. It also challenges the regulatory community, who needs to find new forms for cooperation and supervision.

What probably stands out in this paper is the call for a common supervision of major European cross-border banks. Since this proposal might seem rather radical and implausible in the short run, a gradual approach to this end is advocated. The EU has institutional arrangements in place which can be used as a platform for such a process. Still, the underlying challenges of financial integration are of a global nature. Therefore, even if it may not be possible to achieve the same solutions outside Europe, it should be of wider international interest to at least move in the direction of enhanced cooperation between supervisory authorities. Considering that financial integration is already widespread and that the process of revising present regulatory structures will most certainly be demanding and protracted, we need to get to work right now. It would be encouraging to see preemptive policy actions rather than being pushed in this direction in the aftermath of a major crisis. Regulators need to show enough courage and determination to tackle the negative externalities a potential financial crisis would entail. And it is only when the frameworks for regulation, supervision and crisis management match the actual structure of financial markets, that the negative externalities of financial crises can be managed properly.

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Crisis Resolution in a Global Context

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I would like to thank the Chicago Fed, George Kaufman, Douglas Evanoff, and David Hoelscher for inviting me to participate in this conference. I also want to join the previous speakers in congratulating the Chicago Fed for its foresight. The topic of this conference could not have been more timely given the current turmoil in financial markets. The papers in this session address different aspects of cross-border crisis resolution. The first paper discusses the current arrangements in the United States, and the other two refer to the current European situation. I would like to briefly summarize each of them and then draw some conclusions.

1. Discussion

John Lane's paper describes the existing institutional arrangements in the United States and provides a comprehensive list of the principles and many complexities that surround the management of a cross-border crisis, such as: the absence of relevant international law, inconsistent national laws, diverse regulatory infrastructures and practices, different processes for crisis management and insolvency, and different deposit insurance systems. Lane's paper points out the importance of early detection of a global crisis and especially of coordinated efforts among all involved parties. It also highlights a series of home–host issues that need to be addressed, such as the effectiveness of the primary supervisor, the availability of information, and the legal and regulatory powers of home and host authorities.

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The next two papers have a European perspective. María Nieto and Garry Schinasi's paper focuses on a particular but extremely important topic for any cross-border resolution: the sharing of costs. The paper provides a model-based perspective on how to share, among European Union member countries, the costs of the provision of a public good called financial stability. Financial stability comprises both the prevention of threats and the management and resolution of financial problems.

The paper begins by providing a description of the current European financial-stability framework, which is characterized by decentralization, segmentation, and cooperation. The paper presents the results of two models that analyze the decision-making processes involved in sharing the costs of providing a pure public good that gives either pure public benefits, or both pure benefits and country-exclusive benefits. Each country chooses the resource allocation that maximizes its own welfare without considering the public-good benefits of the other countries. The resulting Nash-equilibrium level of aggregate expenses in financial stability will be smaller than the Pareto-efficient level. The models lead to a series of interesting conclusions. I would like to mention some of them.

The first logical conclusion is that decentralized processes lead to sub-optimal allocations for financial-stability expenses. The fact that each country chooses the resource allocation that maximizes its own welfare without considering the public-good benefits of other countries leads to smaller stability expenses. This conclusion could easily be extended to the case where a country has many decentralized supervisory bodies, where each particular supervisor, central bank, or deposit insurance agency would expend less than the optimal amount. A second conclusion is that some countries, presumably the smaller ones, will find it optimal to free-ride when it comes to sharing the costs of financial stability. It follows that the optimal allocation of the burden of financial stability (including bank bailouts) will fall disproportionately on the larger countries. In this regard, the paper concludes that any proposal to agree on an *ex ante* burden-sharing for cross-border bailouts will benefit larger countries at the expense of smaller ones. This particular issue, as María just explained, was discussed by European finance ministers and central bankers two weeks ago at their Porto meeting. ECB Governor Trichet praised the Porto agreement (which delineated common principles for crisis management) for not including an *ex ante* burden-sharing concept for cross-border bailouts.

According to the model presented in the paper, *ex ante* agreements will benefit larger countries. So the agreement not to establish *ex ante*

burden-sharing implies that the larger EU countries will be willing to foot a larger proportion of the costs if a large European bank gets into trouble. I doubt this is the case. It is very likely that the reason for agreeing to any *ex ante* burden-sharing is to prevent free-riding by smaller countries. So some of the model assumptions are very restrictive, such as the existence of a single public good and also the assumption of its perfect substitutability (the possibility that exactly the same public good can be produced by either Germany or Portugal). Exploring alternative assumptions, such as differentiated prices (perhaps considering some kind of economies of scale for large countries) or a public good with exclusive benefits (as the second model does), should enrich the model and provide additional conclusions. For example, lower prices for the public good in large countries could lead to greater provision of that public good in those countries than in the previous framework.

The paper also assumes that if a parent bank and its subsidiary are both systemic, home and host supervisors will have incentives to cooperate. It could easily be argued that in this particular case, home and host supervisors will be more inclined to engage in ring-fencing their respective banks. Cooperation between home and host supervisors will only take place if, as the paper assumes, a subsidiary cannot stand alone without its parent bank. And even then, we should keep in mind the fact that home supervisors are not accountable to host-country taxpayers, so they will always look out for their own best interests without regard for the subsidiary's depositors. For these reasons, the trend among many host supervisors is to put in place regulations to promote the operation of subsidiaries on a stand-alone basis in case the parent bank gets into trouble. One example is New Zealand. This paper is an excellent contribution to research on the subject as it gives anyone interested in the issue a fine starting point to analyze the sharing of costs. This is something nobody talks about, but it is key for reaching agreements. The paper does not tackle the issue of implementation, but to be fair, this was beyond its scope.

Mattias Persson's paper starts by rightfully asserting that the days when all financial crises could be dealt with domestically have passed. It highlights the characteristics of today's financial landscape: financial crisis and authorities' decisions in any given country lead to effects in other countries; legal frameworks do not match the economic reality; and the concurrence of many authorities in the management of a crisis makes the attainment of solutions more difficult, as conflicts of interest will arise.

I found particularly interesting, and timely, his discussion of the potential consequences of having deposit guarantee schemes with different characteristics in terms of scope, coverage, and triggers. As Mattias just mentioned, in Europe there are more deposit schemes than countries. In the event of the failure of a cross-border entity, the differences in deposit guarantee schemes among countries will affect the burden-sharing among those countries and thus complicate the attainment of efficient resolutions.

Recent events also give us an opportunity to reflect on the importance of the particular designs of deposit insurance schemes, as Lane's paper pointed out. For example, it is key to have deposit insurance agencies that are able to give depositors their money back within days instead of months. Persson discusses a series of alternative solutions for the challenges of crisis management and crisis resolution. He seems to favor the creation of supranational institutions. However, as he recognizes, these solutions are either very complex or unrealistic in the short run.

2. Conclusions

The first condition for successfully addressing a cross-border crisis is a common understanding of the causes and magnitude of the crisis. This requires timely access to relevant information and a high degree of knowledge and understanding of the complexities involved. The second condition, following Nieto and Schinasi's analysis, is an agreement on a common and cooperative strategy.

Recent episodes of financial market turbulence have exposed many realities that will make crisis resolution processes more complex and more difficult to deal with than previously thought. First is the speed at which shocks in one particular market spread to other financial markets, institutions, and regions. Second, to attain efficient solutions, it is imperative to have a shared understanding of the problem and an agreement with regard to a potential and efficient solution. In the current financial crisis, there seems to be some disagreement over the magnitude of the crisis and over the best responses. The attainment of common strategies could be hampered by a lack of fluent communication, not only among home and host authorities, but also among the different supervisory authorities of the same country. Third is the existence of fluent communications — keeping everyone´s telephone numbers is not enough, nor is the simple existence of formal agreements. We need to have some harmonization of instruments,

deposit schemes, and other institutional arrangements, following the guidelines of best practices.

The three papers conclude that cooperation is needed. Two of them recognize that the centralization of decision-making processes may lead to improved and less costly outcomes. At the root of the difficulties in attaining efficient solutions lies the dichotomy between legal and regulatory financial frameworks and the economic reality. Legal frameworks, regulations, foreclosure procedures, and deposit insurance schemes are built around individual entities and their national jurisdictions. The economic reality does not recognize any of them. As Professor Kane said yesterday, globalization has outrun the political institutions that support it.

Stefan Ingves and others have suggested that the way ahead is the creation of supranational institutions. However, any supranational institution responsible for financial stability will require substantial tax transfers. I do not foresee this in the near future, not even in Europe. I believe that before thinking about supranational institutions, we need to modify and harmonize existing national institutional frameworks. As far as supranational institutions go, a step ahead could be to contractually agree to resolve the international disputes that might arise during a cross-border crisis at a common or specialized legal court. If we have an international court for war crimes, why not an international or specialized national court to resolve international disputes that might appear during cross-border insolvencies? This already takes place with sovereign debt.

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VIII. WHERE TO GO FROM HERE — POLICY PANEL

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Speaking Points for Where to Go from Here? Policy Panel

Jaime Caruana*
International Monetary Fund

I would like to take this opportunity to draw some lessons from the interesting discussions that we have had over the past two days of this conference and the implications for systemic risk arising from the recent turmoil. Over the last two months, we have experienced a very relevant test of the financial system. At first, we at the Fund viewed this as the first real test of structured credit products — a topic that we had been following and analyzing for some time. But this episode has deepened into more than that, and has raised issues that are at the heart of central banking and financial stability.

To my mind, the issues on the table today represent a combination of three elements. First is the original source of the turmoil — the lax credit discipline leading to mortgage delinquencies and defaults, after a long period of benign conditions (characterized by low interest rates, low volatility). Second is the complexity of risk transfer instruments and difficulties in valuation which causes a repricing and deleveraging of risky assets, notably structured credit products. And third is an old or traditional element — a maturity mismatch causing liquidity dislocations, particularly in some conduits. The result of this unique constellation of elements was the transformation of liquidity problems in a few asset markets into general market liquidity difficulties, and this in turn led to funding liquidity for core elements of the banking system.

To some, the surprising element has been that the episode began in the mature markets, not in emerging markets. The last several crises have

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begun in a specific emerging market country or region and then spread to others through mature markets. Thus, this is a unique opportunity to draw out lessons that apply very broadly (and especially to mature markets) — issues of how much weight central banks should place on financial stability in their monetary policy decisions; whether they have the correct tools for dealing with financial instability; and, not least, lessons regarding regulation and supervision. The moral hazard issues raised by the turmoil and the central bank responses are also very important. But in my view, the debate about bailouts or moral hazard on this occasion are a little exaggerated. There was tremendous pressure to reduce rates in the US, and my view is that the Fed had to do so. The Fed had to inject liquidity to ensure that the core financial markets kept functioning, so that the plumbing of the financial system remained working, to permit monetary policy to be effective.

Many of the topics covered at this conference over the last two days are echoed in the most recent *Global Financial Stability Report* of the International Monetary Fund, which we released on Monday. In it, we begin to raise some policy questions that are just now coming into focus given the ongoing events. I would like to share these ideas with you today and perhaps delve a layer deeper into what, exactly, should be done to improve the resiliency of the global financial system in light of the recent turbulence.

The first key policy issue is the important role of information and transparency. Accurate and timely information about underlying risks, the way they are managed, valued and accounted for, is a critical component of the market's ability to properly differentiate and price risks. As Andrew Haldane has noted, the present system appears to provide incentives for sophisticated institutions and investors to create products with tail risks that are difficult to understand and value, and thus greater tail risks are an inherent part of the new securitized business model. Thus, greater transparency is needed in the links between systemically important financial institutions and off-balance-sheet vehicles. Only by disclosing fully their interrelationships with asset managers, conduits, and special purpose vehicles will investors be able to assess the creditworthiness of the institutions with which they deal. As Rick Mishkin has noted, when it comes to transparency, the more the better. But how should we respond to this challenge?

- In the short-term, a more "hands-on" approach to financial institutions and their supervision may be required. A more difficult question

concerns what information is necessary for investors to facilitate their due diligence?
- In the medium-term, Pillar 3 of Basel II should be helpful, but is there more that needs to be done to make sure it works? Or are other inducements (either regulations or not) to disclose information needed?

The second key policy issue for policy-makers is the incentive structure in the present financial landscape. While financial innovation, such as securitization and structured products, has enhanced risk transfer and broadened the scope for risk-sharing, it has also altered the incentive structure in ways that may have contributed to the relaxation of credit standards. Origination has outstripped the capacity of market participants to value and assess risks properly. Generally, the relation between the checks and balances throughout the supply chain of structured products will require study and possible strengthening.

- Next step: In the early days of structured products and securitization, the institution that put together the deals often kept a portion of the equity tranche or some of the riskier loans, in part to demonstrate their commitment to watch the creditworthiness of the borrowers in the pool. How do we return to this, or some other strategy, in which the incentives are present for originating higher quality loans and for monitoring?

The third key policy question concerns ratings. While ratings and ratings agencies will continue to be fundamental components in the proper functioning of financial markets, questions have been raised about the rating methodology of complex products and their use by investors. We have said in our previous reports that differentiated ratings scales for structured products could alert investors to the inherent liquidity and market risks and therefore the scope for more rapid ratings changes. Likewise, investors' use of ratings should not be seen as a substitute for due diligence and appropriate risk management.

- Next step: Credit ratings agencies are now moving toward establishing liquidity ratings, establishing higher and thicker Chinese walls within their firms to mitigate the criticism of conflicts of interest, reviewing their assumptions, and modeling procedures for structured credit prod-

ucts. But, do credit ratings agencies need a push from regulators to do the right thing?

- Next step: The burden on credit ratings agencies is likely too high. How can we encourage investors to better educate themselves about what they are buying in the complex world of structured credit? The ability for other parties (beyond credit ratings agencies that helped to underwrite them) to see through the structures and evaluate the risks would help. Will other "consultancies" naturally arise to do this work? Are there enough "experts" to go around? Would greater standardization or simplicity in the products help investors perform better due diligence?

The fourth policy issue is the valuation and liquidity of complex products, particularly in illiquid markets. More work on best practices in liquidity management is necessary. The way market illiquidity has evolved into funding illiquidity also calls for more robust funding strategies in financial institutions. Martin Summer's comments about valuation being a systemic problem are insightful here, as are previous works by other groups such as the Institute of International Finance's *Principles of Liquidity Risk Management*, and the reports of the Counterparty Risk Management Policy Group.

- Next step: Valuation is a very knotty and difficult issue, as you all know. Still, it needs to be tackled since valuation and market liquidity are intimately linked. For instance, should all securities of the same type, even if held by different types of investors with different investment horizons, receive the same "value" — however that value is acquired? For instance, there is some anecdotal evidence that prime brokers assign one price for their own book for a structured credit product but a different price for their hedge fund clients' margin requirements. The notion that some structured credit products cannot be valued and thus cannot be sold in a timely fashion (for instance, in the asset managers associated with some banks) is also rather disturbing.
- Next step: Funding liquidity is also a tough one. There are already some private sector initiatives to improve individual institutions' (funding) liquidity management strategies. But there are several elements of this problem that may still require more thought. For instance, how does one prevent individual institutions from hoarding liquidity

when they receive it from central banks? How can institutions better anticipate when they are going to be hit with a number of customers asking for the contingent credit lines? When is it appropriate to borrow from central banks (either short-term or long-term) versus from other banks? What sorts of assets are compatible with what sorts of funding strategies?

The fifth main policy issue concerns the relevant perimeter of risk consolidation for banks, and how it has proved to be larger than the usual accounting and legal perimeters. Some banks have needed to step in to support affiliated entities, such as conduits, special investment vehicles, and asset management subsidiaries.

- Next step: There are at least two points to make here. From a risk point of view (especially from a systemic risk point of view), trust among counterparties is important. If others have insufficient knowledge of the counterparties' risk because some of it is "off-balance-sheet" activity, risks are not consolidated and transparent and can come back "on-balance-sheet", and thus, the confidence for interbank lending and a host of over-the-counter derivatives contracts are at risk. Furthermore, supervisors should also be able to see these risks to assess the soundness of the institution and to give advice to the central bank about its solvency and risks.
- Next step: It is also evident that the banks themselves did not have a good handle on the risks that these off-balance-sheet entities were taking on. Some banks announced days before losses were discovered that they had no exposure to the US mortgage market. [Other major institutions have told us privately that they purposely do not include their asset managers and private-label hedge funds in their risk analysis since their exposures to these entities are considered to be small amounts of the banks' equity.] This begs the question, then, about how far "reputation" should be extended and if legal and accounting boundaries are actually likely to be respected when difficulties arise.

A last area that we did not flag in our report, but that will require a lot of soul-searching by central bankers, supervisors, and regulators alike, is the deeper question about how financial stability should factor into central bankers' monetary policy decisions. To the extent that central bankers are both tasked with maintaining price stability and growth through the

control of interest rates (for example, the price of credit) and the smooth functioning of financial intermediation, there is a tension between how much weight to put on macroeconomic goals and how much weight on financial stability, including by preventing asset price bubbles. My own take on this issue is a middle-ground — central banks should aim to maintain price stability and adequate economic growth with one eye and with the other eye on financial stability.

A related issue is whether central banks have correct tools to influence financial stability. To discuss this, whether they have oversight over financial institutions (of various types) or share this responsibility with other entities becomes important. For example, it is likely that this is the first time the tripartite arrangements between the Bank of England, the Financial Services Authority, and the HM Treasury in the UK have been used in a stressful episode. Note also, it is unusual for the Fed to encourage the use of the discount window for longer-dated borrowings. The tools for influencing interbank liquidity appear to be less than fully effective, though this opinion may be premature. But, suppose we live in a world in which credit is created outside the banking systems (as well as within it) and that short-term policy rates do not affect the cost of credit very directly. What tools should the central bank use then? How should they interact with markets and various types of participants?

Overall, then, policy-makers now face a delicate balancing act. They must re-evaluate prudential frameworks so that investors are encouraged to maintain high credit standards and strengthen risk management systems in good times as well as bad. At the same time, they must be careful not to discourage financial innovation.

The US Government's Approach to Financial Decisions

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Whether we call what we have just been going through a crisis or just turmoil, I shall use the word "crisis" because the question is not so much what we do now, but whether we are prepared for a real crisis. One way to approach that question is to define crisis rather broadly to see exactly how our governments — individually and collectively — react to unexpected challenges in international financial markets.

I hope that you will forgive me for being somewhat autobiographical in approaching that question. It is the easiest way for me to make a few quick points.

I have been fortunate (or unfortunate) enough to have been in three different US administrations and to have faced crises (broadly defined to be sure) almost immediately after having taken office. These three occasions have allowed me to see how our government deals with crises from the perspective of four offices: the Office of Management and Budget (the OMB), the West Wing of the White House, the Department of State, and the Department of the Treasury.

Within a month of joining OMB in 1971, I found myself on a sunny August weekend at Camp David because I was in charge of international programs for OMB. What were we doing in the bucolic Maryland countryside that lazy August weekend? We were doing what was then called "closing the gold window", which was in essence devaluing the dollar under the Bretton Woods system. This was an action forced on the US by the march of economic events. And it was an action opposed by our trading partners.

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What President Nixon did was to take his key government officials to Camp David to get the decision taken over a weekend because there was no way to take the decision through any kind of thoughtful, organized governmental process. Implementing the decision, which required a further devaluation in 1973 and a move to floating, effectively destroyed the Bretton Woods system. This was a prolonged crisis, lasting several years. There was effectively no international process in place in advance to resolve the crisis, but one was cobbled together by the International Monetary Fund (IMF) to recognize *de jure* what had happened *de facto* by adopting amendments to the IMF Articles of Agreement four years after that August weekend.[1]

My second experience was in a second August, this one in 1982, again only one month after taking office, this time in the Department of State. Again it was a weekend, and this weekend the Mexican finance minister, Jésus Sylva-Herzog, flew to Washington to tell us that Mexico was going to have to stop servicing its debt. This set off the Latin American debt crisis which lasted the rest of the decade. It was a difficult crisis, and there were no institutions in place to handle it. But since the Latin American debt was almost all owed to commercial banks, the resolution of the crisis was, in a sense, outsourced to a committee of banks headed by Bill Rhodes from Citibank. Since Latin American debt is today more in hundreds of different bond issues than in bank loans, there would be no one to outsource the new crisis to, as we are today still learning in the unruly litigation going on in New York over the Argentine debt.

My third experience was a little different. This time I had been in office half a year, and I was in the Treasury when two airliners flew into the World Trade Center on September 11, 2001. One can call this a terrorist crisis, but the event deepened a recession we were already in and thereby worsened the problems of dealing with the Turkish, Argentine, and Brazilian exchange rate and debt problems. This crisis too lasted a few years, but fortunately the world economy has been growing about 5 percent a year, and the crisis surprisingly quickly evaporated. But even with the good efforts of the IMF, it is hard to say that the crisis was abated through international cooperation.

The short of it is that US international instruments for dealing with economic crises are defective. For a time, especially late in the Bretton Woods

[1] On the Camp David decisions and the aftermath, see Shultz, G. P. and K. W. Dam (1998). *Economic Policy Beyond the Headlines*, 2nd ed., Chicago: University of Chicago Press, pp. 109–131.

period, the Group of Seven/Group of Eight process was used effectively. But that process now lacks legitimacy due to its well-known membership issues, and no longer produces much, even among its members. At the conference yesterday, someone from the floor said that we need new institutions. Perhaps. But how does one create them? In discussing the issue of international institutional change, it is well to remember that, except for the creation of the Bretton Woods institutions at the end of World War II, changes in the international financial system have normally taken place through evolution rather than through explicit reform.[2] So we ought to look for small changes first. For example, the US and the European Union have a successful informal Financial Services Regulatory Dialogue. It has a good record in defusing quite a number of tensions and misunderstandings across the Atlantic. It has been a positive instrument of reform. It needs to be formalized and upgraded from the normal Deputy Assistant Secretary level to a full range of meetings from the cabinet level on down and empowered at the highest level to tackle current issues decisively.

What about internal US organization? The days when the Treasury, back in the Bretton Woods period, could effectively monopolize US policy-making are long over. The Camp David meeting demonstrated the change. The Treasury Secretary and the Fed chairman can decide a few things over their breakfasts and lunches — but not much.

In the banking regulatory arena, we have the worst of all worlds with a bunch of squabbling independent agencies — the Fed, the Office of the Comptroller of the Currency (OCC), the Federal Deposit Insurance Corporation, and still others such as the Office of Thrift Supervision. It is said that the OCC is part of the Treasury, but that is a real estate statement since the OCC in policy-making is, by statute, independent of the Treasury.

That is just the banking side. On the capital markets side, we have an independent Securities and Exchange Commission. And with the rise of derivatives, we have to deal with an independent Commodities Futures Trading Commission. Until this past month and the Northern Rock affair, I had envied the UK with its multi-purpose FSA (Financial Services Authority). But the hasty way in which the decision to broaden deposit insurance was taken and confusingly announced suggests that the interagency process works no better in London than in Washington.

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[2] Dam, K. W. (1982). *The Rules of the Game: Reform and Evolution in the International Monetary System*. Chicago: University of Chicago Press.

Fortunately, the US government does have one institution — the President's Working Group on Financial Markets — where the heads of these rival independent bastions of government can meet under the chairmanship of the Secretary of the Treasury. This interagency group, first formed after the 1987 stock market crash, has been reinvigorated by Treasury Secretary Paulson. But it still is only a study group, primarily used this past year to study hedge funds. It is not an action group. The members are still independent under congressional statute. This is no way to run anything, much less the country with the largest economy in an increasingly globalized financial system. But the President's Working Group contains the seeds of a solution for our internal US policy-making shortcomings. The Group should be empowered to take and implement decisions, not just to study them and then stand aside for interagency coordination through a White House-managed committee.

So assuming that the international community and the internal US government were properly organized to deal with international financial crises, what should they focus on? One thing I know for sure is that they will focus on the last crisis, not the next crisis, which is likely to be quite different. This is one of three principles that may be used by our foreign friends to understand the US policy-making and political morass. The first, to which I have just alluded, is that the US always focuses on the last crisis. The second is that the US always does the right thing, but only after every other possibility has been discussed and ultimately rejected. And the third principle is that the regulatory agencies and the Congress tend to react most often and most quickly to scandal, rather than to carefully defined economic problems.

To illustrate this third principle, the focus in Washington this past week has been on the rating agencies. And the press is covering the matter on the assumption that the rating agencies' behavior has been scandalous. As a result, one can safely assume that there is going to be a reform, however minor, of their role. To be sure, the rating agencies have two huge conflicts of interest. First, their ratings are paid for by the issuers, whose securities they are supposedly independently assessing. And second, the rating agencies make a large share of their revenues by telling the issuers what to say back to the rating agencies about the securities to be issued. What happened in the sub-prime crisis is that the rating agencies sat down with the issuers and their banks and took them step-by-step through the process of getting a AAA rating. And in fact, a AAA rating for mortgage-backed securities turns out to have meant something

quite different in terms of default rates than a AAA rating for corporate bonds.

However, in my view, this way of looking at the rating agencies is quite wrong. The reason things went wrong in securitization was that the AAA ratings became, by statute and regulation, a necessary legal condition for a large set of investors to buy the securities. This new constituency of institutional investors was legally required to have the investment grade rating in order to invest at all in securitized products. As a result, there has been a powerful constituency among regulated investors for exactly the kind of simple-minded "grade card" represented by the ratings. Where the focus should be is on what these regulated investors actually do by way of due diligence in their investment decisions. What needs to be changed are the law and regulations that drive those investors to seek the AAA ratings in place of doing the requisite due diligence. The rating agencies can help in the due diligence process, but the law and regulations should not allow the regulated investors to substitute ratings for their own research and judgment.

This week in Washington we are thus focusing on a minor aspect of the last crisis, but we are failing to recognize that the problem about rating agencies has to do with US law and not with the agencies themselves. Rating agencies are not saints, to be sure, but the problem is US law, not the agencies.

I wish I had time to go on. For example, I do think we should discuss the role of disclosure and transparency. Disclosure and transparency seem to be the two universal recommendations for reform whenever something goes wrong in US financial markets. A politician does not need to know anything about a problem to grasp onto disclosure and transparency as solutions. What disclosure and what kind of transparency are the real questions, but those are seldom addressed in a comprehensive way.

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Globalization and Systemic Risk: Where to Go from Here — Policy Panel

William L. Rutledge*
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1. Introduction

I should say at the outset that the perspective of many of us on this panel is quite different from that of other panels. We are practitioners and bank supervisors, not academics. So my remarks will focus on what we can really do in practice to address issues, rather than looking at them from a more conceptual perspective.

- Much of our focus as supervisors is to look to reduce the likelihood of institutions for which we are responsible encountering major financial or operational problems, and more generally at the Federal Reserve, to promote financial stability.
- To do that, our efforts are geared very heavily to working to ensure that there is strong risk management and controls in place and an adequate capital cushion to absorb unexpected losses in order to limit the number and severity of problems.
- But we also look to prepare ourselves to deal with the problem situations that will necessarily arise despite our prophylactic efforts, and look to take the lessons learned from problem situations into account as we modify our approaches over time.

I will begin by reviewing what we do to limit the number and severity of problems in the major global institutions we supervise. I will do that by ticking off four key elements of our business model.

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Then, I will shift and talk more specifically about implications of the credit market issues for the workings of those four elements of that model.

2. So What are Some of the Elements of Our Ongoing Supervisory Process That are Designed to Limit the Occurrence of Significant Problems at Major Firms?

First, we at the Federal Reserve look to be exacting in the critical review of the risk management and control practices of institutions we supervise, utilizing heavily the concept of specialization. We use teams of examiners assigned full-time to a particular firm — institutional specialists. Then, we look to use examiners with specialized expertise in credit risk, market risk, and operational risk to critically evaluate the adequacy of risk management and control processes, and the sufficiency of capital for the kinds of risks borne by those institutions. Recent events have highlighted what we have known for some time: the financial world is a specialized place. We need people who understand collateralized debt obligations (CDO), structured investment vehicles (SIV), and asset-backed commercial paper (ABCP) conduits and be able to evaluate the credit risk, market risk, and liquidity risk of these and other complex instruments.

Second, they cannot make those assessments very well in a vacuum; they need the capacity to stay on top of developments and see the nature of the issues that are coming up. For us, that means providing them access to a cross-section of globally active firms. This is not just a Federal Reserve Bank of New York approach, but a Systemwide approach to look at the largest institutions as a portfolio to ensure that expectations are developed based in significant part on risk management practices of well-managed firms, and then applied consistently across the set of the largest firms we supervise.

Third, we need to work effectively with other supervisors within the United States and abroad — the Office of the Comptroller of the Currency (OCC), the Federal Deposit Insurance Corporation (FDIC), the Securities and Exchange Commission (SEC), and international supervisors — to do our job well both as an institutional supervisor as well as to understand developments that are relevant for broader financial stability. Particularly, given the focus of this conference on globalization, I will look particularly

towards how we work with the international supervisors. This has to take place on several levels.

2.1 *We coordinate on broad policy development*

Examples of this include:

- Working with other banking supervisors on Basel II.
- Working through the Joint Forum — which includes a broader array of financial supervisors (that is, securities and insurance supervisors as well) — on issues like credit risk transfer activity and its implications for financial stability. In 2005, it prepared a report that provided recommendations for market participants and supervisors in the areas of risk management, disclosure, and supervisory approaches.

2.2 *Another level of coordination is the ongoing supervision of individual institutions*

In the financial industry, the major banking institutions we supervise operate globally, across a broad range of national and international jurisdictions and legal structures.

Against this backdrop, supervisors have stepped up their coordination efforts to develop and share supervisory plans, and to make clear who does what — that is, to determine what is the role of the home country supervisor and of each of the key host country supervisors.

The Federal Reserve has participated in colleges of supervisors under the auspices of the Basel Committee's Accord Implementation Group (AIG). Going back well before the AIG effort, the Federal Reserve has been participating in "trilateral" discussions with the Swiss EBK and the UK FSA concerning the operations of the major Swiss banks.

2.3 *A third level of coordination is conceptually between the first two*

This level involves looking to work with other key supervisors to develop risk management and control expectations for major global institutions in cutting-edge areas. This is really home/home coordination on establishing

expectations based in part on what well-managed global institutions are doing.

- As one example, a current initiative is a multilateral horizontal review being conducted with the SEC, the OCC, and various international supervisory authorities on counterparty credit risk management practices at the largest global financial institutions.
- We are finishing an earlier review of corporatewide stress-testing practices — again working with many of the same financial services supervisors domestically and internationally.

The final element of our ongoing supervisory model that I will mention is making use of other sources of market intelligence in our supervisory and financial stability processes.

- For example, we have the tremendous advantage of being part of a central bank with major tentacles into the world's financial markets through our Payments role, through the operations of the Open Market Desk, through our Discount Window people, and through analysts following developments in foreign exchange and equity markets.
- In a coordinated way between our Markets and Supervision people we maintain a dialogue with other players in the financial system, such as investment banks, hedge funds, and private equity firms.

Through these and other sources, our examiners learn of developments that are relevant to supervising their firms; of course, the information flow is both ways within the Central Bank.

So four key elements of our supervisory program are: direct institutional supervision based on a philosophy of specialization, treatment of major firms in a portfolio way, coordination with other supervisors at various policy and operational levels, and utilizing information gleaned from numerous sources in our ongoing processes.

3. What Does This Mean in the Current Situation and Going Forward?

I have talked about efforts to limit the number and severity of problems, but problems will occur. They can arise because of misjudgments on the part of firms we supervise, by firms that are supervised by others or not at

all, or because of external shocks. While it is too early to come to definitive and specific judgments on all that has gone wrong, it is clear that a broad range of lenders and investors misjudged the credit, market, and liquidity risks associated with instruments based on sub-prime mortgages.

In any event, we at the Federal Reserve want to make sure we understand the nature and implications of market disruptions for the firms we supervise and, more broadly, for overall financial stability. Of course, the more reliable information we have, the easier it is to choose the best course of action when a problem does arise. So let me offer some comments on each of the four areas I just mentioned that each involve the development and use of key types of market intelligence.

First, in the current environment, we are using our on-site teams and capital markets risk specialists to maintain the closest of contact with the major banking organizations they supervise. They are getting and critically evaluating information on firms' own exposure and risk management in a very specific granular way and insight into developments broadly in the capital markets, including insight into particular counterparties.

Second, our view of firms within our supervisory responsibility on a portfolio basis has been a very focused one. For example, we have looked at capital positions across the firms, not just where they are now, but how their capital positions would be affected by assets coming on to the balance sheets as a result of various kinds of commitments, and by possible adverse market developments.

We have looked across the firms at various exposure questions and various accounting issues. All these kinds of portfolio assessments are, in many ways, very normal actions on our part, but we are carrying them out in an accelerated way given the speed of developments in the market place.

In terms of coordinating with other supervisors, major efforts are going on across the three levels I mentioned tied to the current set of market problems.

- Beginning on the policy development side, I would say that Basel II has been covered by numerous speakers. In addition, the Joint Forum is currently updating the report I mentioned on credit risk transfer in light of the continued growth of, and recent events in, the credit risk transfer markets. In particular, it is studying how credit risk transfer activities have affected incentives to assess credit risk and how credit risk transfer instruments are behaving under stressful circumstances.

- On individual institution supervision, there has been extensive dialogue among supervisors on particular firms with a sharing of information on various issues.
- On the middle-ground area between individual supervision and broad policy development, we are having ongoing discussions on further work on counterparty credit risk management for the review we have had underway. And we will be looking to frame efforts to assess what worked well and what did not work so well in the broad area of risk management. Liquidity risk management is an obvious sub-category.
- The coordination between bank supervision and other areas of the central bank, as you can imagine, has been particularly intense — critical for us given how the financial system is becoming ever more market-centered.
- In this connection, some of the tabletop and scenario exercises we have done internally and with various other central banks and supervisors have been helpful in giving us insight into issues we should be sensitive to and into sources of information we can tap when the need arises.
- We have been meeting with key areas of the Bank several times a day to exchange very granular information as well as to analyze various policy options.

In wrapping up, let me leave you with a couple of points of emphasis from the current market turbulence.

As recent events have made clear, there is no checklist for managing disruptions to financial system stability. In working through challenging issues, it is imperative that supervisors have internal information systems, processes and contingency plans in place to ensure that they are better positioned to deal with events that may not have been fully anticipated and that they are kept up to speed as developments unfold.

And second and finally, it is not possible, or desirable, for individual supervisors to work in isolation. Working through challenges requires cooperation on the part of supervisors across jurisdictions at home, with authorities located overseas and also with market participants and trade associations to gather intelligence and to help influence market practices. We have made some clear progress in that direction, and we look to continue making meaningful progress as we look to deal with the ongoing challenges associated with the national and global credit markets.

Comments on Session VIII: Where to Go from Here — Policy Panel

Andrew Sheng*
China Banking Regulatory Commission

I want to thank Douglas Evanoff of the Chicago Fed and Jaime Caruana and David Hoelscher of the International Monetary Fund for kindly inviting me to join this illustrious panel. The last time I recall I attended this annual conference was when I presented a paper on the reforms of the East and Central European transitional banking economies, which was more than a decade ago.

The policy challenges facing banking regulators are currently huge, considering that global banking industry has grown in leaps and bounds, in both scale and sophistication in the last three decades. Since my return to thinking about bank supervision issues, particularly after seven years in the supervision of capital markets, and with the Asian financial crisis in between, I have come to appreciate much more the risks and opportunities in the globalization of finance.

I want to use this opportunity to think through Minsky's framework of financial crisis in terms of leverage in the economy with capital flows and the derivative markets. After carefully studying the role of the carry trade in the Asian financial crisis, I believe that these are all interrelated. If we do not understand where the vulnerabilities and the channels through which contagion can spread in global financial markets, then we will tragically confirm Santayana's dictum that those who do not learn from history are bound to repeat history's mistakes.

I recently re-read John Galbraith's classic *The Great Crash* and I recommend that all look there for the eerie similarities with the current environment.

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1. The Global Economy

From all indicators, it would be true to say that, economically and financially, globally we never had it so good. These are famous last words, since prosperity is never forever. But so far, so good.

The current global economy is characterized by a period of long and strong economic growth, with increasing growth in trade, foreign direct investments, and relatively benign inflation. In addition, the world is also flush with excess liquidity, which has resulted in strong equity market growth since March 2003, and also real estate price growth in almost every market I can think of, except those involved in war or civil strife. Almost all stock markets, developed or emerging, touched peaks in July this year. But since 1999, oil prices have risen from US$20 to more than US$80 per barrel, and commodity prices have risen sharply. After a few years of cumulative increases in asset and commodity prices, price pressures are finally beginning to emerge in consumer products.

In 2006, world gross domestic product (GDP) growth was expanding at 5.5 percent, this being the fourth year of growth above 4 percent per annum. World trade volume growth accelerated to 9.2 percent in 2006, from 7.4 percent in 2005. The main engine of this growth in the world economy remains the US, which has been the consumer of last resort. Unfortunately, its current account deficit has now worsened to US$811 billion in 2006, creating what is now known as the "global imbalance". The US current account deficit amounted to 6.2 percent of GDP in 2006, whereas the Chinese current account surplus has risen to US$250 billion or 9.4 percent of GDP.

The reasons for global prosperity are many and need not be debated here. One obvious reason is the rise of new producers and consumers, notably China and India. Greater global productivity, improved technology, financial and trade liberalization, better corporate governance, and exceptionally good weather (probably the effects of global warming) have all come together to produce greater prosperity without (until recently) too much inflation. Overall monetary policy has been relatively lax, resulting in excessive global liquidity that may explain a lot of the bubbly markets.

In China, major reforms in the banking system, especially the listing of the large commercial banks, have created records in capital fund raising. Stock market reactions are such that the top bank by market capitalization

in the world is the Industrial and Commercial Bank of China (ICBC), which was only listed in 2006.

In 2007, there are now signs that the US economy is slowing down, with annual GDP growth down from over 4 percent 18 months ago to 2 percent currently. Housing prices have begun to decline and the sub-prime crisis has broken out, forcing the major market central banks to inject nearly US$300 billion liquidity into their banking systems. Although the crisis is attributed to the sub-prime phenomenon, I personally think that the issues are deeper and deserve more careful analysis.

It may be useful to use the late Hyman Minsky's theory of financial crisis to think through the role of leverage in this economic and financial cycle. The first stage of his cycle begins with a major economic shift or events, which in the last two decades were probably the advance of technology and the rise of China and India. This created new global demand and so in the second stage, some or many people became rich, increasing the income disparity in many societies. In the Minsky third stage, those who know how to use leverage for hedging become richer, or at least managed their risks. However, leverage increases returns at higher risk, not all of which can be hedged. Hedge financing is defined by Minsky as income flows that are expected to meet financial obligations in every period. In the fourth stage, the borrowers begin to engage in speculative finance, and therefore overtrade or overstretch themselves. Speculative finance involves the borrower rolling over debt on the basis that income flows can cover interest costs. This sounds like mortgage lending that covered interest rate only.

In the fifth stage, Ponzi financing takes over, when everyone becomes slightly drunk with greed, thinking that the prosperity will last forever. The poor and the innocent rush in thinking that they will also become rich quickly. Borrowers cannot even cover their interest costs from income flows and must liquidate assets or borrow more to service debt. When this happens, the "smart money", those experienced traders, will take profits and prices will begin to fall. Some of the overtraders fail. Then, panic steps in and everyone sells, so that prices plunge and a lot of people lose a lot of money. More firms fail and the cycle starts all over again.

All these traits of the Minsky cycle are manifested in the recent sub-prime crisis, but the crisis only illustrates the underlying structural problems of the derivatives markets and leverage in the financial system.

2. Sub-Prime, Derivatives, and Financial Bubbles

The sub-prime crisis is a classic example of the excesses in credit that manifests itself during the late stages of a bubble. Derivative markets are characterized by low transaction costs, high turnover, and high levels of leverage through different orders of derivation or leverage and lack of transparency. Derivative products are useful to financial markets because they enable the divisibility and transferability of "lumpy property rights", which transfer or reduce risks to holders who may find such assets or liabilities match their own risk appetite.

In the last ten years, a period of "great stability" in global economy with low inflation and high growth, the derivative markets have grown beyond all expectations. Under the twin trends of liberalization and financial/communications innovation, global financial assets have grown from 108 percent of global GDP to 395 percent in 2006. The International Monetary Fund estimated that the total value of global financial assets, comprising banking assets, stock market capitalization and bond market value, amounted to US$190 trillion, nearly four times the size of global GDP of US$48 trillion in 2006. In contrast, the total notional value of global derivatives amounted to US$415 trillion or roughly 8.6 times notional GDP and 2.2 times the size of underlying financial assets.[1]

Since finance is a derivative of the real economy, and using GDP as the underlying asset,[2] the crude leverage "ratio" or layers between finance and underlying economy as represented by the financial system assets and GDP has moved from roughly 1.1 times in 1980 to 4 times in 2006. However, the notional value of global derivatives is 8.6 times GDP. Even though "true leverage" cannot strictly be represented by the notional value of derivatives, their gross market value is estimated at US$9.7 trillion, or 20 percent of global GDP. Obviously, the credit exposure of banks involved in derivatives will be dependent on the gross market value of their derivative exposure and, as we recently discovered, whether they are involved in contracts to provide liquidity for such derivatives. The opaqueness of

[1] Calculated from data from *Global Financial Stability Report*, September 2007, Appendix Tables 3 and 4. Gross credit exposure of OTC financial derivatives is much less at US$2,045 billion, but still 2.9 percent of total global bank assets.

[2] Strictly speaking, GDP is a flow and not an asset. The degree of leverage should compare a liability (stock) with equity (stock). Therefore, the comparison of asset size with GDP is only a crude estimate of national leverage.

the derivative market is such that we have difficulty identifying when, how and if the market is moving from the Minsky speculative finance to the Ponzi stage.

Much of the growth in derivative markets arose from asset securitization and their derivatives. Global structured product issuance, including collateralized debt obligations (CDOs) rose from less than US$500 billion in 2000 to more than US$2.6 trillion by 2006. US leveraged loan issuance amounted to US$500 billion in 2006, and before the crisis, the volume of issuance of European securitization reached €280 billion, over 70 percent higher than the same period in 2006.

Unfortunately, the excess liquidity throughout the world, partly generated by excessively low Japanese interest rates since the 1997–1998 Asian financial crisis and excessively low US interest rates after the dot.com bubble in 2000, had created a housing boom in the US that resulted in the relaxation of lending criteria by some financial institutions. Sub-prime loans, defined as residential loans that do not conform to the criteria for "prime" mortgages, became popular and many sub-prime borrowers were able to buy housing that they could not really afford without creative adjustable rate mortgages (ARMs) that lowered their mortgage payments. The buyers were effectively betting on a continuous house price increase and praying that interest rates would remain low. Sub-prime lending was made attractive by fee-driven remuneration when such loans were securitized, structured and sold. By the end of 2006, sub-prime mortgages accounted for roughly 15 percent, or US$1.5 trillion, of the US residential mortgages, of which US$600 billion were originated in 2006. About 90 percent of these were ARMs and borrowers were therefore hurt badly when interest rates began to rise in 2006.

The worldwide volume of such leveraged loans that banks are stuck with is estimated at between US$350 and US$380 billion.[3] Federal Reserve Chairman Ben Bernanke has estimated that the ultimate direct sub-prime losses may not be more than US$50 billion to US$100 billion, or 1 percent of GDP, relatively small compared with the savings and loan crisis of the early 1990s, which cost 2.5 percent of GDP.

However, because many sub-prime loans were blended into asset-backed securities (ABS) that were credit-enhanced and rated AAA by the rating agencies, the contagion spread into the ABS market, which had

[3] *Financial Times*, "So what is it worth? Financiers and accountants wrangle over credit pricing", September 13, 2007.

grown to become an important funding market for the banking system. Matters were exacerbated when several of Bear Stearns's hedge funds suffered losses and the rating agencies downgraded the structured securities. Investors who did not understand the true extent of their credit risks began to shun the ABS market, partly because they did not know how to price their portfolio and to avoid further exposure.

In late August, the European, Japanese, and US central banks had to inject massive liquidity into their individual money markets in order to restore order, but it is quite clear that the full implications of the sub-prime crisis have not fully worked their way through the global financial system.

3. Lessons from Sub-Prime and Macroeconomy Implications

Although it may be premature to assess the full implications, there are a few lessons that may be worthwhile to consider from a macro, micro, and regulatory perspective. It shows that the bubble conditions of the last four years, which witnessed exuberance in both stock and real estate markets, have created potential structural weaknesses in global financial markets.

- At the macroeconomy level, the first lesson is that the *sub-prime crisis is clearly a signal that the US economy may be heading for a consolidation, if not a recession*. House prices are already off-peak by up to 10 percent and as unemployment numbers and inflation rise, we may witness stagflation, which would definitely hurt consumer confidence. This will have huge implications on US imports, which would also address in part the global imbalance. If US imports slow down, one possible effect is that the US slowdown will also reduce overheating in the East Asian economies, which are already confronted with problems of excess capacity and emergence of inflation.
- At the micro market behavior level, the second implication is clearly that the derivative markets have "overshot" the capacity of the issuers, investors, accountants and regulators to understand their true value and measure their risks. It is precisely the *lack of transparency and understanding of the complexity of the derivative risks that caused the panic and refusal to invest in ABS markets*. Markets are not markets if they cannot "price" derivative markets properly. This is a bit like a repeat of the Long-Term Capital Management (LTCM) debacle when LTCM models could not price their assets properly. As Michel Prada, head of

Autorité des Marchés Financiers (AMF), the French securities regulator and Chairman of the Technical Committee of International Organization of Securities Commissions (IOSCO), recently said, "How in the world can all these [accounting] rules be of any use if one is not able to determine the price of a product?"

- Thirdly, the risk-transfer advantages of derivative markets have created new risks, because *no one knows where exactly the risks have been transferred to, and who is holding how much toxicity*. This has resulted in the fall in the share prices of banks, insurance companies and mutual funds, as investors struggle to find out the true extent of their exposure and holders of ABS try to determine accurately their true losses.
- Fourthly, *the rating agencies cannot escape some responsibility* for the crisis, since it is valid to ask, as Michel Prada[4] has asked, "everyone has been wondering how some vehicles could have lost their AAA status to a CCC rating overnight!" Indeed, the rating agencies may have to answer the same accusations that auditors faced after Enron for their lack of independence in giving opinions on credit quality.
- Fifthly, as we have discovered, derivatives are only as good as the underlying assets, although the relationship is not linear and definitely complex. Consequently, *lenders and issuers, as well as their lawyers and accountants, have to go back to fundamentals and get the basic credit procedures right through tightening assessment, collateralization, due diligence and regulations right.*
- Sixthly, there will be many questions whether in violation of Bagehot's Rule, central bankers should bail out the bad lenders, borrowers and investors, or simply lower interest rates and make everyone pay for the mistakes of the few.

All this would not have happened without the greed and excesses that are brought to the surface because of loose credit, excess liquidity, and market greed. Hence, the ultimate lesson of the sub-prime crisis is that we must go back to basics and get the fundamentals right.

To understand how excess liquidity, contagion and capital flows are interrelated, we need to examine the role of the carry trade.

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[4] Prada, M. (2007), "Address to ESF/IMN European CDOs, Credit Derivatives & Structured Credit Products Summit", Autorité des Marchés Financiers (AMF), September 7, Paris.

4. Carry Trade

Part of the global excess liquidity can be explained by the global carry trade. The carry trade is a method of funding by borrowing in a low-interest currency and investing in another currency asset that offers a higher yield. The interest rate cost on the funding currency is the "carry". The most popular currencies for the carry trade are the yen and the Swiss franc, the yen being more commonly used in Asia because it has tended to depreciate since 1995 and interest rates since 1998 have been close to zero.

Using the Bank for International Settlements (BIS) international banking statistics, one could get a rough estimation on the potential size of the yen-funded carry trade position. It is estimated that the yen-funded carry trade was in the range of US$200 billion to US$350 billion during the mid-1995 to end-1998 period. Although a rough estimate, this is close to the size quoted by major market participants in New York and Tokyo of US$200 billion to US$300 billion at its peak in mid-1998.[5] In recent years, the amount has been estimated as high as US$1.2 trillion, using Chicago Mercantile dollar–yen trading net open positions. A crude estimate of the current level is therefore roughly US$500 billion to US$600 billion[6] (Figure 1).

Since the spread between the US Fed funds target rate and the Bank of Japan official discount rate remains roughly 5 percent, the average interest spread from the average increase in yen carry trade alone was US$25 billion per year (5 percent spread on an average volume of US$500 billion of carry trade). However, since the yen depreciated from ¥85 in 1995 to around ¥120 or roughly 30 percent over 12 years or about 2.5 percent per year, the rough gain in one year would be US$37.5 billion, which is the "gift" for those engaged in carry trade.

The willingness of banks in low-interest rate countries to lend to fund the carry trade has, since the early 1990s, created a massive industry that funded hedging and speculative financing, and perhaps ultimately created the conditions for borrowers to engage in Ponzi financing. The cheap financing generated by the carry trade "underwrote" the rise of hedge

[5] de Brouwer, G. J. (2001), *Hedge Funds in Asia*, Cambridge, Cambridge University Press.
[6] Ng, A. (2006), "Estimating the carry trade using bank lending statistics", Unpublished mimeo, Bank Negara Malaysia, December.

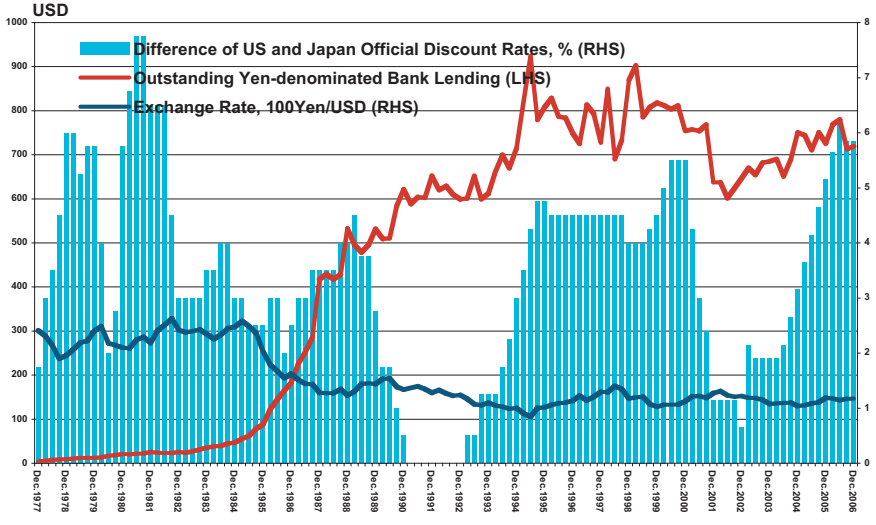

Figure 1. Total international outstanding yen-denominated bank lending (exchange rate adjusted, excluding domestic lending in Japan)
Source: BIS, Eurostate.

funds and other derivative trading since the early 1990s. Speculative and Ponzi financing is much more difficult when the carry costs are high. In other words, excessively low interest rates and underlending in some markets can spread to other markets globally through the carry trade.

During the 1997–1998 Asian crisis, I estimated that the carry trade helped fund some of the speculative activities against East Asian currencies, so that it was no accident that some of the banking shocks were connected with the volatility in the Japanese yen during that period. BIS data showed that between 1996 and 1999, Japanese banks cut US$47.4 billion from the five crisis nations amounting to about 5 percent of their GDP, and a total of US$192.5 billion from Asia between 1995 to 1999 (mostly from Singapore and Hong Kong).[7] It was the combination of the carry trade flows and international bank lending withdrawal, added to their own fragilities arising from corporate overleverage and bank risk management and supervision, that broke the banking systems in Asia and deflated their earlier asset bubbles.

[7] For a fuller explanation, see Andrew Sheng, "Japan and the Asian crisis", Chapter 2 in forthcoming book on Asian crisis.

Small wonder that the number of hedge funds, private equity and private banking investors who engage in the carry trade accelerated in the last decade. From only US$500 billion in size in 2000, hedge funds grew to nearly 10,000 by number with US$1.4 trillion in assets by 2006, whereas the private equity business grew rapidly from US$300 billion to nearly US$700 billion over the same period. Both rely on cheap market funding to hedge or speculate in emerging market assets, particularly currency, stock market and derivative products.

5. Where Do We Go from Here?

The good news is that the corporate sector in the US and the rest of the world is, as far as all indicators can tell, in reasonable shape, although central banks have been worried about the growing level of household indebtedness in many markets for some time.

Moreover, Asia is in pretty good macroeconomic shape, with still large current account surpluses and fairly robust fiscal positions; and corporate debt levels have been reduced substantially since the Asian crisis. Banking supervision has tightened up considerably since the crisis, foreign exchange reserves are at record levels and regional efforts to work together against external shocks have gathered momentum. However, Asian stock markets and real estate prices have also risen considerably since 2003. It is too early to say that Asia has decoupled from the US since one-third of Asian exports go to the US alone, if indirect exports are taken into consideration. In reality, the power of Japan (US$4.5 trillion in GDP) and China (US$2.5 trillion) to become the engine of growth in a US$45 trillion world is still small relative to the US (US$13 trillion).

The old adage still applies. When the US sneezes, Japan catches a cold and the rest of Asia gets pneumonia.

What should be done about the global banking system, its supervision and architecture?

There is no doubt in my mind that the reforms since the Asian crisis, with the creation of the Financial Stability Forum, the reforms in global standards in accounting, information disclosure, corporate governance, and multilateral surveillance, have collectively improved the resilience of the global financial and banking system. Many of the emerging markets are busily implementing the Basel II Accord with varying degrees of success, the new international financial reporting standards, and also

tightening supervision using IOSCO, Basel, International Association of Insurance Supervisors, and other standards.

But in spite of the huge efforts in improving surveillance and supervision over global and national financial systems, I am also clear in my mind that market discipline has declined under the conditions of excess liquidity, since making money through leverage and speculation has proved much easier and cheaper than engaging in manufacturing and service exports. Only after the sub-prime crisis have risk spreads in the bond and equity markets widened somewhat to reflect the underlying risks in credit and market volatility, let alone legal and accounting risk. Fair-value accounting is in real jeopardy when you try to "value to model", and there is no active market in such exotic products to price such products properly. "Price to Model" is not universally accepted as a market standard on a transparent basis, since many such derivative products are priced by the sellers, not clearly to the advantage of buyers.

A further problem driving financial innovation, including the "fair-value accounting" issue, is the current tendency to go for fee-income amongst banks and other financial intermediaries, in that these products actually bring forward future income into current fee income through derivative packaging. This short-term "we want it now" mentality can create "shell-games", where complex derivative products hide the true nature of the transaction and the risks from the ultimate buyers. In other words, some types of financial innovation can bring future risks into the present without telling the buyers that such future risks cannot be quantifiable. The greed for current fee-income at all levels of the supply chain (including the prime brokers and rating agencies) will not transmit the true risks of such assets to the market.

Overall, in the pursuit of financial innovation, regulators have been too sanguine in being blind-sided or dazzled by the wizardry of derivative products that disguise the true level of leverage. We come back to the lesson of the LTCM crisis — those who fly by black boxes, die by black boxes. There are already signs that the accounting systems, back-offices and risk management models (of even the most sophisticated investment banks and hedge funds) are not in position to properly control their derivative market risks, nor in identifying some of the true nature of such risks.

In the end, we have to recognize that there is no "End of History" in financial innovation, nor can we find the magic formula of innovation to infinitely postpone the trade cycle. Derivative products, like all financial products, are only two-edged tools. If they are properly used, and the user knows how to control his or her risk appetite, the tools are useful. If not,

they can also inflict losses, not just to the users, but also to the community at large.

There is an interesting sub-lesson from the perspective of emerging markets in the recent sub-prime losses. It is only those "sophisticated" banks that engaged in CDOs and such trade that got hurt. The latecomers and less sophisticated banks that avoided exotic products because they did not understand or did not have the systems or tools to manage such sophisticated products were not affected at all.

What does all the above analyses tell us? We cannot conclude simply that we should not have financial innovation, nor that sticking to basic banking can avoid derivative risks. If we believe that it is the non-transparent and excessive "layers of leverage" in derivative finance that is the vulnerable point in financial markets, then regulators have to have a reasonable handle or benchmark indicator on the "thin ice" zone where speculative finance in an economy moves to Ponzi financing. To think that market forces themselves will control Ponzi financing will not be realistic, especially since there is a high level of opaqueness in derivative markets. In other words, how do we stop derivative shell-games from happening?

This is a real challenge for regulators. Until the sub-prime crisis, most regulators would be willing to admit that they are behind the curve in financial innovation and are willing to trust market leaders in financial innovation to get their pricing, systems and risk controls right. This is the "let the prime brokers and rating agencies take care of the risk monitoring" frame of mind. This mindset works if the central banks can stand by and let those players who didn't control their own risks and their mistakes fail, even at the cost of contagion and pain to the rest of the market. In practice, this does not appear to be the case. Hence, the moral hazard that a speculator can move quickly from speculative finance to Ponzi finance at high private gain and social cost clearly is a disturbing issue.

Personally, I am not part of the "stop the derivative train and regulate" camp. However, I feel that the regulator community must now seriously bite the bullet and confront the current methodology of regulating complex derivative markets. I have not had the opportunity to think through how to do this, but my own instinct is to examine closely the following:

- Kick the tires at the underlying assets to ensure that credit procedures and legal risks and back-office procedures are sound.

- Re-examine the present tendency to try and get "fee-income" at all costs, which drives banks and financial intermediaries to innovate without fully thinking through the consequences. Much of this would depend on the proper measurement of income that is "brought forward" as a fee-income, but may actually be at the cost of future profits.
- Explore how to measure the "layering of leverage" in financial markets and how underpricing of risks can spread risks through contagion channels.
- Re-examine the fundamental question of transparency in derivative markets, to see how markets as a whole can have a better understanding of the risks involved, specifically liquidity measures.
- Re-examine the role of rating agencies, particularly whether there could be some public funding to ensure that the conflict of interest in being paid for giving ratings can be ameliorated.
- Have a better understanding of the macro-prudential implications of macroeconomic policies, not just nationally, but on a global scale.

Financial innovation must continue for markets to thrive. But the rules of the game for financial innovation need to be carefully thought through without getting the whole market to pay for mistakes of the few. I have to admit that it does take a crisis and real pain and losses for everyone to wake up to the realistic benefits and risks of finance. Unfortunately, there is no substitute for getting the basics and fundamentals right.

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Basel II, Regulation and the Sub-Prime "Crisis"

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The papers at this conference have developed a coherent and consistent explanation of the causes and consequences of what, we are generally agreed, would be premature to call the sub-prime "crisis". The consensus of opinion is that the recent turmoil in the credit markets has its roots in the "originate and distribute" model of banking that has become such a central feature of the financial system in the past decade. Until recently, central bankers and regulators have perhaps been a little too ready to assume that this was a trend that had market-stabilizing properties. In particular, we have tended to suppose that collateralized debt obligations (CDOs) and credit derivatives have allowed risk to be distributed around the financial system so that no single institution would have a life-threatening concentration of bad assets. While this is one possible consequence of recent financial innovation, it has also had some less welcome consequences for financial stability that this conference has identified.

From the perspective of a bank regulator, the move to the "originate and distribute" model seemed a positive development as it shifted risk away from the core payments system towards other parts of the financial system — insurance companies, investment funds, pension funds, and ultimately hedge funds — which were more willing and able to absorb it. As a result, the risk of a major failure at the core of the payments system appeared to have been significantly reduced.

However, instead of this benign scenario, the sub-prime turmoil during the summer of 2007 resulted in the evaporation of liquidity in markets for asset-backed securities and gridlock in the interbank market. As banks diverted liquidity to support the off-balance-sheet vehicles that they had

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established to invest in CDOs, hedge funds were forced to liquidate their holdings of otherwise sound assets, producing cascade effects through financial markets.

Only one part of the unfolding scenario has so far run according to the script. No major financial institution has failed as a result of the sub-prime turmoil, although it has claimed a number of victims in the US mortgage industry and among several smaller German banks, and the losses at some major banks have exceeded analysts' expectations. The problems at Northern Rock in the United Kingdom also briefly suggested that the sub-prime turmoil might spillover into the core payments system, with the result that all of our too confident assumptions about the beneficial consequences of financial innovation would need to be revisited.

By way of rounding off our discussions, I thought it would be helpful to consider the extent to which the new Basel II capital adequacy framework — which most bank regulators are still in the process of putting in place — might have resulted in a different outcome to the sub-prime turmoil. Put simply, the question I would like to consider is as follows: would Basel II have helped to avoid the sub-prime turmoil had it already been in place?

The first point that needs to be emphasized is the very important role of the original Basel Capital Accord (Basel I) in creating the incentives for the emergence of the "originate and distribute" model of banking. Under Basel I, if a legal opinion supported the view that the originating bank no longer had a claim on the securitized assets, these assets could be treated as "off-balance-sheet" for regulatory capital purposes and thus, banks did not have to hold capital against them. As a result, a bank could securitize residential mortgages, provide the credit enhancement and take the first loss piece of the securitization, and still find that its capital requirements were lower than if it had held the original assets on its own balance sheet. Nonetheless, the risks to which it was exposed were substantially greater than if it had simply kept the mortgage portfolio on its own books — as it still had most of the risk of default, with little of the benefit from holding performing assets. The point that needs to be emphasized is that a good deal of the motivation for securitizations derived from banks' desire to reduce their required regulatory capital under Basel I and was thus an example of regulatory arbitrage

Under Basel II, the attraction of securitization to originating banks is materially reduced. The overarching purpose of Basel II is to bring regulatory capital charges closer to underlying "economic" risk. To the extent

that these are better aligned, banks' incentive to securitize in order to lower their regulatory capital requirements will be reduced. In developing Basel II, the Basel Committee sought to limit banks' ability to manipulate regulatory rules to lower their regulatory capital held on retained, concentrated first loss positions.

The treatment of securitization exposures under Basel II differs depending on whether a bank is using the standardized or internal ratings-based (IRB) approaches. In the case of the standardized approach, all positions in a securitization retained by the originating bank will be assigned a capital charge. In addition, stakes in securitizations rated below BB+ held by an originating bank (or B and below for an investing bank) will have to be deducted from regulatory capital. Thus, depending on the securitization tranches retained by an originating standardized approach bank, it could be required to have more capital than if it had not securitized the assets in question. For banks using the IRB options for credit risk, the Basel Committee has offered a choice of calculation methodologies, the SFA (supervisory formula approach) and the RBA (ratings-based approach). Their main difference from the standardized approach is that an IRB bank will never be required to hold more capital in a securitization than had it held the same assets on its balance sheet.

Another basic principle of the Basel II approach to securitization is that of the "clean break". If an originating bank supports its own securitization ("support" can include subsidizing the costs of servicing or subsequently substituting better assets in a special purpose vehicle, SPV), any credit risk obviated by securitization returns to the bank. The Basel II rules are also designed to address situations in which a bank provides "implicit support", defined as arising "when an institution provides support to a securitization in excess of its predetermined contractual obligation". The first consequence would be that an originating bank, supporting its own securitization, would have to hold capital to cover all the exposures encompassed by the transaction and to disclose publicly that it had provided noncontractual support and the capital impact of this action. If the bank were to be found to have provided implicit support on more than one occasion, it would be required to disclose this publicly, and the national supervisors have a range of options, including, among other things, requiring the bank to treat all securitized assets as though they had remained on its balance sheet for regulatory capital purposes.

In these respects, the new capital adequacy framework might have significantly reduced the incentives for banks to engage in the "originate

and distribute" model and, hence, might have forestalled some of the regulatory arbitrage-driven financial innovation that has contributed to the recent market turmoil.

Nonetheless, although Basel II contains a number of positive features, a balanced scorecard would also need to note that in a number of respects it can be considered at best only a partial fix of the problems that have contributed to the recent turmoil. There are three factors in particular which seem to be worthy of comment: the central role played by credit models under the IRB approaches; the role of consolidation criteria which are outside the scope of Basel II; and the emphasis that has been placed on credit risk at the possible neglect of liquidity risk.

Under the IRB approaches, Basel II makes internal ratings systems and credit models central to the calculation of banks' regulatory capital in respect of their credit risk. The aim is to produce more fine-grained and sensitive measures of risk. While the systems employed by the most sophisticated international banks are undoubtedly capable of generating more finely-tuned risk assessments than the broad brush measures set by regulators, two important reservations need to be entered. First, there remain issues concerning the robustness of credit models, especially given the instability of the correlations on which they are constructed. Trends in the US sub-prime market provide one such illustration. While obviously many factors were at work in contributing to the rising levels of bad debts in the sub-prime sector, an important — and so far overlooked — factor was the changing structure of housing finance in the US Itself partly the consequence of the widespread adoption of credit risk models, changes in the way in which US households financed the purchase of homes completely changed the nature of the correlations on which many lending decisions were based. Past default data reflected the experience of a more stable market in which interest rate risk was not assumed by the borrowers as their mortgages were nearly all 30-year fixed rate deals. As soon as adjustable rate mortgages (ARMs) and interest-only mortgages, especially those with ultra-low teaser rates, became a significant proportion of the market, its dynamics were changed fundamentally. And this is where models-based lending has come unstuck.

A second reservation is that credit risk models are constructed around business-as-usual assumptions. Although banks using the IRB approaches need to ensure that default probabilities and loss estimates are calculated through the cycle as well as on a point-in-time basis, the periods of most extreme market stress go beyond what might be expected to arise from

normal cyclical factors. Basel II tries to correct for this by also requiring IRB banks to conduct regular stress-testing, but supervisory approaches to setting and assessing stress tests are still quite rudimentary. One of the main issues to emerge from the discussions at this conference has been the need for regulators to concentrate on "fat tail" events. To the extent that Basel II inhabits a world in which risks are normally distributed, its risk assessment framework will need to be supplemented and enhanced before we can be reasonably confident that capital is adequate to guard against such low-probability, high-impact events.

If these problems exist in the developed markets, in the emerging markets they are raised to a higher power. An important feature of emerging market economies is that they tend to be more exposed to potential fat tail events than the developed economies. Although they have so far escaped relatively unscathed from the recent market turmoil — in contrast to previous bouts of financial instability in the 1990s — nonetheless, this feature of the emerging market financial systems remains important for assessing appropriate levels of capital. Against this background, authorities in the emerging market economies need to carefully consider whether it is really necessary for them to offer the full range of options for assessing credit risk under Basel II. In particular, they need to consider whether or not their banks have the technical capacity and requisite data to be able to implement the IRB approaches properly. In some cases, adoption of the "advanced" approaches under Basel II seems to have become a matter of national pride, irrespective of whether or not the necessary preconditions are in place. Basel II could potentially hinder rather than help the development of more stable financial systems if it is inadequately implemented.

My second observation concerns the failure by auditors and regulators to consolidate many of the structured investment vehicles (SIVs) or "conduits" with their sponsoring institutions. The abuses to which off-balance-sheet vehicles lend themselves (and as Enron so graphically illustrated not so very long ago) should give regulators pause before permitting banks to exclude them from the scope of their consolidated returns. Whatever accounting standards might indicate, bank regulators need to adopt a more cautious approach. If there is a possibility that reputational factors might require a bank to support an ostensibly off-balance-sheet vehicle, then it would only be prudent to consolidate it with the parent institution. This has been HKMA policy towards off-balance-sheet vehicles and it may not be coincidence that banks in Hong Kong have not sought to establish SIVs as a way of investing in asset-backed securities. Although the Basel II

capital requirements apply at a consolidated group level, the framework itself does not address the relevant consolidation criteria. There is now a strong case for the international regulatory community to revisit the question of what should and should not be consolidated for regulatory purposes, and perhaps to agree some guidelines on this issue.

A final topic to which the international regulatory community must now give much more attention is that of liquidity. In the Basel II scorecard, an important debit entry is that by absorbing so much regulatory energy over the past decade, it has prevented attention from being devoted to other threats to financial stability which are now at least as serious as credit risk. It is worth remembering that until the 1970s, bank regulation was almost exclusively concerned with the regulation of liquidity — usually in the form of reserve requirements — and it was with the change in the tools of monetary policy that regulatory attention shifted instead to credit risk. Arguably, the pendulum has swung too far in the direction of credit risk and now the regulatory community needs to return bank regulation to its roots. However, as has been pointed out in this conference, the traditional supervisory approach to liquidity risk management — ensuring that an institution has a sufficient stock of liquid assets to ensure that it can survive to the next weekend — is no longer sufficient. Bank regulators need to take a page from the book of securities regulators and concentrate equally on market liquidity risk. With the rise of the "originate and distribute" model of banking, this risk has now become much more central to ensuring financial stability.

The steps needed to address the limitations of Basel II, which has been my main theme, do not exhaust the regulatory policy issues thrown up by the sub-prime turmoil. By way of conclusion, it is worth mentioning several other issues which policy-makers will need to address, a number of which have been mentioned — at least in passing — in several of the papers presented at this conference.

The first concerns the practice of "marking to model", The models that were widely used for the purposes of valuing thinly traded CDOs and similar instruments appear to have assumed the existence of market liquidity that simply evaporated during the turmoil of mid-summer 2007. One of the famous logical fallacies is known as the "fallacy of composition", in which it is assumed that what holds for the part also holds for the whole. When the volume of sales by CDO holders led to the emergence of one-way markets and yet valuation models assumed a ready secondary market, there you have a vivid illustration of the consequences of other-

wise sophisticated risk managers committing an elementary logical blunder. However, this problem is not easily fixed, as it would be mathematically difficult to model such scenarios. What this illustrates, therefore, is that we need to maintain a healthy dose of skepticism towards the output of our models, and should beware of placing too much reliance on them for a wide range of purposes.

The latter observation applies particularly to the practice of marking to model under international financial reporting standards. Bank regulators and accounting standard setters have been locked in a debate for some time concerning the appropriate valuation basis for nontraded or thinly traded financial instruments. The "fair value" concept has received strong support in accounting standard-setting bodies, some of whose members have sought to extend it to the valuation of traditional commercial banking assets. The rise of the "originate and distribute" model of banking seemed to give strength to their arguments. Nonetheless, the sub-prime turmoil has enabled us to put the arguments in favor of fair value into better perspective. The idea that marking to model might provide an adequate valuation basis for nontraded assets, or assets that are thinly traded, must now be subject to much more scrutiny than in the past. In particular, the strong push by some accounting standard setters towards requiring fair-value accounting for all financial instruments (a point of view strongly endorsed by some members of FASB in the US) ought now to give way to a period of reflection.

Another issue raised by several papers in this conference concerns the division of responsibilities between central banks and specialist regulatory agencies. Several presenters have argued that the response to the sub-prime turmoil shows the shortcomings of a regulatory system in which the central bank is not also the bank regulator. Clearly, as I have argued in a series of papers in the past, crisis management arrangements do need much more careful consideration than perhaps they received in the mid-1990s when the single-regulator model was first popularized. Given the propensity of emerging market economies to periods of financial instability, there is a very strong case for them retaining the central bank as the banking supervisory agency, especially as their financial systems remain heavily bank-dominated. In advanced economies, the arguments for and against the separation of monetary policy and banking supervisory functions are, as always, very finely balanced. However, it is difficult to generalize from recent events in the UK to conclusions about the single-regulator model per se. Those looking for lessons to be drawn from

the Northern Rock episode might care to focus on the very wide range of responsibilities of the UK's Financial Services Authority, which functions as both a prudential and a consumer protection regulator, concerned with misselling and other irregular sales practices. At the time it was established, there were those who argued, myself included, that such a combination of responsibilities was sub-optimal and was likely to detract from its role as a prudential regulator. There were concerns that regulatory attention and resources would be devoted to consumer protection issues given their much greater frequency of occurrence. There is certainly a case to be answered as to whether this was a factor in its supervision of Northern Rock.

Finally, it is necessary for regulators to consider whether or not the regulatory burden may have helped create an environment in which market-destabilizing financial innovation could flourish. I have already noted the role that regulatory arbitrage under Basel I created the incentives for the emergence of markets in securitized assets. The regulatory community needs to reflect on whether the objectives of regulation are best served by piling on ever more detailed and complex regulations that apply to certain sectors of the financial industry, only to find that the risk has migrated elsewhere. The very clear lesson of the recent sub-prime turmoil is that risk that has migrated elsewhere in the system has not been eliminated — it simply awaits the opportunity to return home when the conditions are right. Thus, we must ask ourselves whether regulation that merely encourages risk to move to more opaque parts of the financial system is really that healthy. Perhaps the best response to the recent turmoil would not be to reach for the rulebook, but instead to seek some rebalancing of the regulatory burden.

International Agenda

September 27, 2007

9:00 am Registration

9:40 am Welcoming Remarks

Charles L. Evans, President and Chief Executive Officer, Federal Reserve Bank of Chicago

Jaime Caruana, Counselor and Director, International Monetary Fund

10:00 am Session I: Current State of Financial Globalization

Moderator: Douglas D. Evanoff, Federal Reserve Bank of Chicago

Philipp Hartmann, European Central Bank; Falko Fecht, Deutsche Bundesbank; and Hans-Peter Grüner, Mannheim University, Germany

Gianni De Nicolò, International Monetary Fund

Philip Lowe, Reserve Bank of Australia

Discussant: Gerard Caprio, Jr., Williams College

12:00 pm Luncheon and Keynote Address

Introduction: Daniel G. Sullivan, Senior Vice President and Director of Research, Federal Reserve Bank of Chicago

Speaker: John Lipsky, First Deputy Managing Director, International Monetary Fund

2:00 pm Session II: Globalization and Systemic Risk — Theory

Moderator: Hesna Genay, Federal Reserve Bank of Chicago

Edward J. Kane, Boston College

Xavier Freixas, Universitat Pompeu Fabra, Spain

Hyun Song Shin, Princeton University; and Masazumi Hattori, Bank of Japan

Discussant: Richard J. Herring, University of Pennsylvania

3:45 pm Break

4:00 pm Session III: Globalization and Systemic Risk — Nonbank Financial Intermediaries

Moderator: David S. Hoelscher, International Monetary Fund

Julian Adams, Financial Services Authority, UK

Mohamed A. El-Erian, Harvard University

Discussant: Dennis E. Logue, Dartmouth College

5:45 pm Reception

6:45 pm Dinner and Keynote Address

Introduction: Jaime Caruana, Counselor and Director, International Monetary Fund

Speaker: Guillermo A. Calvo, Professor of International and Public Affairs, Columbia University

September 28, 2007

7:30 am Continental Breakfast

8:30 am Session IV: Globalization and Systemic Risk — Banks

Moderator: Luca Benzoni, Federal Reserve Bank of Chicago

Nicole Allenspach and Pierre Monnin, Swiss National Bank

Andrew G. Haldane, Bank of England

Martin Summer, Austrian National Bank (OeNB)

Discussant: Grant Spencer, Reserve Bank of New Zealand

10:15 am Break

10:30 am Session V: Globalization and Systemic Risk — Capital Markets

Moderator: Richard J. Rosen, Federal Reserve Bank of Chicago

Kenneth M. Lehn, University of Pittsburgh

Chester S. Spatt, Carnegie Mellon University

David A. Hsieh, Duke University

Discussant: Liliana Rojas-Suarez, Center for Global Development

12:15 pm Luncheon and Keynote Address

Introduction: Charles L. Evans, President and Chief Executive Officer, Federal Reserve Bank of Chicago

Speaker: Frederic S. Mishkin, Member, Board of Governors of the Federal Reserve System

2:15 pm Session VI: Crisis Resolution in a Global Context

Moderator: Eva Hüpkes, Swiss Federal Banking Commission

John Lane, Federal Deposit Insurance Corporation

María J. Nieto, Bank of Spain; and Garry J. Schinasi, International Monetary Fund

Mattias Persson, Bank of Sweden (Sveriges Riksbank)

Discussant: Pascual O'Dogherty, Banco de México

4:00 pm Break

4:15 pm Session VII: Where to Go from Here — Policy Panel

Moderator: George G. Kaufman, Loyola University Chicago and Federal Reserve Bank of Chicago

Jaime Caruana, International Monetary Fund

Richard Portes, London Business School

William L. Rutledge, Federal Reserve Bank of New York

Andrew Sheng, China Banking Regulatory Commission

Michael W. Taylor, Hong Kong Monetary Authority

6:00 pm Reception

6:45 pm Dinner and Keynote Address

Introduction: Charles L. Evans, President and Chief Executive Officer, Federal Reserve Bank of Chicago

Speaker: Michael D. Bordo, Professor of Economics, Rutgers University

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