EDITED BY GEORGE MERGOS
MARINA PAPANASTASSIOU

FOOD SECURITY AND SUSTAINABILITY

Investment and Financing
along Agro-Food Chains

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George Mergos • Marina Papanastassiou
Editors

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Preface

The relevance of this volume is very timely. With evidence on climate change accumulating, the issue of feeding 9.5 billion people in 2050 climbs high up in the international agenda. There is little doubt that global warming represents for mankind the huge challenge of making development sustainable. Hence, despite current efforts, these two issues, food security and sustainability, remain unsettled. It is not just that the world needs to produce more food to accommodate rapidly rising demand due to fast-growing populations and incomes, but food systems are also under severe stress due to climate change, there is a diet shift to animal products and resource degradation.

After the food crisis of the 1970s, the downward trend in food commodity prices in the 1980s and the 1990s led to complacency. The year 2002 represents, though, a turning point with a food price trend reversal and increased food price volatility initiating renewed interest on food security and sustainability. However, this time the global terrain is different. Globalization has elevated a large part of the global population to affluence, changing consumption, production and trade patterns, and significantly affecting population well-being everywhere.

Clearly this challenge needs to be met on all levels of the political system, that is, institutions of supra-national governance, national governments and sub-national actors. In addition, it requires not only strong effort but also innovative governance practices. At the international level

there is strong effort in this direction, and achieving food security is the second of the UN Sustainable Development Goals with the specific target to solve the problem of hunger by 2030. However, the issue has not received similar attention at national, sub-national or even at household levels due to its complexity and the difficulties encountered in policy analysis and design.

Methodologically, food security has been analysed, up to very recently, using traditional food-supply demand balances at global, national and household level. The objective was to address issues of chronic or transitory food insecurity, purchasing power, financing of food imports, buffer stocks and commodity price volatility. However, over the next three–four decades the problem of food insecurity gets increasingly complex, because it should be considered within the context of climate change and resource constraints, at a time of an accelerating economic and social transformation due to globalization. Thus, the nexus of food security, sustainability and globalization establishes a new perspective in the very old issue of food security. This new perspective should take into account complicated Global Value Chains, responsible investment, sustainability issues and recent advances in consumer behaviour. In addition, there are other important issues that should also be considered, such as the efficiency of distribution chains in reaching households in need, the impact of microfinance for generating purchasing power, the importance of price and income volatility, risk mitigation policies, as well as the importance of GMOs for global supply–demand balances. This new perspective gives a new direction in the research agenda on food security, globalization and sustainability. Hence, this is a timely volume because food security has been designated as a key priority for sustainable development and as such has been acknowledged by all major stakeholders responsible for the future of global economy and human welfare. In the light of this, the volume includes contributions of researchers from major international organizations, national research institutions, universities and the private sector.

The volume is by necessity eclectic. It aims to touch upon only a few of the dimensions of food security. The volume begins with two chapters on the shifting market environment and green growth strategies. Then it proceeds to discuss issues of Global Value Chains in the agro-food system,

investment, finance and risk. The second part of the book presents food-security-related policies in a number of case studies drawn mainly from the Mediterranean area.

When it comes to summarizing the discussion assembled in this volume, the message is mixed. Although food security and sustainability are receiving increased attention and the commitment to improve food security is widespread, the evidence on actual policy making is scarce. At the core is the lack in understanding the complexity of the issues and the need for interdisciplinary analysis. Food security and sustainability are at the crossroads of three areas: science, economics and governance. Hence, the identification of evidence-based policy measures would require the collaboration of researchers in the three areas. This will be the main challenge for future research in the domain of policy design for food security and sustainability.

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Acknowledgements

This book stems from the inaugural workshop of the *Mediterranean Center for Food Security and Sustainable Growth* (MED-SEC) that was established in early 2015 as an interdisciplinary network of researchers engaged in research, education and policy making in the area of Food Security, Development and Sustainable Growth. The Workshop titled "Investment and Financing along the Agro-food Value Chain for Food Security and Sustainability" was convened in Athens, Greece, in May 2015. The high-quality contributions presented at the workshop by leading experts from academia, industry and international organizations provided state-of-the-art knowledge on the challenges food security poses to the world.

The location of the Workshop was ideal, as Greece is located at the crossroads of South East Europe, Eastern Mediterranean and the wider MENA region which faces the impact of food insecurity. Countries in the region experience limited and fragile natural resources—in particular, land and water—and acute vulnerability to climate change. In addition, the unstable political environment, conflicts that tantalize the region, imposes further pressure on food prices and on available land for cultivation among other factors

This volume includes papers presented at the Workshop, as well as papers by other prominent international experts who kindly responded to the editors' invitation to join and support this project. As a result,

this edited volume reflects the multidisciplinary approach adopted in the Workshop as the only way to achieve an in-depth understanding of the multifaceted nature of food security.

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Food Security and Sustainability: Globalisation, Investment and Financing

George Mergos and Marina Papanastassiou

Introduction and Overview

The world has ample food, but a billion of people suffer food and nutrition insecurity (von Brown 2014). At the same time, food systems are under severe stress due to climate change, population growth, a shift in diets and continuous resource degradation (Godfray et al. 2010; Nelson et al. 2010). Food security has been a long-standing issue, but after a period of complacency in the 1980s and the 1990s, it has recently attracted renewed interest due to food price crises and high food price volatility, forcing governments to consider food security as a stated strategic

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objective. Problems of long-term food supply and chronic food insecurity are caused by factors that affect long-term food demand and supply, as well as by trade prospects in the horizon of 2050. But, food insecurity results, also, from lack of purchasing power, volatility in international food prices, food supplies and incomes, at national or at household level, inter alia. The link between food insecurity and poverty necessitates a strong research effort on poverty alleviation. Finally, public policy design to address chronic or transitory food insecurity at national, regional or household level is part of the research agenda (FAO 2014).

On the other hand, globalisation has brought sweeping changes in the global economy and has affected the operation of food supply chains that play a major role in determining food security at the country level. In addition, huge inefficiencies of the food supply chain and significant food loss and waste have a strong negative impact on food availability, productivity and the environment. The emergence of Global Value Chains (GVCs) dominating international investment and commodity trade represents a paradigm shift in policy design for food security. Also alternative conduits of mobilising the private sector in linking the millions of small stakeholders (small farmers, traders, processors) to international markets through more inclusive value chains need to be explored as to results and impact. In this context, this book explores how recent developments link a number of food security issues with recent trends in international agricultural trade and globalisation of agricultural production and manufacturing, the mobilisation of small stakeholders through innovative financing mechanisms, the green growth strategies that are promoted widely and the importance of risk. Then, these issues are examined in the context of a number of case studies mainly from the Mediterranean region.

Food Security and Sustainability: Renewed Interest on a Long-Standing Issue

Thomas Malthus in his *Essay on the Principle of Population* (1798) described a forthcoming population catastrophe where he predicted a forced return to subsistence once population growth outpaced growth of food production. The accelerated population growth rate in the twentieth century, in particular population growth in the developing countries since the 1950s,

renewed Malthusian fears expressed by the Neo-Malthusian Paul Ehrlich. Ehrlich, a biologist, in his book *The Population Bomb* (1968), a widely read publication that sold several million copies worldwide, argued that in the near future developed countries would be required to undertake some type of food rationing because starvation will be the result of over-population in developing countries. In the extreme case, he argued, the lack of food security in developing countries would be the trigger point to serious socio-economic and political developments worldwide.

The wide acceptance of these ideas led to the establishment, in 1968, of the *The Club of Rome* and the publication of the book *The Limits to Growth* (Meadows et al. 1972). It was argued that if present growth trends continue, and if associated industrialisation, pollution, food production and resource depletion continue unchanged, the limits to growth on this planet will be reached sometime in the next 100 years with the most probable result being the sudden and uncontrollable decline in population and industrial capacity.

Malthusian ideas, however, have not gone unchallenged. Ester Boserup, a sociologist studying pre-industrial societies in Indonesia, wrote in 1965 *The Conditions of Agricultural Growth: The Economics of Agrarian Change under Population Pressure* in which she puts Malthus on his head, claiming that population growth is good for the society as it fosters technical change and innovation. She claimed that people develop the required resources of knowledge and technology to increase food supply as necessary. She agrees that the environment poses limits that restrict population, but these limits can be changed using innovation and technological change, with population growth being the trigger for innovation to allow food supply to increase.

Further, Julian Simon, an economist, published two books challenging Ehrlich further stimulating the population debate: *The Economics of Population Growth* (1977) followed by *The Ultimate Resource* (1981), in which he argued that the relationship between population growth and economic growth was not as simple as assumed, and that the extent to which population pressure had an impact on resources was overstated. In his argument Simon suggested that population was the ultimate resource with the capacity to invent new technologies that relax resource limits. He also argued that the current views on population and resource issues fail to take the long view and demographic problems should not be examined in a short time frame.

It is interesting to note that while this debate was taking place, the Green Revolution was expanding rapidly in several parts of the developing world.

Green Revolution is the catchword describing a package of "research, development and technology transfer mechanism" in agricultural production that took place mainly in the 1950s and 1960s. The Green Revolution produced in the research centres (International Rice Research Institute (IRRI) and International Maize and Wheat Improvement Center (CIMMYT)) of the Consultative Group on International Agricultural Research (CGIAR), a global public agricultural research partnership, made widely available new high-yielding varieties of wheat, rice and maize, changing completely the food supply situation in many parts of the world. Although the Green Revolution should be credited to the work of a large number of unknown researchers and scientists of the CGIAR, Norman Borlaug, one of the founding members of CGIAR, has been named "Father of the Green Revolution" and has been awarded the Nobel Peace Prize in 1970 for saving over a billion people from starvation by changing food production technology in the new technology package combining high-yielding varieties of cereal grains with irrigation, modern management techniques, hybrid seeds, and chemical technology of fertilisers and pesticides.

It is also interesting to note that while the ideas of "resource constraints and the limits to growth" were popularised, leading to the establishment of the *Club of Rome* (Meadows et al. 1972), the research of Hayami and Ruttan (1971) has put forward and empirically verified an "induced technical change model" for agricultural development that builds upon the induced innovation hypothesis of Hicks in his *Theory of Wages* (1932), implying that these resource constraints can be relaxed by scientific discovery, technological change and innovation. The empirical evidence accumulated since the 1970s on the induced technical change hypothesis of Hayami and Ruttan supports strongly the theory of Boserup, "diffusing completely the population bomb" and shaping an optimistic view about the global food–population balances.

The debate between Ehrlich and Simon continued in the 1980s unabated. Simon criticised the conventional wisdom of resource scarcity arguing that it ignores the long-term decline in wage-adjusted prices of raw materials, which is in line with the induced innovation hypothesis of Hicks (1932). Simon argued that increasing wealth and technology make more resources available, because although supplies are limited physically they may be viewed as economically indefinite as new substitutes are assumed to be developed by the market. Simon, as Boserup in 1965,

argues that population is the solution to resource scarcities and environmental problems, since people and markets innovate. In this context it is interesting to mention the famous Simon–Ehrlich scientific wager in 1980, through the pages of *Social Science Quarterly*, in which they agreed betting on a mutually agreed-upon measure of resource scarcity over a decade leading up to 1990. Simon had Ehrlich choose five commodity metals. He chose copper, chromium, nickel, tin and tungsten, with Simon betting that their prices over a decade would decrease, while Ehrlich said they would increase. Ehrlich lost the bet, as all five commodities that were betted on declined in price from 1980 through 1990, the wager period. However, Ehrlich would have won if the wager was extended to 30 years, on four out of the five metals.

The food and energy crisis of the 1970s led to a fervent research on food and energy demand. The International Food Policy Research Institute (IFPRI) was established in 1975 as a research centre of CGIAR with the mission to undertake economic research to free the world from hunger and malnutrition providing research-based policy solutions that sustainably reduce poverty and end hunger and malnutrition. At the same time, a great deal of research in the World Bank was devoted to the definition of food security, the causes and the remedies of food insecurity and research on various aspects of the global food–population balance (see for example Reutlinger 1978, Reutlinger 1985). Policy research was also focused on particular problems of food insecurity, such as buffer stock operation, international finance of food imports for importing countries in periods of supply shortfalls with the objective of providing evidence-based policy options (see for example Huddleston et al. 1982). Other research has focused on the causes of food–population imbalances such as the observed worldwide rapid increase in grain demand, malnutrition and poverty, the lack of trickle-down effects of development to the poor, the proposal for a basic needs approach to poverty alleviation and on targeted measures to address food insecurity.

Significant attention was also given in that period to a rapidly increasing component of food demand, feed grain demand (see e.g. Mergos 1989). The observed rapid increase was in the indirect demand for grains used as feed in animal production to satisfy the rapidly growing demand for meat; this effect was called by some the graduation effect on food (grain). Even at
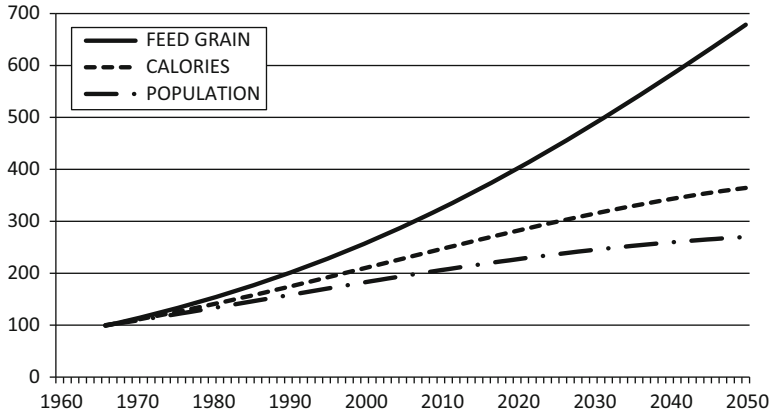
Fig. 1.1 Three indicators of world food demand (1966 = 100). Source: Adapted from Babcock (2008)

present, feed grain demand is projected to grow rapidly, reaching in 2050 a sevenfold increase compared to 1966, much faster than any other food item (see Fig. 1.1). The observed rapid increase in feed grain demand is explained as the result of changes in factors used in the course of economic growth, especially capital accumulation and labour outflow from agriculture, leading to the introduction in the livestock sector of capital-intensive techniques of production that are also grain-intensive. This leads to higher use of feed grain, lower use of traditional feeds and a changing composition of output, implying long-term prospects for very high growth in feed grain use in the world (see Mergos and Yotopoulos 1988).

Civil society initiatives have also led at the same time to the establishment of non-governmental organisations, such as the *Worldwatch Institute*, founded in 1974 by Lester Brown, who has been named by *The Washington Post* as one of the world's most influential thinkers, with the mission to accelerate transition, through research and outreach that inspire action, to a sustainable world that meets human needs with an emphasis on renewable energy and food. Brown has helped the shaping of the concept of sustainable development and founded, in 2001, the *Earth Policy Institute* with goals to provide a global plan for moving the world onto an environmentally and economically sustainable path, to provide examples demonstrating how the plan would work, and to

keep the media, policy-makers, academics, environmentalists and other decision-makers focused on the process of building such an economy.

The 1980s has been a period of unconstrained optimism about global food supplies (Mergos 1989). Prices of food commodities declined strongly in real terms and optimism about global food–population balances prevailed. On the cover page of a World Bank policy study appeared the following statement: "*The world has ample food. The growth of global food production has been faster than the unprecedented population growth of the past forty years.… Yet many poor countries and hundreds of millions of poor people do not share in this abundance. They suffer from a lack of food security, caused mainly by a lack of purchasing power*" (World Bank 1986). However, Mellor considered the situation with apprehension, stating that *"my message is a simple one: of thanks, for bounteous harvest in much of the world; of concern that complacency will diminish that bounty; and of apprehension, that the extreme complexity of the task of using that bounty to banish hunger will turn us away from the policies for its sustenance and use"* (Mellor 1986).

In the 1980s a shift in thinking on food security took place from global food–population balances to households and individuals. Whereas in the 1970s the focus of the debate was on national and global food supplies, in the 1980s the focus shifted to questions of access to food at household and individual levels. The shift was initiated by Amartya Sen with his book *Poverty and Famine: An Essay on Entitlement and Deprivation* (1981) with a focus on the causation of starvation in general and of famines in particular. Sen showed that the traditional analysis of famines concentrating on food supply is fundamentally wrong, theoretically unsound, empirically incorrect, and misleading for policy. He proved that the collapse due to various reasons of purchasing power of households or individuals, what he calls entitlement, in an entire country or region is principally the cause of famine, although adequate food supplies may be available close by.

This interest of food security research at household level continued in the 1990s identifying four core concepts, implicit in the notion of "secure access to enough food at all the time." These are: (a) sufficiency of food, defined mainly as the calories needed for an active, healthy life; (b) access to food, defined by entitlement to produce, purchase or exchange food; (c) security, defined by the balance between vulnerability, risk and insurance; and (d) time, where food insecurity can be chronic, transitory or cyclical.

The literature on household food security has developed taking into account developments in other fields. For example, the household itself is a problematic concept or it would be misleading to separate household food security from wider livelihood considerations. This assumes that poverty is the main cause of food insecurity and the two are inextricably linked together in policy interventions. Such a diagnosis implies that policy should be directed towards self-targeting interventions rather than imposing standards.

This approach has taken the form of an international action. Following the Millennium Summit of the UN in 2000 and the UN Millennium Declaration, eight Millennium Development Goals to be achieved by 2015 were adopted, the first of which is to eradicate poverty and hunger. A similar approach is suggested by Collier in his book *The Bottom Billion* where he challenges traditional wisdom and emphasises that the solution to endemic poverty (and hence food insecurity) in the overlooked "third world" countries whose inhabitants constitute the bottom billion of the world population is to resolve corruption and other internal governance practices and infrastructures that are ineffective by having collective action at the global level that will impose a radical new set of strategies upon these countries in order to force change upon them.

Current Developments and Future Challenges

The complacency of the 1980s and 1990s regarding the global food–population balances has given way to serious concerns about food security globally. The year 2002 seems to be a turning point (see Fig. 1.2). Food prices in real terms started an upward trend in 2002. Furthermore, the food price crisis of 2007–2008 drew significant attention to the issue of food security and caused serious concerns that extreme events may become more frequent in the future. However, even before the crisis it was obvious that food insecurity concerns are becoming a recurring theme, as it is estimated that about one billion people did not have access to sufficient, safe and nutritious food.

Starting in 2002, food prices exhibit not only an upward trend, but also higher volatility and spikes, as shown in Fig. 1.3. Price volatility affects household incomes and purchasing power and, thus, food security. In fact,
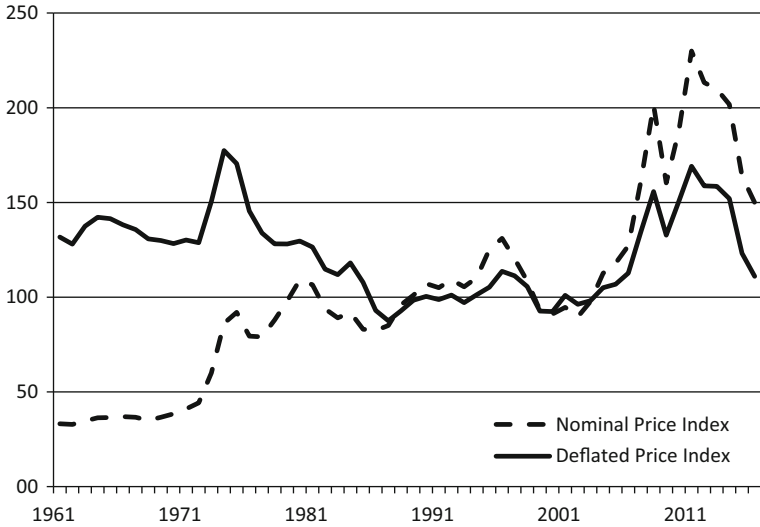
Fig. 1.2 Trends in Food Prices (2002–2004 = 100). Source: FAO Food Price Index Nominal and Deflated
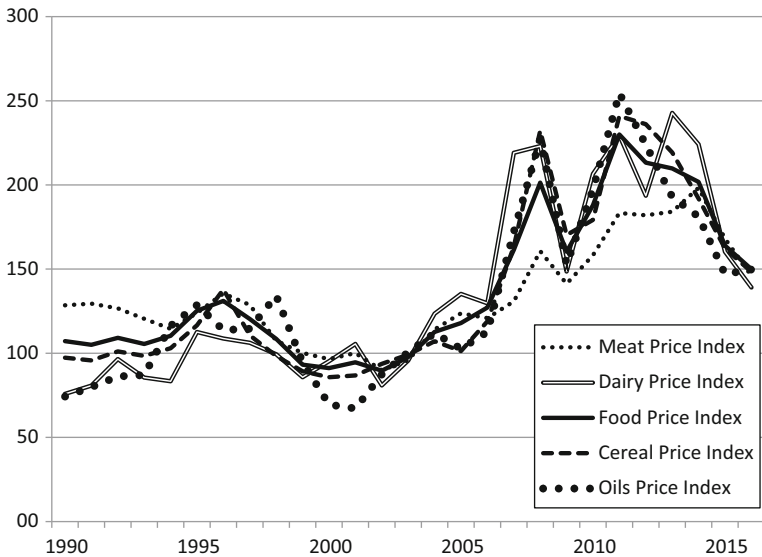
Fig. 1.3 Trends in Nominal Prices of Food Commodities (2002–2004 = 100). Source: FAO annual Food Price Indices, Nominal

price levels and volatility are interrelated in determining food security, with higher prices implying a stronger welfare impact of volatility for consumers, while the opposite is true for producers. Hence, focusing only on price spikes will not suffice to assess the overall welfare consequences of price volatility. Based on the view that volatility is the normal state of agricultural markets, three possible causes of international food price volatility may be considered: a decline in food demand elasticity, trade policies, and investment dynamics and speculation. With a universal increase in incomes, food demand is less price sensitive, leading to higher volatility. Restrictive trade measures adopted by many countries to protect consumers during periods of crises are considered to have contributed to the observed increase in prices. Another possible explanation is the recurrent nature of food crises (1950s, 1970s, 2000s) which might be related to the dynamics of investment and trade. Finally the role of speculation in the futures market on food price volatility has been quite controversial with diverging views on the formation of price bubbles.

In searching for the causes of this profound change several explanations have been offered, climate change being one of them. Stern with his book on the economics of climate change has raised public awareness about the consequences of climate change and the need to undertake immediate action for mitigation (Stern 2006). The nexus between food security, climate change and sustainability has become now the big issue and has generated great concern among academics and policy makers alike. An example of such concern is shown in an article that appeared in *Science* (Godfray et al. 2010). The paper claims that growing competition for land, water and energy will affect the ability to produce enough food globally.

It is shown, also, that although production of main grains and root crops increased only modestly over 50 years from 1960 to 2010, production of coarse grains increased by almost threefold, implying that it is meat demand that drives the food system. Perhaps globalisation has elevated a large part of the global population to affluence, changing food consumption towards foods of animal origin and also production and trade patterns, and significantly affecting population well-being everywhere. The paper advocates a sustainable intensification of production calling for policies of an interdisciplinary nature because of the complexity of the problem.

A major study by the IFPRI on *Food Security, Farming and Climate Change to 2050* suggests that if climate change is left unchecked it will

result in a 20 per cent increase in malnourished children in 2050 (25 million more than with perfect mitigation). The study calls for public policies that will address poverty and climate change resilience with broad-based income growth, investment in specific kinds of agricultural productivity and strengthening of international trade agreements (Nelson et al. 2010).

The 2015 Food and Agriculture Organization (FAO) State of Food Insecurity in the World states that although hunger has continued to decline, it remains an everyday challenge for almost 800 million people in developing countries. Thus hunger eradication and food security should remain a key commitment of decision-makers at all levels (FAO 2015b). A key factor for success in reducing undernourishment and food insecurity is economic growth but only when it is inclusive, providing opportunities for the poor, who have meagre assets and skills. Enhancing the productivity of family farmers and strengthening social protection mechanisms are key factors for promoting inclusive growth, along with well-functioning markets and governance.

Thus, currently, the nexus of food security, sustainability and globalisation establishes a new perspective in the long-standing issue of food security in the horizon of 2050. This new perspective should take into account a number of issues:

- Population is expected to reach 9.5 billion in 2050, with two thirds in urban areas; thus forecasts of long-term trends of food demand–supply balances are necessary for policy definition at global and country levels.
- Trade is an area that poses several challenges and risks in the definition of public policy for food security. International agricultural markets can be a source of food commodities for importing countries but also a source of revenue for exporting countries to finance staple imports.
- Linked to trade is commodity price dynamics in international markets and their relation to domestic prices and incomes. In this respect, the operation of complicated global agro-food value chains, foreign direct investment (FDI) and responsible investment are important consideration in the functioning of international agricultural markets, as well as the integration of small-scale agricultural production to local and GVCs.
- Productivity, investment and financing are important policy areas for bridging the yield gap, increasing food supply and incomes of small

farmers by linking them to markets, thus addressing food and nutrition insecurity in the majority of the rural areas of the developing countries. Gender issues are also part of the agenda as many agricultural households are headed by women.

- Resource efficiency and sustainability in the context of green growth strategies are important issues in attaining long-term food security at global and country levels. Promoting resource efficiency and sustainable consumption and production, decoupling economic growth from resource use and environmental degradation, and helping poor people to meet their basic needs will require behavioural changes in production and consumption decisions.
- Governance and institution issues at country and global levels are important considerations in the design of public policy for enhancing food and nutrition security.

Definition, Measurement and Analysis of Food Security

Sound policy analysis of any issue requires a clear definition and measurement capacity for the concept at hand. Food security has been an elusive concept. It means different things to different people and changes over time. Its measurement has also been difficult and controversial. It is, therefore, necessary to start with some definitions and measurements in the context of a methodological framework for addressing policy questions related to food security at global, national or even household level (Pinstrup-Andersen 2009).

Some Definitions

The concept of food security has evolved over the last 40 years reflecting changes in official policy thinking. Food security was defined in the World Food Summit of 1974, reflecting the global concerns of the 1970s, with respect to the volume and stability of food supplies. Thus, the term "food security" was initially used as a synonym of "food self-

sufficiency" at national or even global level, implying that the country or the world had access to enough food to meet the nutrition requirements of the population. This definition puts emphasis on the supply side of the food equation, either by domestic means, through local agricultural production, or from food imports, through the international market. The former considers the local resource production capacity, resource constraints, productivity and the operation of the agro-food supply chain, while the latter assumes that the country has sufficient foreign exchange to finance its food imports. On the other hand, "food sovereignty" has been, and still is, used to measure the capacity of any country to provide its population with the food needed or demanded irrespective of whether the food is domestically produced or imported from the international market (see e.g. Harrigan 2014).

However, availability of food at the national level does not imply access to food for the entire population, as Sen has shown (Sen 1981) and recent research indicates (Burchi and De Muro 2016). Hence, a proper definition of food security should take into account not only availability, but also access to food at the household and individual level. This has been widely recognised early and food security has been defined as access to enough food by all people to live a healthy and productive life. Thus, the food security definition was extended in 1983 to include the nutritional value of foods and food preferences of the consumer. In 1983, the FAO expanded its concept to include securing access by vulnerable people to available supplies, implying that attention should be balanced between the demand and supply side of the food security equation. According to this definition, a household is considered food-secure if it has the ability to obtain, either from its own production or from the market, the food required for its members to be food-secure (Maxwell and Frankenberger 1992). This definition is qualified to include transitory or permanent food insecurity at the household level, due to obvious reasons, food and non-food preferences of households as well as intra-household allocation of food to household members.

Finally, the current definition, adopted by the World Food Summit in 1996 (FAO 1996), is that food security exists when all people, at all times, have physical access to sufficient, safe and nutritious food to meet their dietary requirements and food preferences for a healthy and active life.

Measurement of Food Security

Food security policy formulation requires the definition of a conceptual framework where the various components of the food system are linked together and the impact of policy measures can be assessed (Barret 2010). Effective public policy needs to be built upon a clear understanding of the conceptual relations between means and ends. Following the definition of food security adopted by the World Food Summit (FAO 1996) four main dimensions of food security can be identified that also constitute the means to measure food security:

- Availability. This dimension describes the supply side of the food–population equation and is determined by the quantity of domestic food production and net trade.
- Access. This dimension pays attention to consumption and the demand side at the household and individual levels and examines the economic and physical access to food, with emphasis on the access by vulnerable people to food.
- Utilisation. This dimension looks at food utilisation in an adequate diet taking into account important non-food factors for households and individuals to attain food security.
- Stability. This dimension examines whether vulnerable households or individuals have access to food at all times.

Taking into account the time dimension, we can define food insecurity also with respect to its duration. Chronic food insecurity is long-term or persistent and results from extended periods of poverty, lack of assets and inadequate financial resources. Transitory food insecurity is short-term and temporary, caused by sudden shocks (economic or climatic). The concept of seasonal food insecurity, being a cyclical event, falls in between the two and is usually predictable, following a sequence of known, recurrent events and is seen, also, as transitory food insecurity.

These dimensions are combined in a conceptual framework that builds on the World Summit definition and integrates them into a system approach (Ecker and Breisinger 2012). In a country perspective the framework distinguishes between the macro and micro dimensions of food security.

Methodological Considerations for Food Security and Sustainability Analysis

A lot of work on food security in the long term (2050) at the global level focuses on the availability of food, the global production potential and the food–population balance. Such analysis requires building complex simulation models of the global food system where scenario analysis is used to forecast long-term trends in food demand, supply and trade, as the IFPRI model (see Nelson et al. 2010). The IFPRI model is the only global model that analyses simultaneously the impact of population growth, income growth in developing countries and climate change within an economic behavioural environment. It provides an appropriate and consistent framework for policy analysis and assessment of the effectiveness of alternative public policy measures either at global or national level. With the computing capacity expanding rapidly, we expect that the use of such complex models will be of great help in providing policy solutions to current economic challenges (Rosegrant 2013).

The main drivers of change of the food equation in the IFPRI model are on the demand-side population growth and the change in the composition of food demand due to income growth, whilst on the supply side, are resource constraints, productivity and technology. With 50 per cent more people to feed in 2050 at the global level, with almost all of the increase taking place in developing countries, and more demand for high-valued food (meat, dairy products, fish, vegetables and fruits) the food security challenges at global level are unprecedented. However, on the supply side another important factor has been added recently, that of climate change. Climate change is considered as a threat multiplier, being responsible for reduced productivity of existing varieties and cropping systems and resource degradation (See Nelson et al. 2010) leading to innovations for climate-smart agriculture (Branca et al. 2011, Neufeldt et al. 2013 and van Wijk 2014).

The building of such models requires an enormous amount of effort and information, contribution from various scientific disciplines and assumptions based on expert judgement about long-term developments in the macro-economic environment, technology developments and institutions. Partial analysis, although useful in highlighting aspects of the global food security situation, may not be considered adequate

to answer questions about the global food supply–demand balance. Similarly, biological models that are based mainly on the continuation of past trends and on expert judgement about technological developments are not appropriate for an accurate representation of the future because they lack the behavioural dimension of economics (see Godfray et al. 2010). If we have learned anything from the experience of the past 50 years and the scientific debate outlined previously, it is the importance of human ingenuity and the innovation capacity, responding to economic factors such as prices, inducing both technical and institutional innovations to address the problems society is facing. Hence, assuming that humanity will in the next 50 years be able to advance new technologies that respond to current challenges, such as climate change, generating new technology with the same pace as in the past 50 years, the future may not be as gloomy as portrayed in such global biological models.

Analysing food availability at the national or regional level is a similar exercise but much less complex and easier. A very simple indicator of food availability is the self-sufficiency ratio (SSR) of the various food items, bearing in mind caveats mentioned earlier. However, simple SSRs are not suitable to be used for making policy choices and a more sophisticated analytical framework is needed. Such frameworks are national models embedded within international agricultural projection models that can simulate the policy impact of various policy measures on food production, consumption and trade dynamics at national and regional level. There are a number of models that use comprehensive data and computer modelling systems to analyse the complex economic interrelationships of the food and agriculture sector at world level. An earlier one is the Food and Agricultural Policy Research Institute (FAPRI), a dual-university research programme with research centres at Iowa State University and the University of Missouri, Columbia, USA that has developed a world model of food and agriculture for projections and policy analysis. Another one is the OECD-FAO AGLINK-COSIMO modelling system, one of the most comprehensive partial equilibrium models for global agriculture used as a one of the tools to generate baseline projections underlying the OECD-FAO Agricultural Outlook. CAPRI and AGMEMOD are global food and agriculture models developed with European research funds and used by the European Commission to support decision making related to

the Common Agricultural Policy on the basis of sound scientific quantitative analysis.

The analysis of food availability at national or regional levels is a necessary but not sufficient indicator of the food security situation in the country. Additional information about the household and individual levels is required to provide an accurate picture of food insecurity in the country or the region (Maxwell and Frankerberger 1992).

Although agricultural production, food demand and trade are at the centre of the food security picture of a country, price and income volatility, at national and household levels, as well as attitudes towards risk and household behaviour, are also important determinants of short-term food security (Timmer 2012). Furthermore, a rapid increase in food production and food self-sufficiency may be desirable for various reasons, but it does not necessarily result in an increase in food security. In addition, an important distinction should be made between chronic (long-term) and transitory (short-term) food security, as well as seasonal (recurrent) food insecurity at the household level. Portraying an accurate picture of the food security situation in a country requires the development of a set of indicators that capture information at the household level using dedicated surveys or general household budget surveys. Such a methodology has been developed by the FAO (FAO 2008 and FAO 2014).

This methodology provides evidence-based assessment of the current food and nutrition situation at the country level, identifies the principal drivers responsible for observed trends and highlights the main challenges and risks faced at the country level in relation to achieving sustainable food and nutrition security. The analytical framework that is usually used is based on the well-established four dimensions of food security (availability, stability, accessibility and utilisation) and is carried out at two levels: at the micro level, i.e. assessing how food-secure the household is, and nationally or at the macro level, i.e. assessing how food-secure the country or region is. Three types of indictors are usually used: (a) household level, (b) analytical level (drivers of change—middle layer) and (c) core indicators for strategy design (at country or regional level). The set of indicators can also form a monitoring system for evaluating food security policy targets. The macro-level indicators may use country-level data available at the country's statistical information and at the

FAOSTAT data base. These detailed micro-level indicators are usually derived from dedicated surveys or from Household Budget Survey data at country or region level. These indicators illuminate various unobserved sides and angles of the issue and reveal poor and malnourished pockets in the population, as well as policy approaches to address the problem that may not be a priori obvious (FAO 2008).

The FAO uses information that combines country-level data on food supply–demand balances as well as information from household budget surveys for almost all countries of the world to make its annual assessment of the State of Food Insecurity in the world (SOFI). According to SOFI 2015, 72 developing countries out of 129 had achieved the 2015 Millennium Development Goal target of halving the population of hungry people, but hunger remains an everyday challenge for 800 million people worldwide (FAO 2015b).

Focus and Structure of the Book

The focus of this book is by necessity eclectic. Food security is a very broad and complex concept and globalisation increases immensely its complexity. Further, food security is a dynamic concept which has changed over the past 50 years and requests new approaches and, hence, new analytical tools. The role of investment and financing, of risk mitigation as well as of other dimensions of food security in generating sustainable food security strategies and the evolution of production paradigms embracing green growth are important concerns of analysts and policy makers alike.

Thus, the nexus of food security, sustainability and globalisation establishes a new perspective in the long-standing issue of food security (OECD 2014). This new perspective should take into account complicated GVCs, responsible investment, green growth strategies, financial innovation, gender issues, agro-food supply chain dynamics, recent advances in consumer behaviour and climate change (Oman et al. 1989, Paarlber 2002, and Hallam 2011). It would be impossible to deal with all these issues in the context of this book. Thus, the objective of this book is to discuss a few of the dimensions of food security within the new global environment created by the changing socio-economic conditions.

Issues Addressed and Case Studies

Globalisation that has led to a rapid decline in the cost of transporting bulky and perishable agricultural products over long distances driven primarily by changes in transportation, information and communication technologies, as well as the reductions in government distortions to agricultural production, consumption and trade have boosted cross-border agricultural trade, increased growth and reduced extreme poverty globally and, in the process, have altered global agricultural production and trade patterns (Anderson 2010). Hence, agricultural trade may open new opportunities for developing countries to pursue their comparative advantage in addressing food security issues (FAO 2015a). Obviously, trade is neither a threat nor a universal remedy when it comes to food security, but it poses challenges and risks that need to be considered in choosing measures of public policy. Trade is only one policy dimension within the broader context of private sector mobilisation along the agro-food value chain. If trade is chosen as a strategy to address food security, it should aim to make agriculture a part of the solution by focusing on small producers and their links to the international networks of markets and knowledge within a broad-based agricultural development strategy.

Focusing simply on agri-food trade and comparative advantage is not enough. Trade is important, but agriculture's economic and social role in addressing food insecurity is wider. Youth unemployment is becoming a social and political concern in developing countries and agricultural policies should focus on building skills, efficiency and sector linkages along the agro-food value chain. Increasing yields in agriculture in general becomes of paramount importance for increasing agricultural production for exports but also for improving food availability at the household level and this would require strong institutional effort. Water use efficiency would also need changes in production technology, putting an additional burden on building skills. Finally, grains will probably remain the main staple in developing countries for some time and increasing efficiency in their supply chain, either home-grown or imported, is quite important. Further, food subsidies, despite well-known disadvantages, cannot be phased out without putting in place an efficient social safety net and

an efficient fiscal management system. Thus, agricultural trade is important in addressing food insecurity, but making this policy option feasible requires mobilisation of the small–holding sector and strengthening of its links to international markets and networks through an efficient agro-food value chain.

Furthermore, it is important to understand the multifaceted nature of food security as related to the grid of complicated GVCs and, thus, to the complex global production networks (Dicken 2011) which are led by Multinational Enterprises (MNEs) creating a close link between food security, agricultural trade and FDI (WIR 2013; Dunning 1993). According to WIR (2013), "GVCs involve cross-border trade of inputs and outputs taking place within the networks of affiliates, contractual partners and arm's-length suppliers of MNEs" (WIR 2013, p. x). As Gerefi et al. (2005) and Gereffi and Christian (2009) point out, GVCs in the agro-food sector evolve around two dimensions: the first is the global dimension represented by MNEs participating in agro-business, manufacturing, franchising and retailing, while the second dimension is the local dimension and is represented by local farmers, producers, local franchises and retailers. The interaction of "global and local food value chains" determines two major challenges for the global community. The first challenge relates to the restoration of competition and empowerment of the stakeholders in the local food value chain, whilst the second challenge refers to the safeguarding of quality standards in the GVCs by the lead firms (Rama and Wilkinson 2008). Responsible investment in the entity of the agro-food chain is then a core prerequisite not only for food and beverage MNEs but for all stakeholders involved in a spirit of partnership for both global and local communities in order to secure viable and responsive GVCs to regional and local needs and diversities (World Bank / UNCTAD 2014).

In addition, investment needs and financing instruments along the agro-food value chain for food security and sustainability is an important concern. Agriculture is at the core of the food security problem, but part of the solution as well. Small stakeholders, in particular, occupy an increasingly important segment of the GVC and MNEs will increasingly rely on small stakeholders to secure their supplies of agricultural commodities and satisfy consumer sustainability preferences.

Finally, it is important to look at these issues also in the context of case studies. The case studies include two countries from the South Mediterranean region, Tunisia and Egypt, one low-income country in transition to market, Mongolia, and a paper focusing on the entire Middle East and North Africa region (Breisinger et al. 2011). All these countries face an increasing challenge of food insecurity. They experience limited and fragile natural resources, in particular land and water, and acute vulnerability to climate change. They also suffer from under-investment in agriculture and insufficient private sector participation. Importing a large part of their food makes these countries extremely vulnerable to price volatility in international food commodity markets. Further, several of them are increasingly dependent on imports for key staples such as grains that supply the major part of the calorie content of domestic food consumption.

Structure of the Book

Following the above, this book is structured into two parts. In the first part, a number of issues of food security are examined within the context of observed trends in international markets and of the operation of agro-food GVCs. In the second part, country case studies are presented discussing particular policy concerns within the broader context of food security and globalisation.

Part I: Issues addressed

In Chap. 2 Haniotis presents the exceptional developments taking place in international agricultural markets during the past several years and the behaviour of agricultural prices, discussing at the same time how these developments influence the food security debate. Price spikes or troughs, associated with excess price volatility, have been features of agricultural markets also witnessed in the past. But the exceptional characteristic of recent years has been that all these factors moved in the same direction, thus compounding their effect on the increase in agricultural prices.

Agricultural price developments since the mid-2000s have been characterised by a confluence of factors that have led agricultural and food prices to move in parallel with the prices of other commodities and, more importantly, to stay at a higher level than their historical past, even after declining. This chapter focuses on the multiple factors of market developments and attempts to place them in the broader context and perspective of the food security debate. And although convergence on the causes remains elusive, no other single variable better reflects food security concerns than prices—in terms of their exceptionally high levels, their volatility and their co-movement. The macro-economic environment, climate, trade, energy, the food chain or other factors affecting demand, such as population and income growth, especially in emerging economies, all play a role in the level of food prices. Finally, the chapter proceeds with an analysis of these factors and the identification of the most important market drivers contributing to recent price movements, providing a discussion and assessment of the policy responses addressing food security concerns.

In Chap. 3 Legg discusses green growth strategies in agriculture and their relation to food security. Agriculture is heavily dependent on natural resources, exerts a significant impact on the environment and biodiversity, and globally needs to double food production by 2050, despite pressures on land and water resources and climate change. This means the sector needs to increase resource use productivity and resilience to shocks, while providing acceptable living standards and poverty reduction. This has been characterised by the Organisation for Economic Co-operation and Development (OECD) as "green growth"—the pursuit of economic growth and development, while preventing or minimising environmental degradation, the greenhouse gas emission intensity of production, loss of biodiversity and using natural resources within their carrying capacity. In the specific case of agriculture this is often termed "sustainable intensification"—which focuses on increasing productivity with scarce natural resources, especially land in an environmentally sustainable way. Many countries are aiming to combine mutually supportive economic and environmental policies to spur economic growth and reduce resource pressures. In the European Union, the Common Agricultural Policy since 2013 includes a new "Greening Payment" for farmers who implement

enhanced cross compliance linking production support to climate and environmental objectives. Businesses are also trying to ensure long-term financial viability while reducing environmental footprints. However, more attention needs to be paid by governments and businesses to research, development and the dissemination of best practices, and to internalising environmental externalities through getting the prices right. But this requires good data on the costs and benefits of externalities, the need for well-targeted policies with a commitment to a longer-term strategy, and tackling environmental issues that are global rather than only domestic in nature.

In Chap. 4 Narula and Wahed make some tentative observations about the role of MNEs in agro-food GVCs, paying special attention to the potential for actors from developing countries to engage as suppliers within these networks. They highlight that the shift away from direct engagement in developing economies through fully internalised MNE subsidiaries to non-equity modes and linkages with suppliers depends crucially on two factors. First, domestic actors need to be a formally organised sector, with access to financial and knowledge capital. Second, the host economy needs to make available the appropriate location advantages that allow MNEs to engage with the domestic economy. This means developing stable and consistent institutions that permit MNEs to enforce contracts and reduce shirking costs, in addition to the necessary infrastructure associated with public goods. Unfortunately, most developing countries—while well-endowed with natural resources—are deficient in both domestic actors with O advantages and the necessary L advantages.

In Chap. 5 Papanastassiou and Mergos discuss the interaction between the organisational structure of MNEs and food security. Globalisation has revolutionised international commodity trade and investment. GVCs control a rapidly increasing part of trade and investment flows. Major stakeholders in achieving sustainable investment and growth are Multinational Corporations (MNCs). In this chapter they analyse MNC-generated GVCs and they argue that the lack of understanding of how MNCs' subsidiaries shape and change GVCs creates a theoretical and methodological void. They showcase their arguments by discussing the agro-food sector and food security as one of the Sustainable Development

Goals (SDGs), a major challenge for the global community. The authors assert that an effective response to generate sustainable GVCs in the agro-food sector requires an in-depth understanding of how the contemporary MNC GVCs operate and how the impact of the role of subsidiaries in the GVC governance is addressed.

In Chap. 6 Sarris presents the investment needs and financial flows in developing countries and their relation to food security. He reviews the various financial tools that have been utilised in a variety of settings in the agricultural sectors of low-income countries, and identifies opportunities for expansion of innovative financial tool and ideas that have been piloted in some countries. His effort is to identify situations and settings where some types of financial institutions are more likely to be successful than others, and to identify gaps in financing needs. He starts by describing the rural smallholder setting and its particularities, the risk management and mitigation strategies and the different kinds of need for financial services, and then he reviews the structure and performance of a variety of informal institutions in rural finance in different contexts, and finally the outreach of formal financial institutions, as well as intermediary institutions will be reviewed. Finally, he indicates from the reviewed literature lessons and good practices, as well as gaps in the provision of financial and risk management services.

In Chap. 7 Navare presents an evaluation of the economic and social impacts of micro-finance on rural households' food security. The dialectics on micro-finance is not new; however, the traditional focus has been on poverty alleviation more so than on managing social risk. In this chapter consideration is given to what might be a new modernity in enabling a shift from pure consumption values to productivity and welfare risk-bearing. Many regions face significant environmental and economic uncertainty impacting not only on food access but also on food value. Access to financing services is not always as it seems. Food value creation demands consideration of pre-existing social risks and the creation of social worth impacting the expected effects of micro-financing. The chapter considers the risks faced by vulnerable (socially and financially excluded) households and risk-based factors that identify the roles that micro-financial service institutions play in enabling food security and in enabling income and consumption smoothing. In considering the rela-

tionship between food security and micro-financial services, it is seen that the vulnerable households are susceptible to both direct and indirect impacts. The chapter in conclusion unveils some cases that provide solutions in reducing vulnerability.

In Chap. 8 Chaniotakis presents the experience of a major bank in Greece in promoting an innovative agro-food value chain financing scheme. The chapter starts the discussion by trying to answer what the elements are that could differentiate an agro-finance model and make it considered as innovative. Before some years the answer would have focused on the combination of the parameters of a loan, such as the duration, the grace period, and the repayment schedule. Today, it is claimed, the answer should be identified in more complex solutions related to the total effect of finance not only on the borrower but also on the entire value chain where the borrower participates and even on the local economy. Then the chapter describes the *Contract Farming Financial Plan* that is offered by the bank to strengthen coordination and support contractual partnerships between primary agricultural producing units (farmers) and commercial/processing enterprises (integrators) in a closed and controlled financial ecosystem. More specifically, Contract Farming is the first banking programme in Greece that contributes to the rationalisation of agricultural production by matching primary production with demand, and financing both sides at the right time, with customised tools. Moreover, it boosts the modernisation of the transactional cycle, embracing the whole production–supply chain and undertaking payment administration. Through this programme the bank supports the agricultural sector and contributes to the economic and social development of the country.

In Chap. 9 Triantafyllou, Dotsis and Sarris examine the impact of extreme events in agricultural commodity prices using the empirical behaviour of the returns of three basic food commodity products, maize, wheat and soybeans. Their methodology makes use of simple statistical tools employed for modelling tail risk. Unexpected price changes and large upward/downward price swings have become very frequent and very common in the volatile agricultural markets. Sudden jumps in agricultural prices denote undesirable events for both policy makers and commodity producers, and create difficult situations for countries facing

food security challenges. Unpredictable price increases raise the cost of food imports and aggravate the food security situation of food-importing countries. The chapter describes some simple tools from extreme value theory that can be used in order to quantify extreme events and applies these tools in the context of food import risk management for three basic food commodities, maize, wheat and soybeans. Finally the chapter concludes presenting the policy implications suggesting significant challenges for insuring food imports by food insecure countries.

Part II: Case Studies

In Chap. 10 Khouri, Breisinger and ElDidi discuss the objective of achieving food and nutrition security in the Middle East and North Africa region with particular emphasis on data and information required in order to formulate evidence-based food security and sustainable development policies. Across the Arab region, there is a renewed consensus on the urgency of addressing the conflicts, the refugee crisis and the economic challenges posed by the international environment, which are impeding development. Consensus-building around regional priorities for the newly launched SDGs, along with some key food policy changes in the region, may afford a new opportunity to address food security, nutrition and poverty needs and contribute to regional stability. Applying evidence-based policies will be key to help achieve these goals. With that comes the renewed need for relevant data, which represents another challenge given the lack of reliable, accessible data in the region. The chapter concludes with three high-priority areas for policy intervention to improve food and nutrition security in the Arab countries: (a) peace building through development activities at local and national levels, (b) education and subsidy reforms to improve nutrition, and (c) research and improved data gathering and analysis on rural development and food security.

In Chap. 11 Soliman explores the need for effective vocational education and training to improve the food security situation in Egypt. Food security has always been on top of the political and economic agenda in North Africa. In Egypt, the problem becomes increasingly complex and challenging because of high population growth and poverty,

as well as due to the political and economic circumstances the country is going through, particularly in the past few years. This chapter examines the problem from mainly an economic perspective. However, the links between vocational education and training and the current problem of food security have not attracted the attention they deserve by policy makers and academics alike. The purpose of analysis in this chapter is to explore the relationship between the food security situation and the ineffectiveness of the agricultural vocational education and training system in Egypt. This analysis improves the understanding of the problem of food security and informs policy makers on agricultural development strategies.

In Chap. 12 Taghouti, Ellumi, Martinez-Gomez and Alvarez-Coque provide an overview of the competitiveness of the Tunisian agro-food sector before signing the Deep and Comprehensive Free Trade Agreement with the European Union (EU). The agro-food sector plays a vital role in Tunisian economy and exports. However, the globalisation of markets can influence the comparative advantage of the agro-food sector enjoyed by Tunisia in exporting several Mediterranean products and increase competition. The Tunisian agricultural sector's competitiveness is an important concern given the particular economic context in the country after the revolution and the important competitive conditions in the Mediterranean area. Meanwhile, food security is an essential priority that cannot be compromised. Thus, Tunisia may need to consider a trade-off between two options by signing the Deep and Comprehensive Free Trade Agreement (DCFTA): developing agro-food exports in free trade area to enhance economic growth or protecting the local market and the implementation of new policies to ensure food security. An analysis of the competitive advantage of the Tunisian agro-food sector reveals an important potential of exporting some agro-food staples. Recently, Tunisia has been facing new challenges in exporting strategic products such as dates and olive oil, underlying the importance of new inclusive business strategies in local value chains.

In Chap. 13 Park, Choi, Kim and Evans explore food security in Mongolia from the perspective of system innovation with an emphasis on sustainability and technology progress. Mongolia has been short of

food supply for stable crops, milk and meats over the last few decades. Although Mongolia has conducted many domestic and international collaboration projects in food security, it has seldom succeeded in leading the results to projects that would establish a holistic learning system of food security in the country. In this regard, this chapter investigates the food security situation in Mongolia with an emphasis on technology and sustainability using the perspective of system innovation. This theoretical framework enables reviewing learning capabilities in attaining food security in the country rather than the consequences of past and current projects and policies. The advantage of using this theoretical framework of system innovation is that it allows the identification of the roles of the main institutions in the food and agriculture industry for food security in the country and suggests three main learning dimensions for these institutions: first, "policy co-ordination for food security"; second, "entrepreneurial learning for food industry"; and third, "public awareness of food security". Furthermore, this chapter elaborates how the country can implement these learning dimensions into practice, providing readers with practical knowledge and policy implications on how government, industry, university and local people in the country can create continuous long-term learning systems for food security.

In Chap. 14 Kamenidou, Priporas and Rigas focus on food security at the household level presenting the findings of their research on the impact of the ongoing economic crisis in Greece on household food security. Their analysis examines the perception of households about their food security, as well as household behaviour regarding food production and storage activities. By employing a multistage sampling method and considering as sampling unit one person per family, the one responsible for food decisions, 1305 households from two poor regions of the country were included in the research. The results show that the welfare of the majority of the studied population has been affected by the economic crisis and most importantly their access to food has been affected as well. To survive during this harsh economic crisis many households have started producing, storing, freezing and preserving food.

Concluding Remarks

Food security and sustainability have been long-standing issues that have recently received renewed interest. After a fervent research effort on food security issues in the 1970s, the complacency of the 1980s and 1990s for the global food–population balance has given way after 2000 to serious concerns about food security globally. The food price crisis of 2007–2008 drew significant attention on food security and caused serious concerns that extreme events may become more frequent and more damaging in the future. However, even before the crisis it was obvious that food insecurity concerns are becoming a recurring theme, as it is estimated that about one billion people did not have access to sufficient, safe and nutritious food. Thus, currently the nexus of food security, sustainability and globalisation establishes a new perspective in the long-standing issue of food security. This new perspective should take into account agricultural price behaviour in international markets, green growth strategies, technical change, innovation and productivity, investment, financing and financial innovation, risk mitigation issues, global agro-food chain dynamics and sustainability issues. This book, by necessity, has been an eclectic one looking at some of these issues and focusing on a few case studies.

Two chapters of this book examine the very complex relationship of food security, sustainability and globalisation, implying difficulties in the attribution of causality in observed developments for public policy design. There is clear evidence supporting the view that after 2000 international food prices are characterised by exceptionally high levels, high volatility and co-movement, justifying a growing concern on food security issues. However, although green growth strategies have been widely followed in agriculture as a policy response to food security and sustainability, the need for increasing agricultural productivity is more pronounced now than ever before for addressing food security, and achieving resource efficiency and environmental quality in an era of climate change.

The next two chapters examine the link between globalisation and food security, highlighting how MNCs shift away from direct engagement in developing economies through fully internalised subsidiaries to non-equity modes and linkages with suppliers. They argue that MNCs exhibit

a relatively more footloose attitude in case of non-equity modes with potentially adverse effects on local economies and conclude that governments need to prudently formulate appropriate policies to mitigate some of the adverse effects that the MNE strategies may have on their national economies or societies or environment. Furthermore, MNEs have grown into complex organisations, adopting multifaceted organisational structures that depart from hierarchies that condition their interaction with local production systems. Hence, the relationship between food security and GVCs is unpredictable and more work is needed to highlight aspects such as innovation and the inclusion of small and medium enterprises.

Four chapters examine investment, credit and finance in agriculture and its relation to food security. There is evidence that lack of adequate amounts of agricultural capital and short-term finance can slow down the agricultural transformation and consequently reduce growth rates in low-income countries. However, new institutional structures and innovations may alleviate the problem considerably. Similar situations of a credit crunch in agriculture are observed in developed countries experiencing an economic crisis requiring action in credit and finance to assist agriculture in overcoming the adverse impact of an economic crisis. Finally, an innovative agro-food value chain finance model, extending the well-known contract farming model to include a bank providing short term finance, has been used successfully, thus providing a good finance instrument for agriculture.

The last of the general chapters examines the risk of extreme events and spikes in agricultural commodity prices using the empirical behaviour of the returns of three basic food commodity products, maize, wheat and soybeans. The findings signify the importance of price spikes on food security and of food import risk management for basic food commodities, maize, wheat and soybeans for importing countries, suggesting significant challenges for insuring food imports by food-insecure countries.

The case studies include a regional study of Middle East and Northern Africa, two North African countries, one transition economy and one country in economic crisis. Food security, in all cases, is an important concern and public policy priority. Across the Arab region, there is a renewed consensus on the urgency of addressing the conflicts, the refugee crisis and the economic challenges posed by the international environment which

are impeding development. In Tunisia, the globalisation of markets has adversely affected exports and has increased competition. The chapter states the country has to choose between two policy options, developing agro-food exports, a strategy that addresses new challenges in local agro-food value chains, and a strategy protecting local markets for ensuring food security. The chapter on the country experiencing an economic crisis shows that the welfare of the majority of the population has been affected by the economic crisis and most importantly household access to food has been affected as well. To survive during the economic crisis many households have started producing, storing, freezing and preserving food. In the final chapter on food security in a transition to market economy a few policies have been identified: first, it stresses the need for policy co-ordination and governance structures for food security; second, it identifies the requirement of entrepreneurial learning for the food industry; and finally, it recognises the vital need to increase public awareness of food security.

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2

The Food Security Debate in a Shifting Market Environment

Tassos Haniotis

Introduction

Agricultural price developments during the past decade have been by all accounts exceptional. From the beginning of the twenty-first century until 2011 commodity prices experienced the longest and broadest post–World War II boom, reversing a decline of nearly three decades, with prices of food commodities doubling (Fig. 2.1). This coincided with unprecedented growth in emerging economies, with low- and middle-income countries averaging annual growth above 6 per cent during 2004–13, the highest of any 10-year period since 1960. China and India, which by now account for more than a third of the world's population, grew at nearly 10 per cent per year during this period.

Price spikes or periods of high price volatility have been witnessed in the past. Yet, when developments from the mid-2000s onwards, driven by a confluence of factors, led agricultural and food prices to move in

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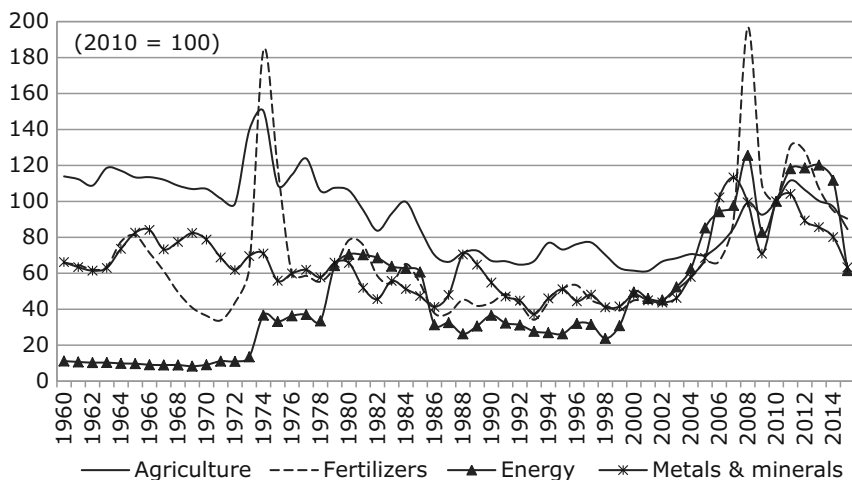
Fig. 2.1 Trends in real commodity prices. *Source*: World Bank

the same direction—higher and in parallel with the prices of other commodities—expectations emerged of a new, higher 'price plateau' at which commodity prices would trade in the future. These expectations have not materialised, as commodity prices have since been on a steady path of decline since then. In fact, today, expectations are of increased uncertainty about the future price path. What could be next?

Inevitably, extreme price movements were associated with major concerns of producers, consumers and policy makers alike, and brought to the forefront a debate about food security as, in both developed and developing countries, consumers felt the impact of higher food prices (especially in times of overall low inflationary pressures), while producers (especially in livestock) felt the pressure from higher costs. But at the same time all alike felt the impact of a generalised commodity roller coaster, one that many characterised as the 'perfect storm' while the commodity price boom lasted, while recent developments and their unexpected downward spiral seem to have discouraged attempts of any characterisation.

As Table 2.1, which summarises these developments, clearly demonstrates, twice in the span of just eight years commodity prices, including agricultural prices, increased substantially, collapsed and impressively

Table 2.1 Cumulative commodity price changes during specific periods

Period	Agriculture	Energy	Fertilisers	Metals/minerals
1997–2008	**29 %**	**336 %**	**298 %**	**107 %**
–2008–09	*– 7 %*	*–45 %*	*–34 %*	*–29 %*
–2009–11	*21 %*	*20 %*	*43 %*	*47 %*
–2011–15	*–24 %*	*–31 %*	*–48 %*	*–39 %*
2008–2015	*–15 %*	*–54 %*	*–51 %*	*–36 %*
1997–2015	**10 %**	**100 %**	**95 %**	**32 %**

Source: Author's calculations based on World Bank data

recovered after the financial crisis, only to follow a prolonged and substantial decline again, with the latter's low point still unclear.

Different explanations have been advanced about the causes behind these developments. This chapter takes these differences in recent interpretative approaches on commodity price movements as its starting point, and looks into the various factors that influenced recent agricultural price movements in order to address three issues. First, to summarise the role these factors played in agricultural price developments; second, to assess their relative contribution and, in contrast to the use of unidimensional approaches in interpreting price developments, to argue for the need to analyse them from a broader perspective; and third, to address the policy relevance of the analysed evidence in the food security debate.

Assessing the Main Drivers of Market Uncertainties

Against the background depicted previously, the debate on food security and its repercussions for agriculture assumed, and continue to assume, a different twist based on the weight different observers place on the perceived causes of price developments. For example, looking solely at the evolution of agricultural prices, one would tend to identify a clear reversal in the long-term downward trend in agricultural prices occurring after 2000 which, when seen in isolation from other price developments, would tend to have a clear policy implication—market price signals

should lead farmers to production decisions that would appropriately respond to market and policy challenges, and in the process correct any short-term market failures.

Yet observing the same figures by looking at the parallel movement of prices in the markets for fertilisers, energy, and metals and minerals provides a different picture. When seen from this angle, it becomes evident that three distinct features characterised commodity price movements during the recent decade: higher *volatility*, significant price *co-movement*, and a higher price *level* for all commodity price indexes. And while it is true that price volatility and price co-movement, which initially led the debate on the causes of price developments, seem to be on the decline, agricultural prices continue to remain high compared to their pre-2005 level (Fig. 2.2), raising questions about their future level.

In search for explanations for these developments, alternative approaches were proposed, most of which were unidimensional in terms of the single factor causing price movements. The first and most prominent among these, especially at the early stages of the debate (spring 2008), was the previously mentioned association of the agricultural price boom to strong global population and income growth in emerging economies, especially in China and India, which has been often cited as the key driver of the past decade's food and other commodity price increases (and the slow-down in world growth as the explanation of the recent bust).
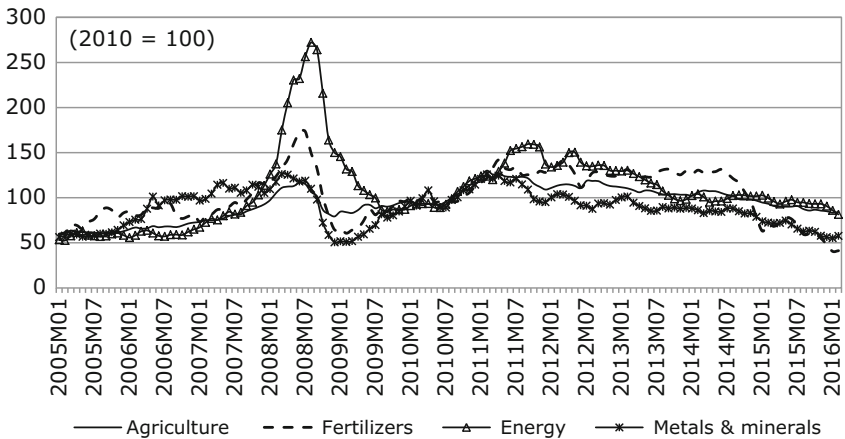
Fig. 2.2   Trends in monthly commodity prices (nominal). *Source*: World Bank

Krugman (2008) argued that the upward pressure on grain prices is due to the growing number of people in emerging economies, especially China, who are becoming wealthy enough to emulate Western diets. Likewise, Wolf (2008) concluded that strong income growth by China, India, and other emerging economies, which boosted demand for food commodities, was the key factor behind the post-2007 increases in food prices. In a similar fashion, the June 2009 issue of *National Geographic*, the first in an eight-month series exploring the Future of Food, noted that the demand for grains has increased because people in countries like China and India have prospered and moved up the food ladder. Other authors have mentioned income growth as the main price driver well (see, for example, Hochman et al. 2011 and Roberts and Schlenker 2013).

That strong income and population growth led prices to rise is self-evident. The impressive increase of Chinese gross domestic product (GDP), both when compared to the GDP of major developed countries and growth in the other BRIC countries (Brazil, Russia, India and China) (Graphs 3 and 4), played its role in the increase of farm commodity prices through increases in demand, and not just in China and India. But was this the stronger factor, and did it influence the process in isolation from the impact of other factors?

In fact, the period characterised by high price volatility is also one characterised by low interest rates. This led to a more complex interaction of macroeconomic variables on GDP growth across the globe, among others via the depreciation of the US dollar, which led prices to rise since these prices were mainly expressed in US currency (the inverse is also evident in the more recent generalised price decline, which coincides with a stronger dollar) (Figs. 2.3 and 2.4).

Interestingly enough, the same world price expressed in US dollars is translated in a very different way in local currency. Figure 2.5 depicts this differential impact of exchange rates on the effective world market price seen by domestic producers with the world (US Gulf) price of maize as an example. (Of course, border measures also apply, but they do so also after the exchange rate is taken into account).

Annual % change
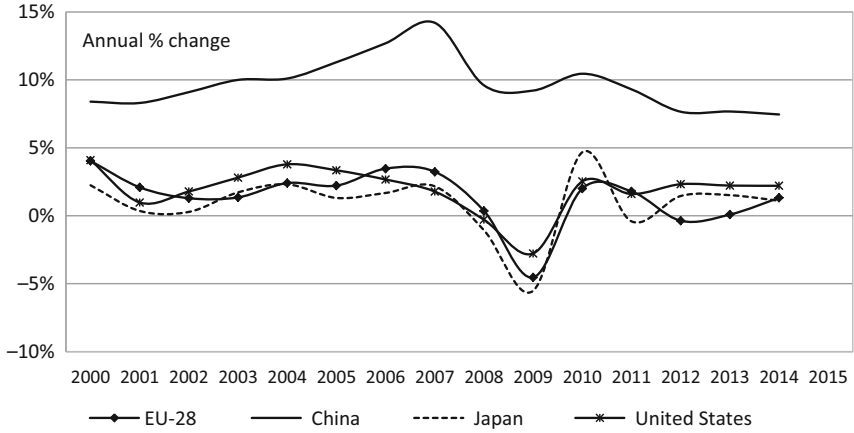
Fig. 2.3 GDP growth—major economies. *Source*: World Bank

Annual % change
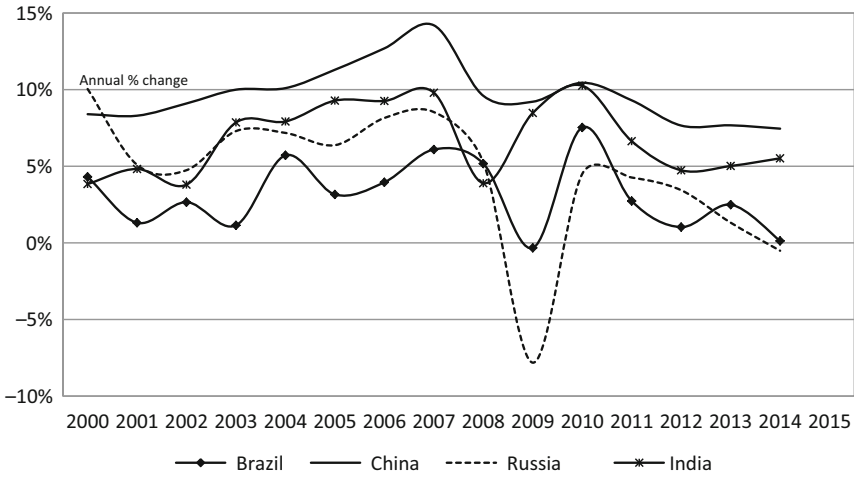
Fig. 2.4 GDP growth—BRICs. Source: World Bank

Despite continuing references to the alleged impact of income growth on food demand and thus food prices, it gradually became evident that there was an apparent contradiction in such expectations, and that the undeniable increase in global food demand was not necessarily changing faster than previously thought. Alexandratos (2008) concluded that
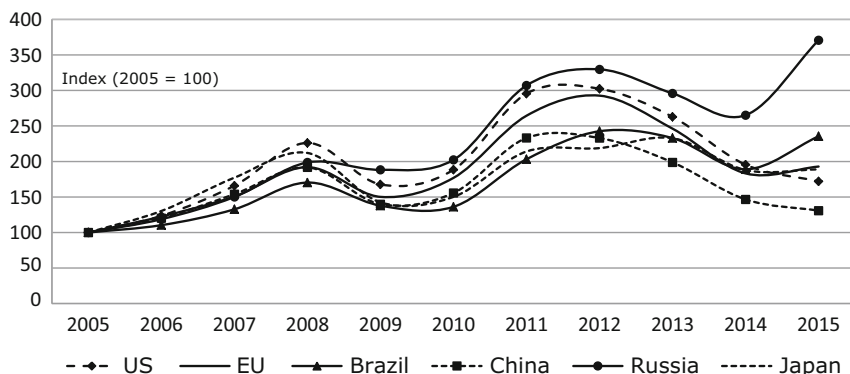
Fig. 2.5 Maize price expressed in local currency (nominal). *Source*: Author's calculations based on World Bank data

China's and India's combined average annual increase in grain consumption was smaller in 2002–08 than in 1995–2001.

Similar findings have been reported in the briefs of the European Commission (2015), which provide detailed information on developments in demand, supply, and prices of major agricultural commodities during different periods and regions of the world since 1960, and by Alexandratos and Bruinsma (2012), Baffes and Haniotis (2010), Sarris (2010), the Food and Agriculture Organization of the United Nations (2008 and 2009), and Lustig (2008). Deaton and Drèze (2008) noted that in India, despite growing incomes, caloric intake has followed a downward trend since the early 1990s.

But the continuous and at times explosive increase in price levels, not only in agricultural but also in all other commodities, brought then another source of possible explanation, linking the discussion to a 'supercycle' in commodities. The impact from 'financialisation', that is from the transformation of commodities into asset values, focused the discussion on market failures, real or perceived, which were exacerbated by the result of the financial crisis (Baffes and Haniotis 2010).

Yet another approach, forgotten for some time due to market developments in the late 1990s, came back with vengeance and linked what was happening in prices to changes in stocks (Wright 2012). Such changes, it was claimed, should be explained not as a result of market failure but as a sign of markets playing their role, especially since the decline in stocks in grains was pretty significant.

This was the case for wheat (Fig. 2.6) and rice, but maize in particular was the focus of much attention (Fig. 2.7) as the growth in biofuels throughout the past decade (mainly maize for ethanol in the USA) dominated the debate in the early stages of the boom.
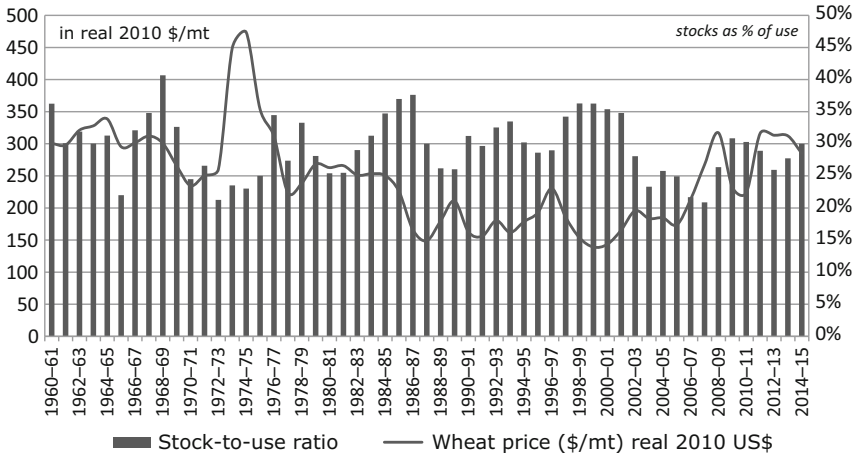
Fig. 2.6 Wheat stock-to-use ratio and wheat price. *Source*: USDA for stocks-to-use, World Bank for whet price (No 1 HRW Gulf ports)
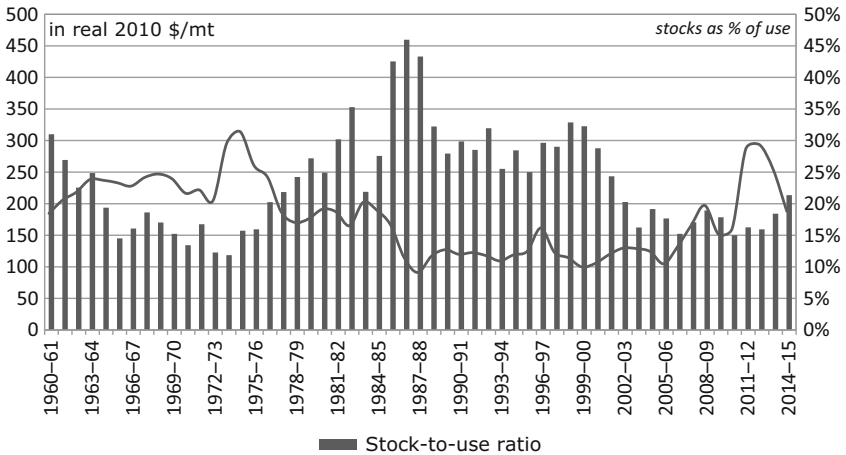
Fig. 2.7 Maize stock-to-use ratio and maize price. *Source*: USDA for stocks-to-use, World Bank for price (No 2 yellow, Gulf ports)

This created the tendency for many to attribute to biofuels a disproportionate role in the increase of agricultural prices, especially in the early stages of growth in mandate-driven maize-based ethanol (De Gorter and Just 2009). And although the explosive growth in the USA seems to have come to a plateau, the debate about the impact of biofuels on land use and the food versus fuel debate will certainly persist in the future. That the significant increase in the use of feedstuff for biofuels, driven by policy mandates, had an inevitable impact on market balance for cereals is evident also from Fig. 2.8, which depicts total changes in wheat and coarse grain demand among main players during 2005–14. Yet the figure shows that this was essentially a coarse grains (mainly maize) story, almost equally split between growth in Chinese demand (essentially for feed) and US demand for biofuels.

During this period, total demand for wheat in the largest developed and emerging economies, the USA, European Union (EU), China, and India, increased by 38 million metric tonnes, a rather moderate figure that also explains why stocks in wheat recovered faster than in maize. From this increase, China accounts for two thirds, essentially all for feed, in sharp contrast with India, where essentially all increase was for food. Total demand in the EU declined (due to feed decline), thus counterbalancing the increase in the USA (for food). In coarse grains, global demand grew by 160 million metric tonnes, 90 million of which
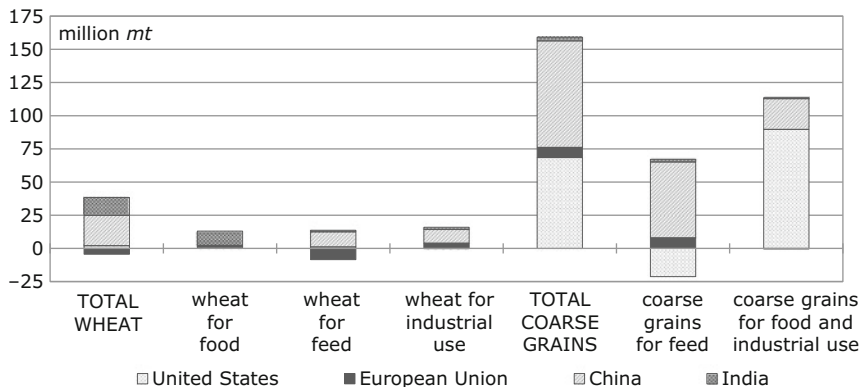
Fig. 2.8 Changes in cereal demand 2005–14. *Source*: Author's calculations based on OECD data

come from US industrial demand (essentially for biofuels). In feed demand, though, the increase in China (57 million metric tonnes) is to some degree mitigated by the decrease in US feed (21 million metric tonnes).

Overall, patterns of growth in world food demand exhibit a rather diverse picture, as annual growth rates in the demand for major food commodity groups demonstrate (Figs. 2.9, 2.10, 2.11, and 2.12).

The above figures lead to one counterintuitive (at least with respect to popular press beliefs) conclusion. The main pressure on world food demand does not seem to stem from meat consumption, whose pat-
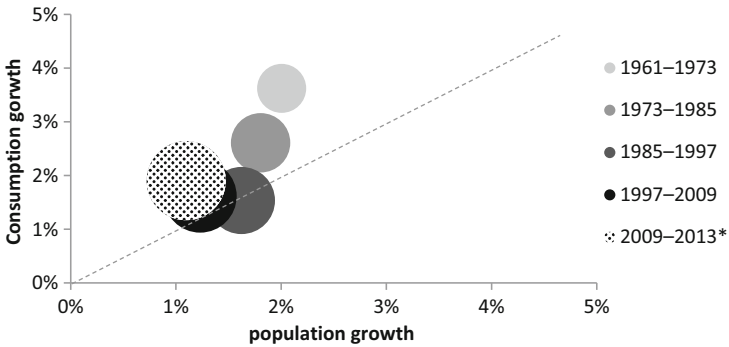
Fig. 2.9   World grain consumption patterns
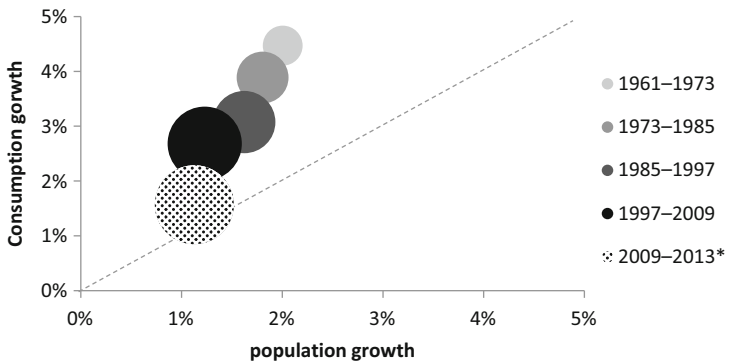
Fig. 2.10   World meat consumption patterns
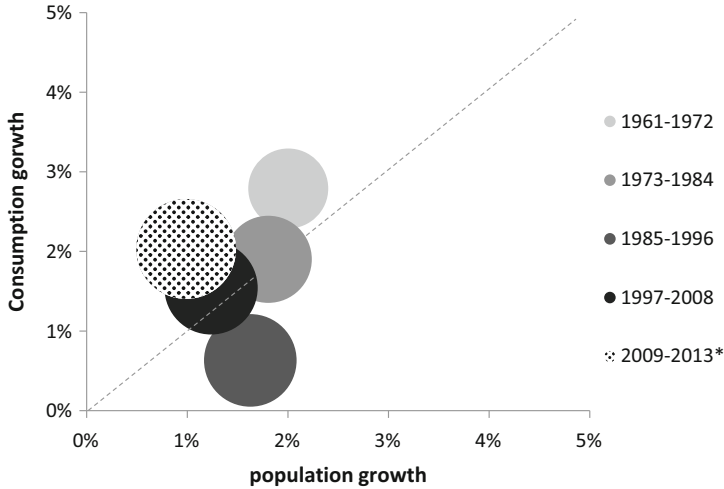
Fig. 2.11 World milk consumption patterns
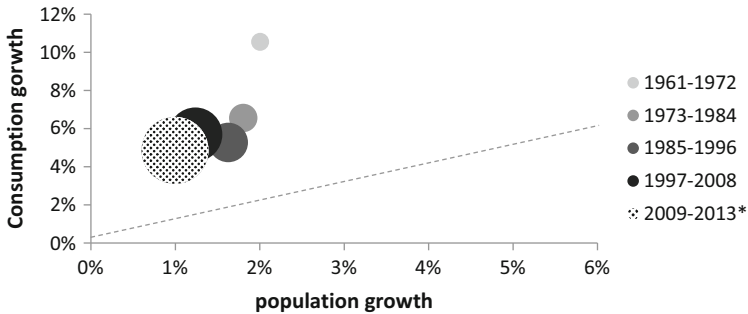
Fig. 2.12 World vegetable oil consumption patterns. *Source*: DG AGRI calculations based on FAO. The bubble size corresponds to the relative consumption size

tern of annual growth has been clearly declining over the years. More detailed analysis (European Commission 2015) demonstrates that the significant decline in beef consumption in the developed world, which is not compensated by increases in the developing world, led the annual rate of beef consumption growth to fall below the population growth rate. If meat consumption grows more than population, this

is mainly due to poultry, the only meat whose consumption growth has increased in recent years (pork and poultry growth has also slowed down).

In the other product groups presented here, vegetable oil consumption remains very strong, and significantly above population growth, while a very strong pattern of milk consumption recovery (mainly in the form of dairy products) is also evident. So is the significant recovery in grain demand, a result of both food and feed demand growth, but not so much of biofuels after 2009.

As the focus on biofuel demand in both the USA and the EU drew attention to real versus perceived impacts on food, a less direct and more complex link of agriculture to energy markets also became apparent. In the early years of the commodity boom, US energy prices broke the link between crude oil and US natural gas prices, linking the latter directly to the price of coal (Fig. 2.13).

Although developments in 2015 led, to some degree, to the coupling again of these prices, the impact of lower US gas prices compared to both Europe or Asia (the result of shale technology) led the USA to reap the resulting energy premium with huge investment in energy-intensive
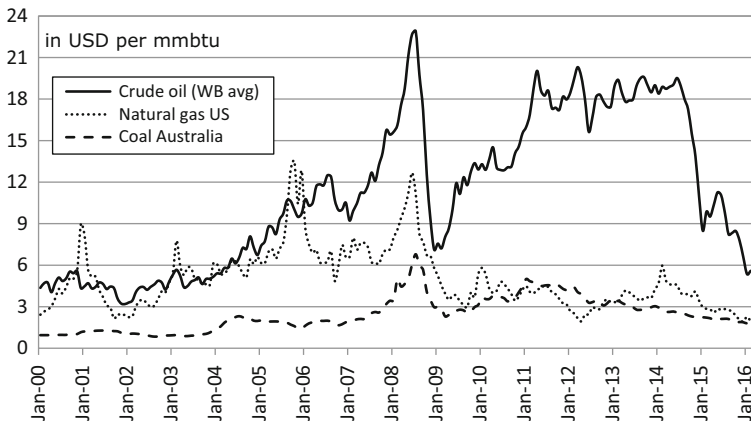
Fig. 2.13 The diverging paths of energy prices. *Source*: World Bank
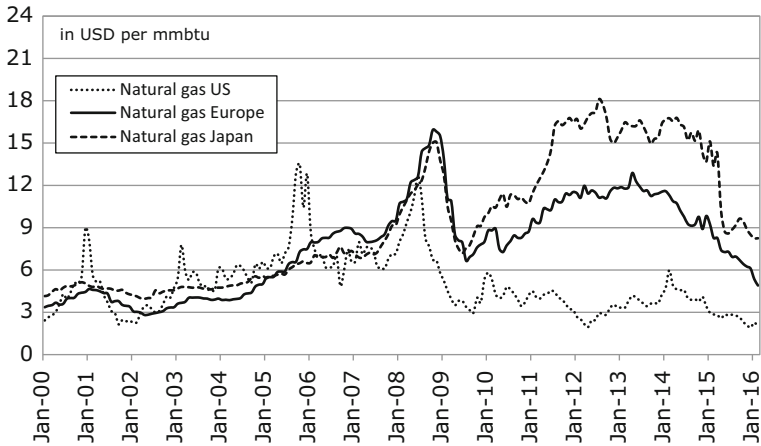
Fig. 2.14 The diverging paths of gas prices. *Source*: World Bank

industries, based both on the direct energy cost benefit vis-à-vis its competitors and also on the indirect one linked to new investments in fertilisers (Fig. 2.14).

On the Causality of Commodity Price Movements

Based on the brief description above, both literature and evidence would suggest that the actual causality of agricultural commodity price movements is really multidimensional, and much more complex than often described. What follows will try to assess the role of individual factors and identify their eventual links and the relative weight of their impact.

Each of the several macroeconomic and sectoral influences identified in the previous section played a role in determining agricultural commodity prices. Yet it did so not in isolation, but in a rather complex confluence of developments. At times, volatility tended to dominate the debate, with the financialisation of commodities assuming the prominent explanatory role. At other times, the co-movement of prices, and

especially their link to energy price changes, assumed the prominent role. Throughout, the level at which agricultural prices would settle in a new equilibrium and the sustainability of this level in the longer term raised and maintained strong policy and political concerns.

In retrospect, some of the measures (export bans) and suggestions (strategic or virtual stocks) advanced during the most extreme period of market turbulence seem disproportionate, if not outright irrelevant, to the problem they were supposed to solve. (It is interesting in this respect to note that very limited attention was paid to the fact that the level of rice stocks dropped in 2015 more than it did in 2009. More interesting would be to estimate the potential loss for public expenditure had the idea of grain stock-building been accepted).

Unlike the developments in 2006–08, agricultural commodity prices recently declined independently of some of the factors affecting them. For example, biofuel use is still high, although it is growing at a much slower pace than before, and interest rates are still low, or even negative when adjusted by quantitative-easing policies. Yet energy, fertiliser, and agricultural prices continue to be characterised by a degree of co-movement.

In the search for explanations about the relative weight of the various factors affecting price movements, a recent paper (Baffes and Haniotis 2016) updates previous analysis of six agricultural markets (wheat, maize, rice, soybeans, palm oil, cotton) by incorporating more recent data. In summary form, here are its main conclusions.

From the macroeconomic variables, *income growth* was found to be negatively associated with agricultural prices, with parameter estimates negative and highly significant. Parameter values of income elasticity ranged within a remarkably tight band (the panel estimate indicates that a 10 per cent increase in the income of low- and middle-income countries reduces the real price of agricultural commodities by about 5 per cent).

Counterintuitive at first sight, this result is consistent with the Prebisch–Singer hypothesis, which states that, as income grows the price ratio of primary commodities over manufactured goods declines (Prebisch 1950; Singer 1950), as well as with Engel's Law of less-than-unitary income elasticity for food commodities, since the negative sign of income elasticity should be interpreted as the difference between the effect of income on nominal food prices and the effect of income on the deflator (the former is generally lower than one, the latter greater than one).

The impact of a rise in the *real interest rate* is found to be negative but small on the prices of individual commodities. A weak relationship between interest rates and commodity prices is a common finding in the empirical literature (Gilbert 1989; Baffes 1997; Frankel and Rose 2010; Frankel 2014), although some studies (e.g., Akram 2009; Anzuini and others 2010) found that interest rates had a moderate effect.

The *exchange rate*, on the other hand, was found to have a negative effect on prices of individual food commodities, consistent with expectations. This confirms conclusions of numerous studies that have highlighted the negative relationship between a US dollar appreciation and commodity prices (see, for example, Lamm 1980; Gardner 1981; Baffes and Dennis 2015, for agriculture; Gilbert 1989; Baffes 1997; Akram 2009, for metals).

Among the sectorial fundamentals, the effect of a rise in the *stock-to-use ratio* is found to be, as expected, negative and highly significant. Baffes and Haniotis (2016) report a panel estimate of −0.37 (remarkably similar to findings reported elsewhere (for example, Bobenrieth et al. 2012, or FAO 2008).

Likewise, the effect of a rise in the real *crude oil price* is found to be significantly different from zero for all six commodities, with the panel estimate implying a 10 per cent increase in oil prices associated with a 1.5 per cent increase in agricultural prices. The strong relationship between energy and non-energy commodity prices was established in the literature long before the post-2004 price boom (Gilbert 1989; Hanson and others 1993; Borensztein and Reinhart 1994; Chaudhuri 2001), and was confirmed in more recent studies (Baffes 2007 and 2010; Moss and others 2010).

Yet not all studies concur with a strong oil–non-oil price relationship. Saghaian (2010) established a strong correlation among oil and other commodity prices (including food prices) but the evidence for a causal link was mixed. Gilbert (2010) found a correlation between oil and food prices, but noted that this could reflect common causation rather than a causal link. Zhang and others (2010) found no direct long-term relationship between fuel and agricultural commodity prices, and only a limited short-term relationship. Reboredo (2012) concluded that grain prices are not driven by oil price fluctuations.

The mixed evidence on the energy–non-energy price link could reflect the frequency of the data series used in the analysis or the presence of biofuels (Baffes 2013). Zilberman and others (2013) noted that higher-frequency

(and hence 'noisier') data are typically associated with weaker correlations. On the other hand, an exogenous shock pushing crude oil prices down under a mandated ethanol–gasoline mixture would increase fuel consumption and push ethanol and maize prices up, and thus lead to a negative relationship between food and oil prices, other things being equal (De Gorter and Just 2009).

Relevance for the Policy Debate

Responses given so far in the public policy debate to address the causes of agricultural price movements and their relevance for the debate on food security differ widely. These differences centre around three fundamental policy problems that have emerged from the food security/price volatility debate, attempting to merge often conflicting demands on issues related to (a) environmental/climate-related challenges and the private versus public good debate (initially mainly an EU issue, which is becoming more prevalent in other parts of the developed world), (b) the price interests of the rural versus urban poor (a developing world issue with conflicting policy implications), and (c) the gap between existing research, innovation and productivity priorities and future market and trade challenges (an issue for all, including the BRICs). In all three above areas, both macroeconomic and sector-specific causality has major policy implications.

On the macroeconomic front, growth in income is obviously associated with growth in demand for food, and during the commodity price boom years the high rates of income growth that emerging economies experienced were associated more with growth in manufacturing and services than with growth in demand for food. And during these years, demand for most food items stagnated in high-income countries. Exchange rates are also clearly associated with commodity prices, through the inverse relationship of the latter with the US dollar. Yet it might be the current low interest rate environment that might affect developments in yet little understood ways.

It is clear that low interest rates increase consumption and induce larger stock-holding, thus raising pressure on demand. Less clear is the impact of the lower cost of capital on supplies. What if the low cost of capital during most of the past decade may have induced parallel rightward

shifts in both demand and supply schedules? Although this hypothesis needs further testing, if confirmed it would add another dimension to the debate on commodity-related stress on resources and the environment.

That is, while a lower cost of capital due to low interest rates and quantitative-easing policies may not necessarily change commodity prices (due to its mutually offsetting effects on commodity demand and supply), it may magnify the pressures on natural resources by expanding the commodity production and consumption base.

Several analyses, even when disagreeing on methodology, confirm the importance of both stocks and energy prices in explaining agricultural price movements. Elasticity values are more than twice as high for stock-to-use ratios as for crude oil prices, thus implying twice as great an influence on agricultural prices from a given percentage change in stock-to-use ratios as the same percentage change in crude oil price. But actual percentage changes in oil prices are significantly larger than actual percentage change in stock-to-use ratios, thus having a much larger impact on agricultural prices than stocks.

This energy/agriculture link is crucial for several reasons. First, it applies as much to the pre-2014 high energy prices as it does to the post-2014 low energy price environment. Second, it is not limited to the direct energy costs to agricultural producers, as it also affects the relative energy costs between various players in global commodity markets (e.g., through the impact of natural gas supplies and prices on fertilisers). Third, there are indirect costs linked to the upstream and downstream industries (transport, storage, etc.). Fourth, energy security concerns, a key justification behind biofuel mandates (which were intended to produce more feedstocks for biofuels, and thus raised concerns about taking land away from food crops), are less relevant in a low energy price environment.

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3

Green Growth Strategies in Agriculture in OECD Countries

Wilfrid Legg

Introduction

Agriculture is heavily dependent on natural resources, exerts a significant impact on the environment and biodiversity, and globally will need to double food production by 2050, if current trends continue, despite pressures on land and water resources and climate change. This means the sector needs to increase resource use productivity and resilience to shocks, while providing acceptable living standards and poverty reduction. This has been characterised by the OECD as "green growth"—the pursuit of economic growth and development, while preventing or minimising environmental degradation, greenhouse gas (GHG) emission intensity of production, loss of biodiversity, and using natural resources within their carrying capacity. In the specific case of agriculture this is often termed "sustainable intensification"—which focuses on increasing productivity with scarce natural resources, especially

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land, in an environmentally sustainable way. Many countries are aiming to combine mutually supportive economic and environmental policies to spur economic growth and reduce resource pressures. In the European Union, the Common Agricultural Policy since 2013 includes a new "Greening Payment" for farmers who implement enhanced cross compliance linking production support to climate and environmental objectives. Businesses are also trying to ensure long-term financial viability while reducing environmental footprints. However, more attention needs to be paid by governments and business to research, development, and the dissemination of best practices, and to internalising environmental externalities by getting the prices right. But this requires good data on the costs and benefits of externalities, the need for well-targeted policies with a commitment to a longer-term strategy, and tackling environmental issues that are global rather than only domestic in nature.

Background

The agri-food sector accounts for a small share of income and employment in developed economies, but is a major user of water and land and has significant impacts on biodiversity and greenhouse gas emissions. Agriculture production itself is dependent on healthy ecosystems. Anticipated growth in the demand for food and agricultural raw materials due to an expected world population in 2050 of over 9 billion and growing incomes—mainly in developing countries—will place considerable extra demands upon scarce natural resources, while agriculture will have to adapt to climate change, contribute to the reduction in GHG emissions, and adapt to environmental risks. It also means enhancing the environmental public goods (such as biodiversity, cultural landscapes, and carbon sequestration) produced by agriculture (Cooper et al. 2009). These are big challenges for policy makers and the agriculture sector.

Green growth, as defined by the Organisation for Economic Co-operation and Development (OECD), is the pursuit of economic growth and development, while preventing or minimising environmental degradation, GHG emission intensity of production, loss of biodiversity, and using natural resources within their carrying capacity. A green growth strategy aims to outline the various pathways and policies to ensure that enough food is provided, efficiently and sustainably, for a growing population.

The food and agricultural sector has been broadly successful at the global level over the long term in providing for an increasing and wealthier global population. Productivity growth has been strong, and has exceeded the population growth rate. Crop yields and livestock productivity have risen substantially and as a result the real price of food has declined over the long term. However, the fruits of this technical accomplishment have not been evenly shared in all countries and at all times. In some countries and regions productivity growth has been low (Alston et al. 2009) and while the number of hungry people has decreased over time, regional food crises and famines persist and there is the paradox that there are as many "over-nourished" as "undernourished" people not only in terms of calories but, as important, with respect to the nutritional composition of diets.

Moreover, from an environmental perspective, continued growth in agriculture using the "business as usual" model is not sustainable in the long run. The pressures on and depletion of natural resources, and environmental damage from some production activities and management practices are causes for concern. Nutrient run-off from farms into watercourses and soil erosion, while improving, are still significant in some countries. Public expenditure on agricultural research and development accounts for over 60 per cent of the total globally, but overall R&D expenditures have been declining (CGIAR 2005).

Climate change is expected to exacerbate the existing challenges faced by agriculture. According to the Intergovernmental Panel on Climate Change, it will lead to an increase in both crop and livestock productivity in mid to high latitudes[1] and a decrease in the tropical and subtropical areas. Importantly, some of the most economically vulnerable countries that are already food insecure are expected to experience the most negative impacts. On balance, at the global level the net impact is expected to be negative in the long term (IPCC 2007; IPCC 2014). The expected increased variability of climatic conditions will also necessitate important adjustments in agriculture. In some cases current production choices (type of crop or animal production) may actually cease to be viable.

In this context, Agriculture Ministers, meeting in OECD in April 2016, agreed to four key policy goals, including the following: contribution to sustainable productivity and resource use, solutions to climate

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[1] In the long term, if greenhouse gas emissions are not significantly reduced, yields will fall in most regions.

change, resilience in the face of risk, and the provision of public goods and ecosystem services. In so doing, they agreed to make innovation a priority in order to achieve sustainable productivity growth; foster production systems that use available water, land, forest, energy, soil, and biodiversity resources sustainably and which promote animal, plant, and human health; and foster greater resilience of farmers to risk to enable them to cope with more frequent, unpredictable events, such as weather-related shocks, disease outbreaks, and market volatility.

This goal is, in essence, green growth, building on a 2011 OECD report on *A Green Growth Strategy for Food and Agriculture,* which argued that green growth is not only desirable and achievable, but is also essential if the food and nutrition requirements of future generations are to be met.[2]

Green Growth Strategy

A green growth strategy for all sectors of the economy, as developed by the OECD since 2009 in the wake of the global economic crisis, focuses on practical and feasible pathways to achieve the overarching goal of sustainable development. This has attracted interest from policy makers and business leaders because it highlights integration and the *synergies* between growth in production *and* environmental performance for both policies and business practices (at least in the long run), stresses the *opportunities* to invest in capital and labour that will promote sustainable development, and focuses on identifying practical *policy solutions*.

In this respect, the agri-food sector has an important role to play in contributing to greener growth, in particular by facilitating the uptake of green technologies and management practices and reducing waste in the food chain. This will involve a range of policies and business practices to account for environmental externalities that are not factored into

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[2] Other international governmental organisations have also developed policy strategies under the broad vision of the "green economy". They include the FAO's *Greening the Economy with Agriculture* project; UNEP's *Green Economy Initiative*, which includes agriculture and fisheries; and the World Bank through its *Global Green Growth Platform*. These initiatives were presented on the occasion of the 20th anniversary of the 1992 United Nations Conference on Environment and Development (the Earth Summit), at the Rio+20 meeting in Brazil in June 2012. Green growth is also in line with the Sustainable Development Goals of the 2030 Agenda for Sustainable Development adopted at the United Nations Sustainable Development Summit in September 2015.

producer and consumer decisions and as such tend to produce too much pollution or resource waste and too few ecosystem services.

The relationship between agriculture and green growth is complex. The food and agricultural sectors can both generate environmental harm and conserve ecosystem services. This is because the sector both depends on and impacts natural resources (land, water, and biodiversity) in the production process. Moreover, resource endowments and environmental absorptive capacities vary widely across countries and regions, and impacts can differ in the short and long run and at different stages of production and consumption. Thus the context is critical.

What Are the (Interrelated) Economic Concepts that Underpin Green Growth?

First, *optimum growth*—by which current economic activity (consumption, saving, and investment) provides a level of welfare for the present population that does not reduce the ability to provide for the welfare of future generations. This is the basis for "sustainable development", which was defined in the 1987 UN Brundtland Commission Report as "development that meets the needs of the present without compromising the ability of future generations to meet their own needs". It means that an economy replaces depreciated capital and invests to meet those future needs. But "capital" is not just the conventional notion of physical assets, but also includes human capital (such as education and skills) and natural resources (such as land and water).

Second, *externalities and public goods*—by which economic activity incurs costs and benefits to society that are not always taken into account and attributed to those producers and consumers that generate them. The "negative" externalities in agriculture are often environmental, such as water pollution, loss of biodiversity, or natural resource depletion, while public goods include the preservation of aesthetic landscapes, or carbon sequestration in agricultural, in particular grassland, soils. The reason why such externalities and public goods are not taken into account is because they lack markets, or regulatory mechanisms, often as a result of poorly defined and enforced property rights. The upshot is that there is a distortion in resource allocation as "too much" pollution and "too few" public goods are provided.

Third, *prices*—by which the allocation of resources within a market economy is primarily determined by prices that reflect the changing nature of demand and supply. However, prices are affected by government policies—especially in the agricultural sector where production and other subsidies are pervasive—market structures (such as monopoly or monopsony), imperfect information, and underpriced natural resources (such as water), and the existence of externalities and public goods.

Which Indicators Can Track Progress Towards Green Growth in Agriculture?

In order to assess if policies and actions by farmers are delivering green growth it is necessary to measure performance. This is complex, not only because of the range of environmental impacts across air, land, and water resources, but also because of the specific agro-ecological context in different countries and the fact that some impacts take a long time to appear, such as the impact of agriculture on GHG emissions and on climate change. And making comparisons across countries is a big challenge, made complex by the lack and variability of data.

The OECD has made a first attempt at developing green growth indicators for agriculture (OECD 2014). Among the indicators developed by the OECD, those shown here are the most robust, and comparable across countries over a long time period using a common methodology. Figure 3.1 shows that while agricultural gross domestic product (GDP) and carbon productivity for agriculture have steadily increased since 1990, GHG emissions have fallen slightly over the last 20 years, meaning that GHGs per unit of agricultural output have decreased significantly—a clear case of economic/environmental decoupling.

A similar development is apparent in Fig. 3.2, which shows the trends in nutrient balances (nitrogen and phosphorous) per hectare of agricultural land since 1990. The nutrient balance shows the difference between nutrients available and used by agriculture. A surplus shows that excess nutrients (fertilisers and manure) are passing into the environment, in particular watercourses, causing eutrophication and pollution. Although there is a very wide range of nitrogen balances across countries—very
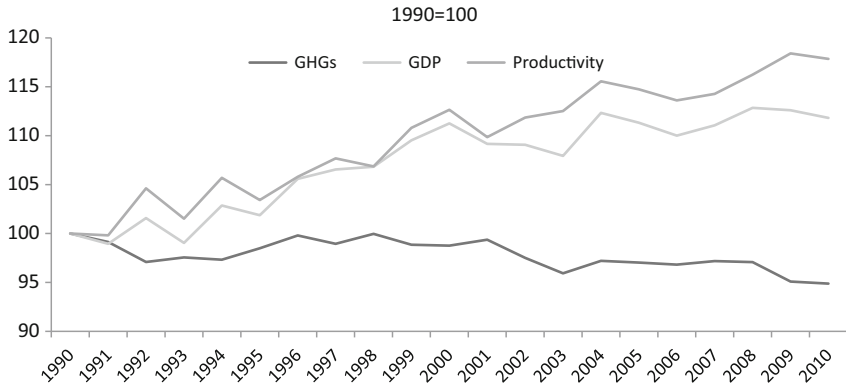
Fig. 3.1   GHG emissions, GDP, and productivity for agriculture in the OECD area. *Source*: OECD Secretariat calculations based on data from UNFCCC and FAOSTAT
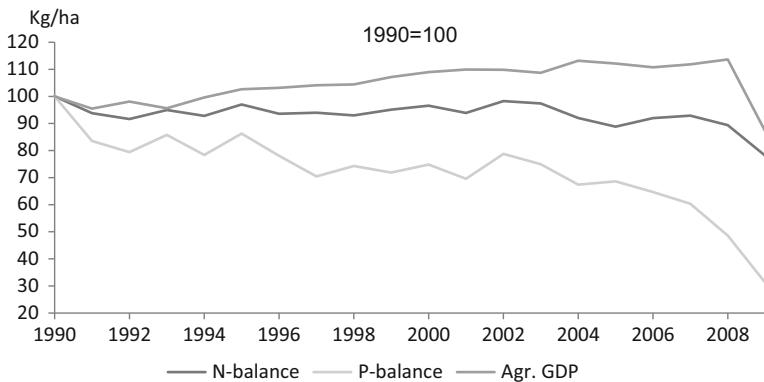
Fig. 3.2   Nutrient balance intensity and agricultural production, OECD area, 1990–2009. *Source*: OECD Secretariat

high in the Netherlands, Belgium, Japan, and Korea due to intensive agricultural systems but much lower in Australia, New Zealand, and North America—overall in the OECD the trend shows a reduction in surpluses.

There are many reasons for the trends—the price of inputs (fertilisers and energy) relative to outputs, and better information and farm management, but a significant factor is likely to have been policy reforms.

Those reforms have provided less incentive to overuse environmentally damaging inputs and farm practices, penalising farmers for environmental damage (polluter pays principle) and providing agricultural support conditional upon undertaking environmentally beneficial actions (cross compliance)—decoupling support from production leading to decoupling of environmental outcomes from production activities.

Sustainable Intensification

In the case of agriculture, green growth is largely synonymous with what is now termed "sustainable intensification". The term "sustainable intensification" is used by (among others) FAO, OECD, and in the UK Foresight report to characterise increased production through increased resource efficiency, taking into account environmental concerns, and potential synergies/trade-offs with climate change goals. The discussion over key aspects of the concept of sustainable intensification have been brought together in an OECD workshop of the Co-operative Research Programme on Biological Resource Management for Sustainable Agricultural Systems on *Feeding 9 billion by 2050: challenges and opportunities* and in particular in a paper by Charles Godfray on *The debate over sustainable intensification* (Food Security 2015).

Sustainable intensification essentially implies "land sparing", whose aim is to increase yields on existing agricultural land, leaving other land as unfarmed green, conservation areas. This is perhaps most attractive in high population-dense countries, such as the Netherlands (which has a highly intensive, highly productive agriculture with scarce green space), but has also been important in North America where agricultural land and wilderness are distinct spaces. Land sparing can be contrasted with "land sharing", whereby the aim is to meet production and conservation objectives from the same land. This is essentially the European agricultural model, whose achievement has been attempted by a whole range of cross compliance, agri-environmental payments, and regulations. The different models are important for the future of agriculture in Europe: both, overall, can achieve desired environmental outcomes, but the former pays more attention to a *competitive* agriculture, while the latter focuses on a *multifunctional* agriculture (COPA-COGEA 2011; European Commission 2011; Harper 2012).

The FAO (2010, 2011) has also developed the concept of *Climate Smart Agriculture* to address simultaneously productivity and environmental concerns in a wide variety of production systems, taking into account the scale and specific context of each situation. Building resilience to climate change for a range of production systems, from the smallholder mixed cropping and livestock systems to intensive farming practices such as large monocultures and concentrated animal-feeding operations, can also help address the challenges of the future.

Agricultural production has to increase, particularly in developing countries, both in quantity and diversity to ensure food and nutrition security and to address future growth in demand. In particular, livestock-sourced foods are projected to increase significantly in developing countries. Under a "business as usual" scenario, this increase will translate in a proportionate increase in direct emissions from the agricultural sector and in increased indirect emissions from derived crop feed demand (for pigs and poultry), deforestation, and production of inputs. To feed the world while contributing to climate change mitigation, there is therefore a need to decouple the increase of emissions from the growth in food production such that the pressure on the environment (GHG emissions, water use, and pollution) per unit of agricultural output produced decreases. This can be achieved by actions on both the supply and demand sides of the agri-food chain.

Policies

Policies play an important part in influencing the efficiency and environmental performance of agriculture. Giving greater emphasis to policies that encourage research, development, and knowledge dissemination can boost productive efficiency. Effective resource management programmes and environmental regulations can limit the negative environmental effect of policies. But not all government support is harmful to growth and the environment, while not all environmentally motivated subsidies are beneficial for the environment. The absence of government support is no guarantee that the desired level of environmental performance will be achieved.

The available scientific evidence suggests that "business as usual"—both of policies and practices—will lead to a future in which economic

growth will be constrained by natural resource limits, and climate change, putting the security of food supplies at risk. But "business as usual" may well be an attractive short-term option in so far as higher growth and better environmental performance may only become apparent in the long term (Box 1).

Box 1 Business as Usual and Green Growth Green growth may involve an opportunity cost in terms of reduced economic growth: some resources are consumed by actions and activities to protect environmental quality, or some outputs will be foregone. But this trade-off arises precisely because the cost of environmental protection is not accounted for under "business as usual", and therefore in the short run output would be higher than under a green growth trajectory. However, in so far as production practices that deplete and/or degrade the natural resource base needed for future growth are unsustainable, in the long run the situation will be reversed. Under green growth the resource base would be preserved—or even enhanced if damages are reversible—thus leading to higher output than "business as usual". Figure 3.3 represents possible stylised future trajectories of growth.

Identifying good policies, overcoming impediments, and embracing opportunities to move food and agriculture onto a green growth pathway,
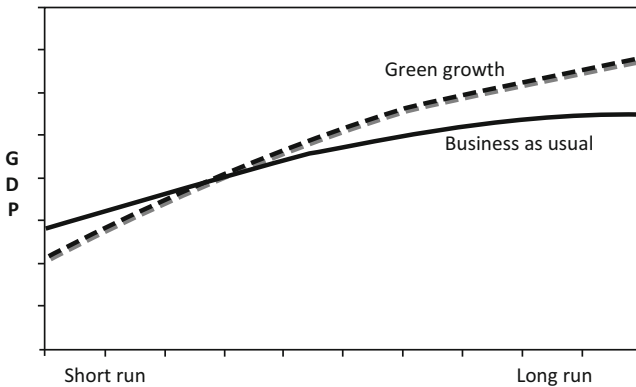
Fig. 3.3 "Green growth" compared to "business as usual". *Source*: OECD Secretariat

and developing the means to measure progress are all important. A green growth *policy* strategy needs to focus on three key elements to:

- *Improve resource use efficiency throughout the supply chain* to not only ensure higher productivity, but also conserve scarce natural resources and deal with waste (the potential for reducing waste along the food supply chain is likely to be considerable). This means according higher priority to research, development, innovation, education, and information applied to the agriculture and food sectors.
- *Facilitate well-functioning markets* so that prices reflect the scarcity value of natural resources as well as the positive and negative environmental impacts of the food and agriculture system that will contribute to resource use efficiency. This means reducing economically and environmentally harmful subsidies while providing incentives for the supply of environmental services; further integrating domestic and global markets through trade; applying the polluter pays principle through charges and regulations; and reducing waste and post-harvest losses, through better consumer information.
- *Clearly define and implement property rights* to help ensure optimal resource use, in particular for marine resources, land and forests, GHG emissions, and air and water quality, because when resources are essentially free or private participants it can encourage over-exploitation, resulting in environmentally and socially suboptimal outcomes. *This is a complex area and is increasingly of a global rather than purely domestic nature, and requires attention in particular to governance and institutions.*

Which Types of Policies Have OECD Countries Been Implementing?

Table 3.1 shows the range of policy instruments that are within the green growth policy toolkit, while Fig. 3.4 shows the steady decrease in support that is potentially most environmentally harmful—basically, with a shift from production-linked and input support towards support for environmental service provision and support conditional on respecting beneficial environmental practices.

Table 3.1. Green growth toolkit for food and agriculture

Green growth policies	
Environmental regulations and standards	Enact and enforce controls on excessive use of agrochemicals and fertilisers in production
	Strengthen rules and standards for water, soil quality, and land management
	Improve enforcement of environmental regulations and standards and certification from the farm gate to the retail sector
Support measures	Decouple farm support from commodity production levels and prices
	Remunerate provision of environmental public goods (such as biodiversity, carbon sequestration, and flood and drought control) beyond reference level and closely targeted to environmental outcomes
	Target environmental outcomes where feasible, otherwise target production practices favourable to the environment
	Target public investments in green technologies
Economic instruments	Price inputs to reflect scarcity value of natural resources
	Impose charges/taxes on use of environmentally damaging inputs
	Implement trading schemes for water rights and carbon emissions
	Address policy constraints (governance etc.) in less developed economies
Trade measures	Lower tariff and non-tariff barriers on food and agriculture products bearing in mind the potential impact on environmental concerns such as biodiversity and sustainable resource use
	Eliminate export subsidies and restrictions on agricultural products
	Support well-functioning input and output markets
Research and development	Increase public research on sustainable food and agricultural systems
	Promote private agricultural R&D through grants and tax credits
	Undertake public/private partnerships for green agricultural research
Development assistance	Allocate more development aid for environmentally sustainable initiatives, in food and agriculture

Table 3.1. (continued)

Green growth policies	
	Raise profile of agriculture in Poverty Reduction Strategies
	Allocate more funding for agriculture in Aid for Trade projects
Information, education, and advice	Increase public awareness for more sustainable patterns of consumption training such as via eco-labelling and certification
	Incorporate sustainable approaches in training, education, and advice programmes throughout the entire food chain

Source: OECD (2013), *Policy Instruments to Support Green Growth in Agriculture*, OECD Green Growth Studies, OECD Publishing, Paris. doi: 10.1787/9789264203525-en.
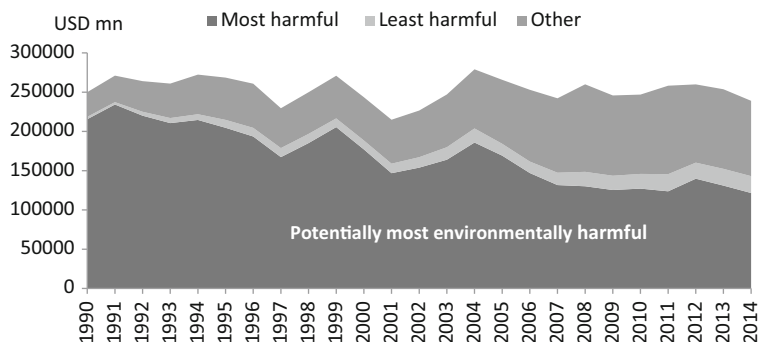
Fig. 3.4 Evolution of producer support in OECD countries by potential environmental impact. *Source*: OECD Database, 2015

From Strategy to Action

From an economic perspective, policies should facilitate *welfare enhancement*, while from a farm- or firm-level perspective the focus is on *financial viability*. Non-viable farms have little incentive to pay much attention to environmental protection in the short run if it reduces their financial viability.

What are some of the elements—particularly for policy attention—that can help move the agri-food sector from where it is today to where it would be in the medium to long term, say by 2050?

- *Developing a sustainable agri-food strategy*—which integrates agriculture, food, and health policies, and identifies measurable targets for production and consumption growth and patterns, as well as for environmental protection and enhancement, with an indication of sequencing and prioritisation.
- *Identifying domestic and collective global actions*—in an increasingly integrated world in the economic, environmental, and social dimensions, it is necessary to identify which are the policies and actions that are domestic responsibilities and those that require collective action at the global level. There is little incentive for any one country to reduce GHGs, for example, unilaterally, and this may also apply to some biodiversity and water issues.
- *Monitoring and evaluating*—in order to track progress in achieving green growth a set of headline indicators relating production trends to environmental performance is needed, from global, national, to farm or firm levels, as well as regular evaluation of policies and business actions to identify best practice. This will involve, for example, identifying the new areas of data and indicators, including life cycle analysis of the whole food supply chain in terms of carbon and water footprints.
- *Facilitating good farm management practices*—ultimately, it is at the farm level that green growth actions have to be taken. Many farmers have considerable knowledge of what works in their specific circumstances, but do not always have the right incentives—and some farmers do not have the knowledge—to realise those actions. The OECD has brought together experiences in different countries that focus on farm management practices for green growth (OECD 2016).
- *Communicating and engaging parliamentarians, stakeholders and public opinion*—which is the most challenging and difficult, given that actual costs are likely to occur in the short run while benefits can only be expected, of unknown magnitude, in the long run. This requires policy makers and businesses to be frank about uncertainties, shocks, trade-offs, and synergies.

Greater collective knowledge about how policies and business actions contribute to green growth is certainly needed. It would be a way for countries and businesses to measure and benchmark their own progress and learn from the experience of others. Most importantly, it would be a step towards reframing growth to better manage natural assets and those environmental risks that would otherwise undermine economic growth and development.

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4

The Dominant Presence of MNES in Agro-Food GVCs: Implications for the Developing Countries

Rajneesh Narula and M. Shakil Wahed

Introduction

The last few decades have effectively changed the existing patterns of global economy, and arguably this has affected the developing countries most dramatically. Economic liberalization has played a significant role, first, through across-the-board global harmonization of trade rules through the agreements and protocols associated with the World Trade Organization (WTO). Second, and concurrently, most developing countries have shifted from import-substituting economic policies to more open and export-oriented policies. This has had two primary effects (Collinson et al. 2016) both associated with growing economic interdependence. First, it has led to a higher degree of economic integration between countries and regions, and second, it has promoted the increasing interdependence of firms. Certainly, both these trends are concatenated with the growing role of Multinational Enterprises (MNEs)

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in the world economy. MNEs are best able to benefit from opportunities that allow them to leverage their ability to internalize cross-border markets, and coordinate complex networks of actors in multiple locations.

It is by no means accidental that—driven partly by significant technological changes associated with information and communication technologies, as well as improved transportation and logistics—there has been a growing tendency of MNEs to engage in foreign markets through different modes of governance that allow them to act as meta-integrators (Narula 2014), coordinating between a variety of actors, and depending less upon wholly owned subsidiaries (WOS) and foreign direct investment (FDI). MNEs in certain sectors have demonstrated a tendency to exercise control through a variety of operational modes that do not involve ownership. In short, MNEs have found ways to control value chains across borders without fully integrating these activities through common ownership. It is perhaps too early to describe these activities as being 'global', but the term 'Global Value Chain' (GVC) is in common use as a means to describe these sorts of complex cross-border chains that engage a rich network of actors that are linked through a variety of equity and non-equity means within specific sectors.

Not all these chains are dominated by MNEs, but many of the firms engaged in such value chains are indeed MNEs. In 2012, more than half of total global exports comprised of intermediate products and services pointing to the growing trend of value chains becoming increasingly fragmented and dispersed around the globe (Kaplinsky 2013: 4). In certain sectors, nonetheless, MNEs have been able to take advantage of these trends to disintegrate their previously vertically integrated activities into complex networks that include both WOS as well as arm's-length suppliers which happen to be located in various locations. This tendency of firms to use networks of spatially distributed actors within networks creates opportunities for firms in developing countries to participate in such MNE-dominated GVCs.

The agro-food sector is especially affected by this tendency, and is of great importance to developing countries given their comparative advantage in primary sectors. There are two distinct types of MNEs that dominate agro-food GVCs. First, there are large integrated MNEs such as Nestlé, Unilever, and Kraft. These firms rely on significant ownership (O) advantages that derive from their ownership of brands, considerable adver-

tising and marketing abilities, in addition to their R&D capabilities, organizational skills, and large economies of scale. They are large MNEs with sales in tens of billions and a geographic footprint that is global, and tend to have oligopolistic power in many developing and developed countries.

On a lesser scale, the second group of MNEs that operate GVCs in the agro-food sector are multinational supermarket chains, although they tend to dominate the retail industry in developed economies, and less so in developing economies. The top five retailers control 80 percent of agro-food sales in the developed countries (Traill 2006 cited in KPMG International 2013: 34). With the help of their dominant market power, these MNEs are lead firms in many agro-food GVCs. The trend is toward concentration of market power in the hands of a few multinational supermarket chains and large retailers (Konefal et al. 2005). Due to huge market power concentrated in the hands of a few firms, most of the agro-food GVCs are buyer-driven.

The dominance of these MNEs in shaping their supply chains is an important issue from an economic point of view. For the developing countries, access to these MNE-dominated agro-food GVCs are windows of opportunities to meet the various developmental challenges. Therefore, the policymakers from the developing countries look for ways and means through which their domestic firms can gain access to these GVCs. At the same time, it is not clear whether such access is always welfare-improving. It is not always clear whether high levels of participation in agro-food GVCs lead to net economic gains, because not all actors benefit equally within GVCs (Kaplinsky and Morris 2001). Therefore, it is important to understand how domestic actors can best engage with MNE-dominated agro-food GVCs.

Over the last half century, international business (IB) has developed as an important area of study looking into the issues related to MNEs and their behavior (Dunning 1980, 1981, 1988; Dunning and Rugman 1985; Dunning and Narula 1996; Buckley and Casson 1976; Buckley and Casson 2009; Rugman 1981, 2010; Hennart 1982). In parallel, Gereffi and his co-researchers (Gerffi et al. 1994; Humphrey and Schmitz 2000; Kaplinsky and Morris 2001; Gereffi et al. 2005) have developed an analytical framework for GVCs keeping the roles of governance and upgrading at the center. One of the core areas of current research is the need to reconcile these two fields of analysis, and this chapter seeks to engage with this discussion.

In this chapter we make some tentative observations about the role of MNEs in agro-food GVCs, paying special attention to the potential for actors from developing countries to engage as suppliers within these networks. We highlight that the shift away from full internalized MNE subsidiaries to non-equity modes (NEMs) and more arm's-length linkages with suppliers in host developing countries depends crucially on two factors. First, domestic actors need to be formally organized sector, with access to financial and knowledge capital. Second, the host economy needs to be able to make available the appropriate location (L) advantages that create the conditions that allow MNEs to engage with domestic firms. This means developing stable and consistent institutions that permit MNEs to enforce contracts and reduce shirking costs, in addition to the necessary infrastructure associated with public goods. Unfortunately, most developing countries—while well-endowed with natural resources—are deficient in both domestic actors with O advantages and the necessary L advantages.

Key Concepts of Global Value Chains (GVCS)

The term 'value chain' can be defined as the range of activities or functions that a product or service passes through from the origination at the concept level to transformation in production and processing up to the level of its final consumption, while Kaplinsky and Morris (2001) went further to include the function of disposal and recycling too. The idea of value chain was popularized by Porter (1985) to highlight the importance of focusing on a firm's competitive advantage along a chain of value-adding activities. As value chains (VCs) have become 'increasingly global in their geographical spread', scholars often refer to them as Global Value Chains (GVCs) (Kaplinsky 2013: 3). Gereffi (1994) broadly divided these chains into two types: (a) buyer-driven commodity chains and (b) producer-driven commodity chains. In the early 2000s, Gereffi along with a few other scholars replaced the term 'commodity' by 'value' in order to accommodate 'the full range of possible chain activities and end products' (Gereffi et al. 2001: 3). Since then the lexicon was changed from global commodity chains to global value chains. Gereffi made sub-

stantial contribution to develop and popularize the concept of GVCs and, therefore, some scholars refer to him as the 'parent of modern GVC theory' (Kaplinsky 2013: 8).

Governance has been central to the GVC framework in explaining how the chain works. There are five types of governance: (a) market governance, (b) modular governance, (c) relational governance, (d) captive governance, and (e) hierarchical governance (Gereffi et al. 2005: 83). At one end, market governance is characterized by the hands of market mechanism while at the other extreme, hierarchical governance is characterized by vertical integration. The other three types of governance fall into a broad category of 'networked governance' with varying degrees of power asymmetry between the lead firm(s) and supplier(s) in the chain.

Upgrading has been another key concept in the GVC framework. It refers to shifts or movements of various actors reflecting upon their competitive positions in GVCs. Scholars in the field refer to four possibilities of upgrading along a value chain: (a) product upgrading, (b) process upgrading, (c) functional upgrading, and (d) chain upgrading (Humphrey and Schmitz 2000).

Overview of Agro-Food GVCS

Agro-foods comprise a variety of industries, from staple crops like rice, wheat, corn, and maize to poultry, dairy, edible oils, cocoa, coffee, tea, sugarcane, aquaculture (both seafood and freshwater fish), horticulture (fruits and vegetables), apiculture (beekeeping), in addition to processing these resources into packaged and processed goods. Horticulture also includes flowers which are beyond the scope of agro-food GVCs. Figure 4.1 illustrates the primary actors within agro-food GVCs.

Agro-food GVCs typically start with the farmers and flow through traders, food companies, and retailers. Not all actors within a GVC are vertically linked to a given chain—there are input companies that provide seeds, fertilizers, crop protection solutions, animal health and nutrition, crop insurance, feed ingredients for poultry and cattle rearing, and so forth. They engage horizontally with a variety of different chains. Food companies and retailers include some of the largest MNEs that control major market shares in their respective sectors.
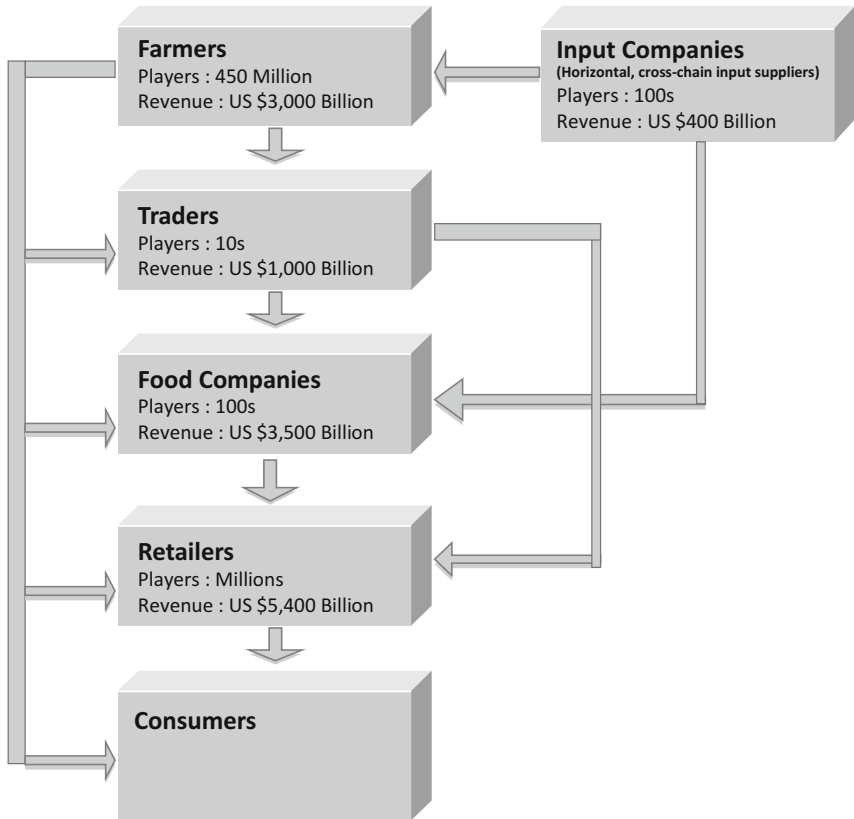
Fig. 4.1 The primary actors within agro-food GVCs. *Source*: Adapted from KPMG International 2013: 5

Growing Significance of Differentiation in Agro-Food GVCs

Since the 1990s, MNEs in the agro-food sector have been structuring themselves around GVCs. Traditional agricultural commodities have started becoming differentiated products with the touch of MNE standards and brands. For instance, basmati rice is a commodity, but it can also be transformed into a differentiated product that is grown, processed, and packed to certain standards, and then endorsed by various brands or labels. Rice as a

commodity is also an input to other higher value-added products, for example, noodles, rice-based wine, and other ready-to-eat food items. Similarly, coffee has evolved due to the adoption of differentiation strategies.

Differentiation strategies of these MNEs are not identical. Both Nestle and Kraft pursue mainly product differentiation strategies since their target is in-home consumption. Contrarily, Starbucks and Costa have to go beyond product differentiation and do more in terms of store ambience, personalized services, location, and so on since their target is in-store consumption (Fitter and Kaplinsky 2001). In particular, their O advantages associated with tangible and intangible knowledge assets help the MNEs in being much more effective than domestic actors from developing countries. Fitter and Kaplinsky (2001) suggest that differentiation largely benefits MNEs, and rarely reaches the farmers from the developing countries. There are fair trade campaigns run as part of differentiation strategies by a few leading MNEs in association with some nongovernmental organizations (NGOs) where farmers who grow coffee are paid fair prices. However, the presence of fair trade coffee in the market is insignificant and accounted for less than 1 percent of global coffee sales as of May 2001 (Fitter and Kaplinsky 2001: 12).

Limitations of the Developing Countries along the Agro-Food GVCS

Hymer's (1960) suggestion that the domestic actors in the agricultural sector in developing countries lack the ability to compete still holds true. Very few have the required capital, technology, access to market, and entrepreneurial and managerial capability to add extra value to their agricultural commodities. Developing countries have largely failed to transform their agricultural sector from an informally driven sector to a formally organized one. Formally organized firms are able to invest in developing and upgrading their O advantages, and formally enter into contracts to gain access to capital and technology markets. In general, the domestic actors in the agro-food sector from the developing world are informal entities, smaller in size, and do not possess the required O advantages that the MNEs usually do, or the O advantages necessary to become suppliers within agro-food GVCs.

The undifferentiated nature of agricultural commodities results in markets with low entry barriers and high competition. Due to the perishable nature of many such commodities, there remains the urgency in most of the developing countries to sell many of their agricultural products within a limited period of time, irrespective of market conditions. Establishment of cold chains, processing industries, and other forward linkage industries around the growing areas requires considerable investment, and most farmers (who are small-scale and informally organized) are unable to afford such investments, and most developing country governments are unable to generate the political or economic ability to provide these as a public good. Developing countries, in general, fail to develop such 'simple, obvious, and useful opportunities for forward linkages' (Hirschman 1984, c1981: 73).

Some scholars have highlighted the unequal distribution of value and income along the GVCs (Kaplinsky and Morris 2001; Gereffi 2014). They have referred to 'immiserising growth' to describe the situation (Kaplinsky and Morris 2001: 21) where an increase in overall economic activity with more output and more employment leads to falling economic returns. In fact, the most common puzzle that many developing countries frequently encounter in agro-food GVCs is how to achieve a balance between the agenda of growth and employment for the host countries and that of net returns for the MNEs.

The Problems of Engaging with Agro-Food MNES

MNEs usually possess a combination of three types of O advantages. First, asset-type O advantages include brands, patents, technologies, and knowledge embedded in personnel. Second, transaction- type O advantages include knowledge of external markets, institutions, relational capabilities, and 'advantages of common governance' (Narula 2014: 6), also termed as 'economies of common governance' (Narula 2016) and referred to as managerial capabilities of MNEs to organize intra-firm activities across different locations efficiently. Third, there are recombi-

nant advantages that allow firms to recombine, or bundle, or substitute existing assets with other internal and external assets (Verbeke 2009; Hennart 2009; Narula 2014). Different firms possess different configurations of these assets, and they provide the basis of their competitiveness in markets.

The degree to which firms are able to generate economic rents from the ownership of such assets depends upon how they can utilize these assets in combination with the L advantages of countries. For agro-food MNEs, there are two aspects of L advantages that matter: first, those associated with accessing inputs needed to manufacture their products (resource-seeking investments), and second, those associated with their markets (market-seeking investments). The first group permits MNEs to 'buy better', that is, to reduce their production costs, while the second is associated with 'selling more', that is, in increasing their revenues (Narula and Cuervo-Cazurra 2015).

Developing countries are important for both these reasons. Developing countries are important markets for MNEs in the agro-food sector. From a developmental and policy perspective MNEs in the agro-food industry that engage with consumers matter because they improve consumer surplus, and due to increased competition can spur domestic competitors to improve their own O advantages. However, our focus in this chapter is on the ability of developing country actors to engage with these value chains as suppliers, and their L advantages that make them attractive as suppliers within the GVCs.

L advantages can be classified into two main types. The first are those that are exogenously determined, such as fertile land, the availability of natural resources, suitable climate, and unskilled labor. The second are endogenous, and largely associated with infrastructure and the institutional environment. Basic infrastructure (roads, ports, electricity, telecommunication, education) matters because it is a public good and is essential for extracting and utilizing exogenous resources effectively. More advanced infrastructure matters for higher value-adding activities, and includes universities, standards, and research institutions, in addition to the associated organizations that shape and create efficient markets. These are often associated with formal and informal institutions

(Narula and Santangelo 2012). In general, the weaker the L advantages available to MNEs, the less likely that the location will attract MNEs, whether directly or through arm's-length linkages, and the less likely it will be home to competitive firms that can act as suppliers to MNEs.

Modes of Governance and Engagement Between Domestic Firms and MNEs

There is a continuum of governance modes available to MNEs. At one extreme, MNEs may engage with actors in a host country through complete internalization, by the use of wholly owned subsidiaries (WOS). That is to say, it engages in direct ownership to achieve control. At the other extreme, it may engage with local actors by not engaging directly through a local presence, but through international markets. That is to say, it engages in neither control nor ownership, and relies on markets to function efficiently.

One of the hallmarks of globalization has been the decline in the use of WOS (Collinson et al. 2016), and a growing popularity of NEMs, whereby firms are able to achieve control of the outputs and internal operating characteristics of their suppliers without engaging in full internalization, but do so without ownership. NEMs include all sorts of cooperative arrangements such as licensing, subcontracting, networking, and alliances that MNEs establish along the agro-food GVCs in lieu of vertical integration or market transaction. Figure 4.2 suggests that MNEs can engage in NEMs either directly with the domestic actors in the host country or indirectly through intermediaries.

The primary objective of an MNE in engaging with a developing country—either through WOS or through the market—remains the same. That is, it wishes to achieve reliable and competitively priced supplies of inputs, and where it can achieve price, quality, and reliability through market means (by outsourcing) it will naturally prefer to do so, but this requires little or no investment of its own resources, and greatly achieves its primary goal of improving its own profitability.
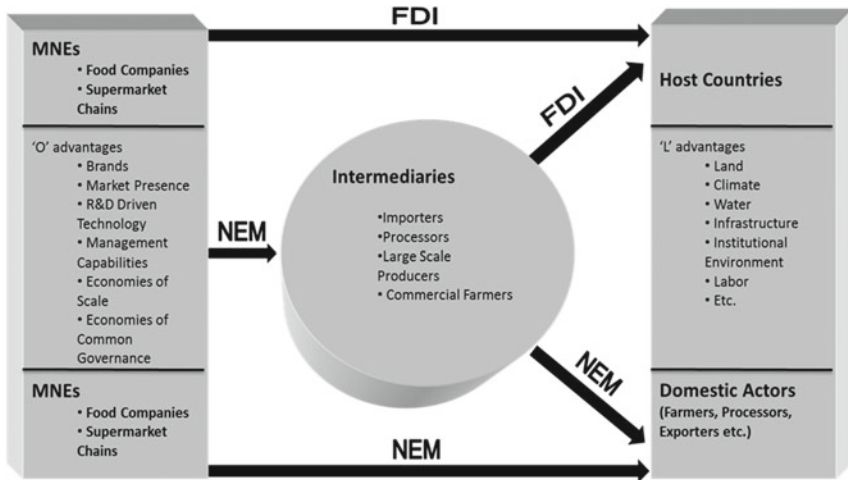
Fig. 4.2 Linking Host Countries to Agro-Food GVCs. *Source*: Authors

However, where there is an absence of domestic actors who meet the necessary requirements to be arm's-length suppliers, firms are obliged to engage in FDI and full internalization through WOS. It is a precondition that suitable domestic actors exist who are competent enough to meet the standards of the MNEs. Indeed, in many developing countries, there are few domestic actors that have the complementary O advantages to act as partners within the MNE-controlled GVC. The lack of resources in many underdeveloped countries means that there are few firms with sufficient financial or knowledge capital at the threshold level to meet the standards that are set by the MNEs.

Where firms that meet the criteria do exist, the question of choice of governance mode becomes germane. The degree to which firms may prefer to use NEMs within an MNE-controlled network is determined by a combination of two factors. First, there are cost-related reasons. That is, firms seek to minimize their net transaction costs, and this includes the costs of monitoring such agreements and the ability (and cost) of enforcing contracts made with external actors. The alternative—using a WOS—has its own costs. Second, there are strategic considerations, associated with the potential loss of proprietary knowledge to potential (or actual) competitors, and the danger of creating potential

competitors (Narula 2001). Although there are no studies that confirm this, the growing use of GVCs and NEMs is indicative of the fact that the costs of enforcing and managing non-equity agreements have declined quite considerably over the last few decades (Dicken 2003). Standards are central to the governance process of agro-food GVCs. MNEs use their own set of comprehensive standards as an effective tool to govern their respective agro-food GVCs. Actors who are unable or unwilling to act as per the standards or other rules of agro-food GVCs face various kinds of sanctions. As a result, no actor along these agro-food GVCs can afford to ignore the standards, instructions, and rules set by the lead firms. This is how the MNEs eventually integrate various external actors, along the agro-food GVCs, who are dispersed in several parts of the world, to act as if all of them are acting as the MNEs' own internal units. This reflects the usual tendency of MNEs to control every nontrivial aspect of their businesses, whether or not they own it.

Even the upgrading of various external actors along the agro-food GVCs is also subject to approval of the flagship MNE. Although the entrepreneurial, managerial, technological, and financial capabilities of the external actors are important preconditions for such upgrading to take place, they can rarely make their upgrading decisions independently. It is usually the MNEs that control key matters related to upgrading through the GVC governance mechanism—who will upgrade up to what level, when, and how—along GVCs or beyond.

MNEs are no longer limited to controlling and monitoring only the first-tier suppliers. Nowadays, the second- and third-tier suppliers are also traced back to monitor inputs, the production process, labor conditions, and environmental compliance. This phenomenon of looking beyond the first-tier actors is referred to in GVC literature as 'The Whole Chain Approach' (Humphrey 2014: 104).

Challenges for Developing Countries

In principle, the growth of agro-food GVCs has opened the doors for developing countries at the periphery to derive the kinds of benefits that they usually expect to derive from FDI, for example, new production

capacity through the establishment of direct and indirect linkages, various kinds of spillovers including technology transfer, skills upgrading, and, overall, a potential boost to employment and national income. However, to what extent both FDI and agro-food GVCs have, so far, created beneficial effects on developing economies remains questionable (Narula and Driffield 2012).

However, it is clear that where local actors that can act as partners within the GVC do not exist, or where local actors do not have the O advantages necessary to act as a part of the MNE's network, there are few benefits that will accrue to host countries. This is a *conditio sine qua non* (Lall and Narula 2004). MNEs from the developed world are increasingly expanding their direct involvement along agro-food GVCs in sourcing their key inputs from developing countries in order to ensure lower cost, higher quality, variety, and so forth (Gereffi 2014). However, the opportunity of linking one to the other remains strictly limited to a few actors due to the rising trend of consolidation strategy followed by a few dominant MNEs. Indeed, the absence of domestic actors means that MNEs continue to engage directly in countries that have the requisite L advantages.

The greatest challenge for the developing countries today is that most fail to obtain access to agro-food GVCs due to the limitations related to L advantages due to weak institutions, poor infrastructure, and the unavailability of formal actors. Most of the actors from the developing world are still some individuals or family members engaged in traditional farming or small-scale processing around growing areas, not yet developed as formal entities, that is, firms. They are largely characterized by the lack of the required amount of capital to invest, the minimum level of knowledge to be able to codify MNE specifications, and the basic managerial capability that may be necessary to engage in business with MNEs along the agro-food GVCs.

The challenge for domestic actors from developing countries here is twofold: (a) gaining entry to the GVCs and (b) upgrading during participation in the GVCs. From the country perspective, the challenge is not only to offer natural resources and low-cost labor to MNEs but also to ensure a complete package of L advantages by adding infrastructure like roads, electricity, and ports, institutional framework, skilled manpower, and, very importantly, capable domestic actors (Narula and Dunning 2010).

MNEs exhibit a relatively more footloose attitude in case of NEMs. Unlike WOS, NEMs do not involve capital investment in physical assets, direct human resource obligations, social and political implications in terms of reputation, and so forth. Therefore, it is easier for MNEs to change partners along the agro-food GVCs within and between countries. The existing power asymmetry between the MNEs and the developing countries is greatly affected by this footloose attitude (Narula and Dunning 2000).

Another important challenge for developing countries is food security. Actors that are engaged in production of high-value items for GVCs move away from cultivation of staple crops like rice and wheat toward growing high-value horticulture due to the higher returns. Staple crops that are needed to feed the local population are undermined by the temptation of gaining more profits from high-value crops for export. This may eventually turn into serious trouble for the developing countries if the crop choices are not made in a balanced way keeping the issue of food security in due consideration.

MNEs sometimes pursue strategies along the agro-food GVCs that may undermine the national developmental priorities of developing countries. For example, the consolidation strategy of multinational food companies and supermarket chains has been in serious conflict with the typical developmental agenda of developing countries. Similarly, the MNE strategy of achieving efficiency by taking advantage of low-cost labor and natural resources in developing countries may at times challenge the sovereignty of government policies regarding promotion of issues like better labor conditions and conservation of the environment.

Finally, it is becoming increasingly difficult for domestic actors along the agro-food GVCs, especially for those from the developing world, to cope with the growing levels of complexity of standards. Standards nowadays cover a wide variety of issues and add complexity for firms: (a) quality (appearance, cleanliness, taste, etc.), (b) safety (pesticide or artificial hormone residue, microbial presence, excessive use of preservatives, etc.), (c) authenticity (a unique origin or a traditional process), and (d) goodness of the production process (best practices related to labor, environment, wholesomeness of fair trade, etc.) (Reardon and Farina 2002: 414). This requires greater interaction between regulators, the MNE itself, other

private entities like consortia, and civil society, all of which are involved with their relevant part(s) of standards. This gives rise to complexity and cost implications for small-scale actors from developing countries.

Conclusion

MNEs are engaged in strategies to maximize their profits. Unless bound by law, they usually do not care much about altruism. On the other hand, governments are not engaged in business for profits. How to insert more domestic actors and upgrade the existing ones along VCs to capture more value, enhance gains, and establish further linkages for a more inclusive growth are some of the important issues for the host governments.

Both the MNEs and host governments have complementary roles to play. For instance, the MNEs need the governments to offer L advantages like a functioning legal environment and policy support, in addition to building infrastructure and a national innovation system. Governments also need MNEs to help spur growth, employment, income, and support other important developmental agenda. MNEs do keep track of government policies including the national priorities of the host countries while pursuing their business strategies. On the other hand, government policies should also take into account the business interests of the MNEs, allowing them adequate space to be able to operate profitably. What will be the impact of a particular government policy on the MNEs' business interests? Will the MNEs be adversely affected to such an extent that they might move away from this country to another? These types of sensitivity analysis should be done before launching a new policy or revising the existing ones.

Governments need to prudently formulate appropriate policies to mitigate some of the adverse effects that the MNE strategies may have on their national economies or societies or environment. It is up to governments to come forward to address the questionable parts of the MNEs' strategies, and provide coherent and consistent regulation to underline the public and welfare interests of the state, while maintaining an optimal environment for the MNEs to achieve sufficient returns.

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5

Global Value Chains, Multinational Corporations and Food Security: Essential Theoretical and Methodological Challenges for a Sustainable Policy Agenda

Marina Papanastassiou and George Mergos

Introduction

As the United Nations Conference on Trade and Development (UNCTAD) first observed in its 2011 World Investment Report (WIR 2011), there are two new major developments shaping global Foreign Direct Investment (FDI) trends. The first is the rising importance of developing economies as inward and outward FDI investors, representing

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half of the top 20 host economies for FDI and just under a half of the top 20 outward investors (9) respectively in 2014 (WIR 2015). The second is the expansion of Multinational Corporations' (MNCs') international production networks through *Non-Equity Modes* (NEMs). According to UNCTAD, MNCs' cross-border NEMs are estimated to be worth more than \$2 trillion of sales, expanding most rapidly in developing and emerging countries. This results in simultaneously complex internalized and externalized Global Value Chains (GVCs) (WIR 2013).

In this chapter we analyse MNC-generated GVCs by integrating two distinctive strands of the literature. One strand originates GVC analysis in the world system and Global Commodity Chain (GCC) theories (Kaplinsky and Morris 2001; Bair 2005). The other strand is International Business (IB), which focuses on the evolution and impact of MNCs on globalization. Today, global production networks are mostly led by MNCs and are organized through GVCs creating a close link between trade and FDI. According to UNCTAD (WIR 2013, p. x), GVCs "involve cross-border trade of inputs and outputs taking place within the networks of affiliates, contractual partners and arm's-length suppliers of MNCs".

We argue that a lack of understanding of how MNCs' subsidiaries shape and change GVCs creates a theoretical, methodological void. Research on GVCs has failed to capture the determining role of the MNC network (including NEMs) and in particular the roles of subsidiaries. At the same time, the IB literature similarly does not fully integrate the evolution of subsidiary roles in the analysis of GVCs. In this chapter we bridge these two theoretical aspects in order to establish an improved methodological framework, especially with a view to enriched policy recommendations.

In doing so, we focus on the agro-food sector, as food security is a priority Sustainable Development Goal (SDG), to highlight the theoretical and methodological challenges faced in addressing viable policy recommendations. Not only is the interrelationship between GVCs and MNCs *"industry and firm-centric"* (Gereffi and Christian 2009, p.6) but additionally, agro-food value chains reach deep into the fabric of developing countries. Finally, on the basis of this analysis we draw conclusions on the theoretical and methodological solutions available for the policy agenda.

Global Value Chains and MNC Subsidiaries

Dependencies can derive from different forms of economic transactions such as trade and investment flows or the development of diplomatic and other forms of political affairs. International economic and political transactions create in turn a complex grid of relationships among countries and in Van Rossem's (1996) "*role equivalence model of the world system*" four distinctive country roles emerge around the dichotomy between core and peripheral countries. Core countries dominate in influencing relationships among the network. This very much relates with Hymer's perception of how FDI transactions through hierarchical MNCs determine economic dependencies between a broad range of peripheral developing countries and a handful of core developed countries (home countries of MNCs) in a vertically functional supply chain. *"Such a functional hierarchy in MNCs is then innately associated with the developmental stratification of the world economy"* (Pearce and Papanastassiou 2006, p. 153).

In turn, Gereffi (1994, 1999a, p.1) links this geographically expanded "functional integration" with GCCs. GCCs are driven by "lead" firms and their suppliers. Their operations grow geographically and can be either "producer"- or "buyer"-driven. Traditional "producer"-driven GCCs are fully internalized and the "lead" firm controls its productive activities via strong vertical integration structures. On the other hand, in "buyer"-driven GCCs, the "lead" firms apply various modes of collaborations including NEMs. As Gereffi (1999a, p. 2) concludes, *"[p]roducer-driven and buyer-driven chains are rooted in distinct industrial sectors, they are led by different types of transnational capital (industrial and commercial, respectively), and they vary in their core competencies (at the firm level) and their entry barriers (at the sectoral level)."*

Bair (2005) provides a thorough analysis of the evolution from GCCs to GVCs where she acknowledges that their intellectual roots lie in MNC and IB theory (respectively) and argues that once upgrading and value are included in the analysis of commodity chains it is important not only to understand how the value is distributed along the chain (sectorally, functionally and geographically) but also how local economies contribute to the creation of value.

Thus, the following four key dimensions of GVCs are highly significant (Sturgeon 2001): the *organization scale*, which distinguishes between value chains and production networks; the *spatial scale*, which ranges geographically from local to global, with domestic, international and regional in between them; *productive actors*, which include lead firms, affiliates, suppliers and others; and the *governance style*, which, as Sturgeon asserts, is the most important aspect that defines the production model pursued and thus the "quality" of profitability achieved.

The notion of governance essentially determines the sustainability and profitability of the value chain. Gereffi et al. (2005) discuss the impact of transaction costs and coordination in the choice of governance model and four basic parameters define governance in the value chain: product, production process, timing of production and quantity of production. The production process in particular "*includes elements such as technology, quality, labour and environmental standards*" (Humphrey and Schmitz 2002, p.8). Thus, governance refers to "*the content and the management of these decisions across all suppliers and sub-suppliers, the strategies behind the decisions taken and management methods chosen to implement them, and the systems through which their outcomes are monitored and reacted on*" (Gibbon et al. 2008, p.4).

MNCs in either "producer"- or "buyer"-driven GVCs have geographical presence, by definition, including in developing economies. Developing countries find themselves taking part in two types of MNC-generated GVCs. The first type reflects the traditional North–North and North–South international production paradigms reflecting market, efficiency and raw material–seeking motivations (Dunning 1993).

MNCs are then organized as *network hierarchies* (vertical integration) (Pearce and Papanastassiou 2009). In such an organizational structure MNCs' subsidiaries play predetermined roles resulting in unsustainable economic linkages with the local environment (Papanastassiou and Pearce 1994). Such subsidiaries are located predominately in developing countries (Jenkins 1990). Their prescribed production profiles do not allow them to capitalize on the creative potential of their local economies compromising their efficiency and the sustainable growth of the host country. GCC and more updated GVC models assume that MNCs operate as network hierarchies and thus ignore the impact of subsidiaries

by not accounting them in the governance models (Gereffi and Christian 2010). This omission results in a serious methodological gap in evaluating the sustainability of GVCs, understanding their impact on both host and home economies. This results in inefficient policy recommendations.

Relatively recent changes in the external environment, such as the intensification of global competition through further liberalization of trade and international investment, technological developments, economic integration efforts of the premises and the rise of developing countries resulted in impacting on such hierarchical organizational structures. At the heart of this organizational change are subsidiaries that have unique and innovative abilities, which in earlier structures were found only in the parent company (Pearce and Papanastassiou 2009).

The emergence of these strategic subsidiaries is a key feature of *heterarchy* (Hedlund 1986). Within a heterarchical structure we observe the coexistence of different subsidiaries and different strategic motivations. Thus, a second type of MNC-generated GVCs is emerging and a South–South and South–North international production paradigm arises based on knowledge sourced in the South by either developing/emerging home country MNCs, the subsidiaries of developed country MNCs or the subsidiaries of other developing/emerging country MNCs (Zhao et al. 2015). A number of authors (mostly from the field of strategic management and international management in particular) reported two factors that can dynamically shape the roles of subsidiaries: factors related to the external environment and factors related to the internal environment of the MNC (Birkinshaw et al. 1998; Birkinshaw et al. 2002). Bartlett and Ghoshal (1989) decisively pointed out that subsidiary roles are determined by the strategic importance of the local market in terms of both size and quality of inputs and other productive resources. Latest research on the notion of "embeddedness" also focuses on the characteristics of the external environment that hosts subsidiaries of MNCs (Håkanson and Nobel 2001). Consequently, there are several cases of subsidiaries that specialize in specific productive activities that are fully integrated in the respective production system of the receiving environment (evidence can be seen in Kuemmerle 1999; Dunning 1993; Jarillo and Martinez 1990). Benito et al. (2003, p. 445) state that there is a strong connection between the skill levels of subsidiaries and the quality of local character-

istics and argue that FDI made in high value-added activities tend to be "sticky" emphasizing in this way the importance of integration (embeddedness). Thus, MNCs have the opportunity to strengthen their competitive advantages when taking into consideration the different features characterizing the host sites in which they operate and eventually arise from vertical hierarchies to diversified heterarchies.

Finally, industry plays a critical role in the structure and governance of GVCs. Consequently, generalizations that do not acknowledge the importance of industry in defining GVCs can produce misleading conclusions both for management and policy implications. Thus, it is important to address issues of sustainable governance in GVCs which are directly linked with the relationships of local and/or regional MNC subsidiaries developed with local host-country agents.

Food Security and MNC-Led Global Value Chains

The agro-food industry provides a clear case where we observe how MNC-led GVCs determine sustainable development for developing economies. Food security and sustainable development are global concerns included in the UN SDGs. Food and nutrition insecurity is a problem affecting billions of people globally (von Brown 2014). Climate change and population growth among other factors have put under stress agricultural resources (Godfray et al. 2010) whilst agriculture remains the main source of income for most of the developing world (Townsend et al. 2013).

Increasing investment along the food supply chain is one efficient and effective way for food security and poverty reduction. Consequently, responsible investment in the agro-food systems (FAO 2014; OECD 2014) and the impact of MNCs at both global and local levels of value chains, such as the interaction of large retailers and producers with small farmers, need to address issues of sustainability and development and demand well-informed policy tools and managerial decision making (Lall and Narula 2004).

Investment along the entire supply chain, from farm to food distribution companies and the provision of public goods are important for increasing productivity and efficiency of food systems. MNC-led GVCs play a crucial role linking small farmers to global food distribution chains and technology networks (Rama and Wilkinson 2008 and Oman et al. 1989). A recent Organisation for Economic Co-operation and Development (OECD) report (2012) acknowledges that value chains in agribusiness are both *producer*- and *buyer*-driven and they are dominated by MNCs. Gereffi and Christian (2009) point out that GVCs in agro- food evolve around two dimensions: the first is the global dimension represented by MNCs: "*This configuration is mainly driven by multinational lead firms: agro-business giants, diversified food manufacturers, fast-food franchises, and global retailers*" (Gereffi and Lee 2009, p. 5). The second is the local one and is represented by the local farmers, producers, local franchises and retailers. The interaction of "global and local food value chains" sets two major challenges for the global community: the first challenge relates to the restoration of competition and empowerment of the stakeholders in the local value chain. The OECD (2012) provides evidence of the strong presence of emerging and developing countries in agro-food GVCs. It also confirms the increased length of the GVCs and the importance of both the international and domestic components observing at the same time enough variation between the two components among countries. Nevertheless, it does not address or directly measure the impact of diversified subsidiaries in the length and share of GVCs.

The second challenge concerns the safeguarding of quality standards in GVCs by the lead firms. For example, in April 2014, PepsiCo accepted the Voluntary Guidelines on the Responsible Governance of Tenure whilst there was a recent pledge by Kelloggs, Nestle and others to stop targeting children in advertisements of unhealthy food. Thus, responsible investment by MNCs is central in achieving quality standards. In this spirit, the New Alliance for Food Security and Nutrition (https://new-alliance.org/) is committed to "*increase responsible domestic and foreign private investments in African agriculture, take innovations that can enhance agricultural productivity to scale, and reduce the risk borne by vulnerable economies and communities*".

The recently published OECD–FAO (2016) guidelines for responsible agricultural supply chains are directed to all types of enterprises involved in the agro-food value chain with the ultimate goal of securing sustainability in all relevant areas characterizing the value chain. Similarly, the inaugural Inter-Agency Task Force (IATF) (2016, p. 73) report stresses that the Addis Agenda further supports initiatives coming especially from MNCs to "embrace business models that have social and environmental impacts, and that operate sustainably".

Conclusion

The empirical evidence on the subsidiary impact is not reflected in the most recent models of agro-food GVCs. In contrast, these models continue to adopt a more neoclassical and hierarchical view and thus do not assess the potential of the host country environment particularly for developing economies and consequently miss to acknowledge the existence of creative subsidiaries who play a key role in the governance of value chains and compromise the adoption of responsible business models. MNC-led GVCs have been analysed theoretically by both the GVC and IB theories. However, looking closely at most existing models, the MNC is perceived as a homogeneous entity of a hierarchical structure. This is clearly showcased though the agro-food value chain and its impact on food security. As value chains are firm and industry specific, we must depart from such tempting simplicities and make sure that all important actors and stakeholders are included in the value chains. Subsidiaries are one of the important actors that are missing in almost every relevant analysis. Unless we include subsidiaries explicitly in the analysis we will continue to deliver incomplete and probably inefficient GVC models. The issue of data type then becomes central to this problem. More specifically, the OECD (2012) correctly acknowledges that we need to depart from macroeconomic data that hide information and address issues at the micro-firm level. We need to collect firm-level data, both quantitative data which can be found in company reports and qualitative data which can be derived from surveys and interviews in order to address the real-life aspects of GVCs. As the IATF (2016, p. 71) states, data collection of

global benchmarking initiatives is organized around five dimensions: "(i) competitiveness and the investment climate; (ii) perceived constraints by businesses; (iii) business and investment barriers; (iv) risk and policy uncertainty; and (v) cost of operations". In concluding, we should further improve the way we integrate theory with model methodology and data collection in order to be in a position to explore the potential for win-win-win situations across the agro-food GVCs.

The top 100 food and beverage (F&B) MNCs account for one third of the production and more than one half of the technological activities of the world's F&B industry. Active in all aspects of GVCs they internationalize their R&D activities in pursuit of competitiveness and in response to the high cultural impact of local tastes (despite the strong global trends) and to diverse climatic conditions; they have extensive production networks, operating through approximately 8000 diversified subsidiaries; and they collaborate closely with their suppliers by providing, developing and exchanging information, products and services (Filippaios et al. 2009; Ernst and Kim 2002).

Consequently, investigating responsible investment and the impact of MNCs on food security requires an in-depth understanding of how contemporary MNC GVCs operate and how the impact of the role of subsidiaries in the GVC governance is addressed.

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6

Financial Needs and Tools for Agricultural Development and Transformation Pertinent to Low-Income and Low–Middle-Income Countries

Alexandros Sarris

Introduction

Investment and financing of small farmers are central issues for agricultural development and food security. This chapter explores the financial needs that arise in the course of agricultural transformation in low- and middle-income countries, and then reviews the financial tools that have been utilized in a variety of settings in the agricultural sectors of such countries. The effort will be to identify situations and settings where some types of financial institutions are more likely to be successful than others.

The agricultural transformation seems to be an inevitable stylized fact of development, characterized largely by major changes in agricultural land and especially labor productivity. It is the transition to a state of

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higher agricultural productivity, and the ensuing higher level of aggregate income, that creates the need for finance. The appropriate provision of both amounts as well as forms of finance can facilitate or delay the necessary transformation.

Rural smallholders are the predominant agents of agricultural production in most low-income countries, and are also the sector where the largest incidence of poverty and food insecurity is located. Rural smallholders have similar requirements of financial services as urban-based agents, albeit the types of specific products needed are different given the agricultural product cycle. These include savings, loans, insurance, production and consumption risk management tools, payment systems, and so on. Many rural residents and agricultural producers are constrained in their economic behavior by the absence of many of these tools, and are consequently greatly hampered in improving their livelihoods, thus affecting the overall growth and welfare of the countries where they reside.

There exists a multitude of formal organizations that deliver financial services to rural residents, including commercial and publicly owned banks and insurance companies, savings and loan cooperatives, microfinance banks, specialty financial institutions, such as leasing companies, and housing and consumer finance companies. However, many of these institutions have not expanded much into agricultural finance. This is because of the dispersion of agricultural households that renders the provision of services expensive, the covariate risks, usually linked to weather, that affect large numbers of rural households simultaneously, the lack of knowledge about the particulars of agriculture, and the low education on the part of rural service recipients. In their absence, a variety of informal financial institutions have tried to fill the gap. These include rotating savings and credit associations, local credit unions, financial nongovernmental organizations (NGOs), businesses financing their agricultural customers, local private moneylenders, friends and relatives, self-help groups, and many others. Nevertheless, a large number of rural smallholders in many low-income countries are underprovided in financial services, and face high costs for the financial services available.

This chapter commences by discussing the patterns of agricultural transformation and its relation to overall growth in different parts of the world. The next section reviews the way in which agriculture grows. Section "Financial Flows into Agricultural Development" describes the

financial flows and financing gaps in agriculture. Subsequently the chapter discusses various models of rural finance, as well as the wide perceived gap between the needs and possible remedies in rural finance. Recent innovations in rural finance are explored. Finally, the concluding section describes the lessons learned from the reviewed literature.

Agricultural Transformation and Development

According to Timmer (2008), "a powerful historical pathway of structural transformation is experienced by all successful developing countries. This structural transformation involves four main features: a falling share of agriculture in economic output and employment, a rising share of urban economic activity in industry and modern services, migration of rural workers to urban settings, and a demographic transition in birth and death rates that always leads to a spurt in population growth before a new equilibrium is reached". Political pressures generated along the pathway, because of the distributional implications of the transition, have led to diverse policy approaches designed to keep the poor from falling off the pathway altogether.

Among developing countries in all continents the share of agriculture in gross domestic product (GDP) has declined considerably over the last 40 years, with the fastest declines being in East Asia and the Pacific, and South Asia. By contrast, the rates of decline have been much smaller in Middle East and North Africa, as well as in sub-Saharan Africa (CTA 2013).

According to the World Bank's World Development Report 2008, which was devoted to Agriculture (World Bank 2008, Fig. 1.2, p. 28), the average shares of agriculture in GDP and labor in agriculture both decline as a function of GDP per capita, with the labor share being largely above that of the GDP share, and both asymptotically converging toward each other and toward zero at the higher income levels. In other words, it appears that in the long run the share of agriculture in GDP and the share of labor in GDP tend to reach the same level. Theoretically this is possible only when the level of GDP per agricultural worker or the level of average product per agricultural worker is the same as the level of nonagricultural GDP or average product per nonagricultural worker. This equality largely defines the end of the agricultural transformation, and implies that agriculture can be regarded in the same fashion from an income and distribu-

tion perspective as any one of the many sectors of the economy. Several of the advanced economies have mostly reached this stage.

While the structural transformation just discussed seems an inevitable part of growth, the role of agriculture in development and growth is much more controversial. For many of the world's poorest countries, especially in Africa, a future without or with low levels of agriculture has been urged as the efficient path to development (e.g. Rosenzweig 2004; Wood 2003). Many macroeconomists, convinced of the power of rapid economic growth to lift populations out of poverty, see resources devoted to slow-growing agriculture as wasted. A "pessimistic school" of agricultural development specialists thinks that for both technical and economic reasons, Africa cannot rely on agriculture as a source of growth or poverty reduction (Maxwell 2004). In fact, the question arises that in a world of ample food supplies in world markets (some of it free as food aid) and increasingly open borders for trade, what is the role of agriculture in pro-poor growth.

The new endogenous growth theory has highlighted the importance of several factors conducive to faster economic growth, such as human capital, infrastructure, sound monetary and fiscal policies, democracy and political stability, trade openness, corruption, and others, while considerable effort has been given to exploring relationships between growth and inequality as well as poverty. This essentially macroeconomic approach to growth has placed much less emphasis on sectoral aspects of growth and poverty reduction. Similarly the World Bank Development Report for 2000/2001 titled "Attacking Poverty", which emphasized three themes—opportunity, empowerment, and security—is notable for the relatively limited discussion of sectoral priorities in reducing poverty and enhancing growth.

Development thinking and practice in the 1960s and 1970s tended to neglect agriculture as a leading sector, with its emphasis on import substitution industrialization and export promotion. It was only in the late 1970s and early 1980s that the role of agriculture as a leading sector was reemphasized in the development literature by authors such as Mellor (1976) and Adelman (1984). These authors emphasized the importance of agricultural growth in generating demand for locally produced non-tradable products, and thereby stimulating overall production and growth. Such a strategy was termed Agriculture Demand-Led Industrialization (ADLI) by Adelman (1984).

The real issue from a growth perspective is how to accelerate growth. More recently, in relation to the revival of discussion about growth rates, in the context of the "endogenous growth literature", there have been a number of papers dealing with agricultural growth, the terms of trade, and overall economic growth (Skott and Larudee 1998; Sarris 2002; Gollin et al. 2002; Adamopoulos and Restuccia 2014). Almost all of these models and papers highlight the fact that a healthy agricultural sector should be the driving force behind industrial growth in the early stages of development, superseded by export growth in the later stages. They also point out that the degree of openness, especially in the presence of economies of scale, is a key factor in understanding the role of agricultural productivity growth in speeding up overall growth. They indicate that since demand factors are crucial in determining whether agricultural productivity growth is helpful for overall growth, the distribution of income and gains from growth is a key factor in this issue. They finally point out that the composition of demand among tradables and non-tradables is an important element of the agriculture-first theories. The models, however, do not consider the issue of how agricultural productivity growth is to be achieved and how it is to be financed.

The World Bank (WB) World Development Report (WDR) on agriculture (World Bank 2008) classified countries into three groups in terms of agriculture's role in fostering growth and poverty reduction. First are the agriculture-based economies (most of them in sub-Saharan Africa), where agriculture contributes significantly to growth, and the poor are concentrated in rural areas. The key policy challenge in such economies is to help agriculture play its role as an engine of growth and poverty reduction. The second group consists of transforming economies (mostly in Asia and North Africa and the Middle East), where agriculture contributes less to growth, but poverty remains overwhelmingly rural. In such countries the rising urban–rural income gap accompanied by unfulfilled expectations creates political tensions. Growth in agriculture and the rural nonfarm economy is needed to reduce rural poverty and narrow the urban–rural divide. The third and final group consists of urbanized economies (mostly in Eastern Europe and Latin America), where agriculture contributes only a little to growth. In these economies, agriculture

can reduce the remaining rural poverty by including the rural poor as direct producers and by creating good jobs for them.

According to the World Bank, poverty is concentrated in rural areas, where 75 percent of the world's poor live. The decline in the $1-a-day poverty rate in developing countries—from 28 percent in 1993 to 22 percent in 2002—was mainly the result of falling rural poverty (from 37 percent to 29 percent) while the urban poverty rate remained nearly constant (at 13 percent). More than 80 percent of the decline in rural poverty was attributable to better conditions in rural areas rather than to out-migration of the poor. So, contrary to common perceptions, migration to cities has not been the main instrument for rural (and world) poverty reduction.

But the large decline in the number of rural poor (from 1036 million in 1993 to 883 million in 2003) has been confined to East Asia and the Pacific. In South Asia and sub-Saharan Africa the number of rural poor has continued to rise and will likely exceed the number of urban poor by 2040. In these regions, a high priority is to mobilize agriculture for poverty reduction.

How Does Agriculture Grow?

What is the process through which agriculture grows? Concerning agricultural growth and its components, early research (Binswanger et al. 1987) showed that the major determinants of agricultural supply are physical capital, infrastructure, human capital, research, extension, and rural population density. Prices were found to be weak determinants of agricultural supply. Similarly, Antle (1983) showed that the major determinants of total factor productivity (TFP) in agriculture in cross-country regressions are education, research, and infrastructure. Later research (Mundlak et al. 1997) confirmed these results and specified that technological change in agriculture is incorporated into increased agricultural production through the increases in physical capital stock.

The changes in the total factor inputs appear to account for only about half of the total growth of agricultural output. The rest is accounted for by the "residual", namely what is normally termed TFP, which is basically technical change. Mundlak (1999) suggests that the empirical evidence

points to the fact that the major way technology is incorporated into agricultural production is through physical capital. The different rates of growth of physical capital among sectors in turn can lead to differential sectoral growth rates along standard Rybczynski theorem logic. Changes in technology, however, especially those involving new discoveries in production techniques, come irregularly, and hence cannot be planned.

Studies that explore the contribution of different factors to agricultural TFP growth have shown that publicly funded agricultural research and extension are the two most important factors accounting for TFP growth, with rural education, irrigation, rural roads, and rural electrification coming next. The internal rates of return to public agricultural research in particular are estimated to be higher than 50 percent (Evenson et al. 1999; Fan et al. 1999, 2000).

The latest work on agricultural growth and productivity is that of Fuglie et al. (2012). Their major finding is that despite earlier worries to the contrary, based on analyses of TFP growth in agriculture during 1970–1990, there does not appear to be a slowdown in sector-wide global agricultural productivity growth. If anything, the growth rate in global agricultural TFP has accelerated since 2001, in no small part because of rapid productivity gains achieved by developing countries, led by Brazil and China, and more recently because of a recovery of agricultural growth in the countries of the former Soviet Union.

It thus appears that publicly financed research and extension, and rural infrastructure in the form of rural roads, electricity, irrigation, and so on are the major contributors to agricultural TFP growth, with investments in human capital also considered a significant factor (Alston et al. 2000). Evenson and Westphal (1995) point out that there are significant differences between agriculture-related research and industrial research, with the former much more circumstantially sensitive, namely sensitive to local conditions. Thus, to have a high payoff of agricultural research, the large fixed cost of establishing and running technological facilities must be geared to producing results that can possibly be adopted by a large number of producers. This explains, for instance why returns to agricultural R&D have been so high in densely populated agrarian countries such as those in Asia, while they are lower in sparsely populated agrarian economies, such as those of Africa.

Financial Flows into Agricultural Development

There are two major types of finance for agricultural production and growth. The first is medium- and long-term finance for investment in both private and public capital. The second is short-term finance for production or marketing. In this section we concentrate on finance for capital accumulation.

A recent State of Food and Agriculture Report by the Food and Agriculture Organization (FAO) (FAO 2012, Fig. 7, p. 17) indicates that capital stock is directly related to agricultural GDP. The same report (Table 1, p. 17) indicates the enormous difference in agricultural capital stock per worker among developed and low- and middle-income countries. The ratio in 2005–2007 was almost 35:1. More worryingly the growth rate of agricultural capital stock per worker in developing countries has declined over the past 30 years, compared to a significant increase for developed countries. The decline is large and significant in sub-Saharan Africa and insignificant in South Asia, while in all other regions the agricultural capital stock per worker has increased.

The FAO (2012) suggests that the level of agricultural capital stock per worker is directly related to the level of agricultural public expenditure per worker. This makes a direct link between agricultural public expenditures and agricultural capital stock. However, not all public expenditure in agriculture is investment. The share of investment in agricultural public expenditures varies from 9 to 84 percent as per a review of relevant figures by the FAO (2012).

Concerning public expenditures for agriculture, the FAO (2012) reports that while total public expenditures have increased worldwide in absolute terms, but mostly in East Asia and the Pacific and Latin American regions, the share of public expenditures going to agriculture has declined over time. Moreover, within that declining share, the share of agricultural GDP going to R&D, a major determinant of agricultural productivity growth, has stayed the same in low- and middle-income countries at 0.54 percent, while the share in high-income countries has increased from 1.53 percent in 1980 to 2.37 percent in 2000 (FAO 2012, Table 7, p. 31). The food crisis of 2006–2008 may have changed these trends but no aggregate figures are available.

The financing needs of agriculture to achieve a world free of hunger by 2025 have been estimated by Schmidhuber and Bruinsma (2011), who provide estimates of incremental public expenditures on agriculture and safety nets needed. Over this period, incremental annual public expenditures were US$50.2 billion. Of this the bulk (US$18.5 billion or almost 40 percent) is for expansion of rural infrastructure and market access, 9.4 billion is for conservation of natural resources, 6.3 billion is for R&D and extension, 5.6 billion for rural institutions, and 10.4 billion for safety nets. They have also estimated the average total (public and private) annual investments (not only incremental) needs of agriculture in low- and middle-income countries for the period up to 2050 to reach the FAO long-term projections for food and agriculture that are consistent with global food adequacy. The investment needs are considerable, amounting to more than 200 billion constant 2009 USD annually.

Concerning resource flows into agriculture, Lowder and Carisma (2011) have made a review of all the available information sources on this and have arrived at some general findings. Comparing among datasets, the average spending on and investment in agriculture for low- and middle-income countries for the three most recent years for which data are available reveal the following:

- Government annual spending on agriculture (both current and investment) in low- and middle-income countries averaged US$160 billion dollars in 2005–2007.
- Foreign Direct Investment (FDI) inflows to the above countries averaged 3 billion current USD (2006–2008) to agriculture, forestry, fisheries, and hunting.
- Official Development Assistance (ODA) to agriculture averaged 7 billion constant 2005 USD during 2007–2009.
- All flows exhibited an increase in total levels as well as levels per agricultural worker, since at least the early 2000s.
- Levels of FDI were larger for the high-income country group than for the low- and middle-income country groups.

The above numbers suggest that annual investment flows into agriculture are much smaller than what is needed to achieve a world free of hun-

ger. Among these flows, ODA to agriculture decreased from the 1980s to 2004 and from then on has increased considerably. Furthermore, the composition of aid to agriculture from 2000 to 2008 reveals that the bulk of aid to agriculture (more than a quarter) has gone into agricultural policy and administration management. Food production and extension, while small in the early 2000s, have seen a revival in the later years.

Concerning FDI flows into agriculture, Lowder and Carisma (2011) have reviewed available figures and showed that much of the apparent upward trend in total FDI is in reality due to an increase in the number of countries receiving FDI that are included in the dataset (from about 30 to 70), and because the data are reported in current dollar values, rather than constant dollar values. They also showed that FDI inflows to food and beverages are much larger than inflows of FDI to agriculture.

Rural Finance and Agricultural Development

Agricultural transformation in the current era involves a world of rapidly changing agrifood systems. In particular, the changing nature of retail systems, with the rise of supermarkets, and the global food chains that supply them have created many opportunities as well as potential problems for the world's smallholders as well as many finance-related issues (for useful references see Reardon et al. 2003; Swinnen and Maertens 2007; McCullough et al. 2008). Some of the related finance issues are discussed in this section.

The literature that deals with finance in the context of agricultural transformation and development (for recent surveys see Conning and Udry 2007; Karlan and Morduch 2010) has highlighted several pertinent issues:

- Financial market imperfections that limit access to finance is key to agricultural and overall development.
- Access to finance is not easy to measure. Financial access by agricultural households is limited in Low-Income Countries (LICs) and Emerging Market Economies, and barriers to access are common.

- Different financial services are required by different groups of farmers. Risk management and mitigation are of paramount importance for the poorest.
- Insurance cannot be separated from credit.
- Access to finance is both pro-growth and pro-poor. Spillover effects of financial development are likely to be significant.
- Provision of financial services to the poor will require subsidies.
- For the rural smallholders (about 450 million worldwide), credit is not the only service needed, but also savings and payment systems.
- Multinational buyers increasingly rely on smallholders for procurement of supplies. The chief obstacle is a largely unmet need for formal value chain finance.

The size of the unmet demand for rural smallholder finance is huge. A report by Dalberg (2012) estimates the demand for smallholder finance in the foreseeable future to be on the order of US$450 billion per annum, of which only about 2 percent is currently met by "social lenders" defined as impact investors, who seek a combination of market returns and social impact. Impact investors generally accept lower-than-market rates of return in exchange for achieving social or environmental goals not easily quantified by the market. Microfinance institutions are, for instance, a form of social lending.

The above estimate is based on the rather dubious assumption that of the 450 million smallholders, 225 million are subsistence farmers who do not currently need finance, while the other more "commercial" smallholders need on average US$1000 short-term finance per annum and US$1000 longer-term finance amortized over several years. However, even smallholders have financing needs, and clearly if one adds the financing needs of smallholders, which do not amount to zero, the numbers are considerably larger.

Social lenders have established a successful model for providing short-term export trade financing to producer organizations and agricultural businesses that reach smallholder farmers. This is where the bulk of financing for agricultural smallholders goes. However, given that only 10 percent of smallholders belong to producer organizations, social lenders

could currently address only US$22 billion of the short-term total financing demand or only 5 percent of the total demand. Of that, 90 percent is for export trade finance, and this overlooks the huge demand for finance of staples, which comprises more than 90 percent of total demand for finance.

The Dalberg report proposes five distinct strategies, or "growth pathways", for deploying investment that meets smallholder finance demand: (i) replicating and scaling existing social lending financing models, (ii) innovating into new financial products beyond short-term export trade finance, (iii) financing through out-grower schemes, (iv) financing through alternate points of aggregation, and (v) financing directly to farmers. These pathways map to particular value chain typologies, geographic focus, and cost structures. In particular, the efficiency of capital varies for each market pathway, because each involves a particular mix of the following costs:

- R&D costs, for developing and piloting models
- Marketing costs, for acquiring and educating customers
- Operating costs, for handling and servicing customers
- Risk management costs, accounting for volatility and the cost of capital

Each of these five growth pathways is discussed briefly below.

Growth Pathway 1. Replicate and Scale Social Lending

Social lenders can continue to expand their existing model of creating and supporting producer organizations and providing short-term trade finance to them. Social lending is targeted toward exportable cash-crop value chains characterized by high levels of smallholder aggregation into producer organizations. This growth pathway is driven by the marketing cost of increasing financial literacy and creating and acquiring producer organizations as clients. Risk management and operating costs are also relevant, but because this model is well established, the cost of R&D is negligible.

Growth Pathway 2: Innovate Into New Financial Products Beyond Short-term Export Trade Finance

Building on the social lending model, this pathway involves social lenders, smallholders in producer organizations, and exportable cash-crop value chains. Currently, social lenders primarily provide short-term trade financing for producer organizations. Through product innovation, social lenders could expand to meet other financing needs, such as working capital, longer-term financing of equipment and tree renovation, and on-lending schemes for financing individual organization members. Some social lenders have already begun to experiment with these products.

This growth pathway is driven by high risk-management costs that stem from long-term lending exposure to market fluctuations. It also involves high R&D costs for developing and testing new products. Because new financial products would be marketed to existing clients, the cost of acquiring customers is small, but there is some cost associated with introducing a new product to customers.

Growth Pathway 3. Finance Out-grower Schemes of Multinational Buyers in Captive Value Chains

Many multinational buyers have captive value chains organized around out-grower schemes that involve production contracts with farmers. These captive value chains can be contrasted with social lender value chains, in which producer groups are not necessarily contractually bound to a particular buyer beyond each individual transaction. Commercial lenders (and social lenders to a lesser extent) could provide finance to smallholders through these out-grower schemes, focusing on markets where buyers already provide finance or technical assistance to smallholders.

This growth pathway is driven by the R&D cost of developing and testing new out-grower schemes. By using existing buyer relationships with farmers, marketing and operating costs can be kept relatively low. Lenders can reduce risk-management costs by sharing risk with buyers and, possibly, farmers.

Growth Pathway 4: Finance Alternative Points of Aggregation

Aggregating farmers allows easier penetration of finance supply, but less than 10 percent of smallholder farmers are aggregated in producer or other organizations, especially in domestic value chains for local staples. Financing for these smallholders could be channeled through alternate points of aggregation in the value chain, such as warehouses, procurement networks, and input providers.

This growth pathway is one of the most expensive on a per farmer basis, because it involves the high R&D cost of new finance models and the high risk-management cost of financing small businesses. It also involves moderate marketing and operating costs related to working with small business clients. Therefore, this is an ideal pathway for donors to support if the social or environmental impacts warrant their attention.

Growth Pathway 5: Finance Directly to Farmer

The value chains of some local staples are unorganized, with dispersed producers and few points of aggregation. Reaching smallholders in these value chains is the last mile of addressing smallholder finance demand. The most promising solution is a variation on microfinance models for agriculture markets, perhaps through mobile banking.

This growth pathway is also expensive on a per farmer basis, because non-aggregated farmers tend to be isolated and dispersed across rural areas. In rural settings, the R&D costs of developing distribution models are high, as are the costs of marketing and operating. However, this growth pathway has the potential to minimize risk through diversification across a wide client base. Microfinance institutions could play a key role in addressing this demand.

There are different actors that are involved in each of the five pathways. The primary financier for the first two pathways are social lenders, while the primary financier in the third growth pathway is commercial lenders, in the fourth is donors and impact investors, and in the fifth is microfinance institutions. Needless to say, several of these financiers can be involved in the other pathways as well. There is ample room for all types of financial lenders to enter different parts of the rural finance market.

The above finance models must be combined with existing finance mechanisms, many of which also serve the "subsistence sector" and this is why they must also be considered. These models are the following:

- Family and friends network "informal" finance
- Interlinked credit (e.g. credit with labor or with land sharecropping), practiced between a larger intermediary (normally landowner or trader) and a farmer
- Microfinance through group lending
- Input supplier finance (interlinked trade and short-term credit)
- Trader finance (interlinked trade and short-term credit)
- Cooperative finance
- Government finance via monopolistic purchasing and input supply parastatals

Clearly there is partial overlap between these and the earlier pathway models, but all are needed if the huge unmet needs for rural finance are to be met.

Recent Innovations in Rural Finance

In this context it is also useful to discuss recent innovations in rural finance. The main ones among these are discussed in the sequel.

Finance through forward sales and contract farming seem to be simple and compatible with many of the institutional structures of the developing agrarian countries. They normally involve an agreement between a seller and a buyer. They are widespread in many parts of the world, especially between larger-scale intermediaries, such as processors who need raw materials, and groups of farmers. Many times the processors provide credit in the form of either cash or advance provision of inputs for production. Such contracts are a way to reduce price risks to farmers, but they seem to be more prevalent in products that need processing or are perishable. There are many different types of contracts (Bijman 2008).

Contract farming and forward sales are well suited to the social-network-based institutional setting of African as well as Asian farmers. They are based on trust and hence enforcement may sometimes be difficult. They are also much less appropriate for sales of staples, as the quantities to be delivered are not easy to guarantee, given the changing seasonal food security objectives of farmers. (For useful recent surveys of contract farming see Wang et al. 2014; Prowse 2012).

As liquidity and credit constraints are present in many developing countries, a system that offers considerable promise is the *Warehouse Receipt System* (WRS). The idea of such a system is that a producer of a storable commodity can deposit in a particular location an amount of the commodity of stated quality against a receipt. The commodity could be cleaned, dried, graded, and stored, all for a fee. The depositor could sell the commodity at any time in the future, and with smaller transaction cost, as the sale could be done with paper or electronically. The main advantage of such a system in credit-constrained rural settings is that the warehouse receipt could serve as collateral for loans obtained by a bank. This could alleviate one of the major constraints of small farmers, namely the need for cash at harvest time, and allow them to market the product at a later time when prices are presumably higher.

A limitation of this system is that a warehouse may require a minimum lot size to issue a receipt, and this may in effect be an entry barrier for smallholders. However, while a WRS may not cater to smallholders, it may well cater to larger operators who may act on behalf of smallholders. These could be cooperatives, larger traders, and others. (For a useful survey of the WRS see Hollinger et al. 2009.)

Another closely related institutional arrangement is an *inventory-based credit system.* The idea of such a system is that groups of farmers place their product in a warehouse, and a lending institution, such as a Microfinance Institution (MFI) or a bank, uses the inventory as collateral to extend individual loans to farmers. The management of the inventory is the collective responsibility of the group, and this places demands on the system in terms of trust. The difference from the WRS is the less formal nature of the system, and the focus on groups. This system has been tried in Ghana and Zambia among others (Coulter and Onumah 2002).

Another related mechanism would be to *indemnify loans for price risk*, in the sense that the price risk could be made part of a loan package. In some African settings price risk may be a major reason for possible non-repayment of a crop or other agricultural product loan, thus rendering lending from banks very risky. In such cases a minimum price contract resembling a put option, namely an agreement to pay the farmer a minimum price for his/her product, could be made part of the loan, so that if the price fell below a certain level, the farmer would not have to pay back the loan. The implicit cost of the option could be included in the overall loan, so that the farmer may not have to pay any money up front, but would have to pay back a larger amount later, at the time of repayment.

Another approach to rural finance is *cereal banks*. The idea here is much like the warehouse receipt system and the inventory-based credit system discussed above, except that it applies mostly to staple crops, such as cereals. Given that cash and export crops are easier to finance than cereals, the cereal bank idea is promising for the largest component of unmet demand for smallholder finance, discussed above.

Conclusion

Agricultural transformation entails considerable financial needs. This is because the demands for productivity improvements necessary in the course of the transformation require considerable capital upgrading, and also short-term financing for production inputs, the demand for which increases with technical change. Also, lack of finance can choke off agricultural development and poverty reduction. This is because of the reasons indicated above.

Government expenditures and financial flows into agriculture are inadequate in most developing countries. The investment financing needs for agricultural transformation in low-income countries are very large, and current lending accounts for a very small share of total needs. The bulk of financing flows into agriculture is private, and public flows are very small compared to the total. Donor ODA flows into agriculture are small compared to the needs, and have fluctuated considerably over the past two decades.

Most agricultural transformation and poverty reduction must be based on a smallholder model of development. Large gaps exist in smallholder financing needs compared to existing flows. Traditional rural financial institutions are inadequate to meet needs. There are several promising rural financial innovations that are emerging and that could address the serious finance gap for agricultural development.

In summary, the lack of adequate amounts of agricultural capital and short-term finance can slow down the agricultural transformation and consequently the growth rates in low-income countries, but new institutional structures could alleviate the problem considerably.

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7

MicroFinancial Services and Risk Management for Food Security: A Vulnerable Household Perspective

Jyoti Navare

Introduction

Microfinance has been perceived as a positive force in stimulating entrepreneurship, and regional and national development. Essentially there is a strong belief that other than narrowing the gap between the rich and the poor, access to microfinance creates a culture or a movement towards social responsibility for the subset of the population that is subjected to both social and financial exclusion (Lacalle-Calderon and Rico Garrido 2006).

The concept of financing people out of the poverty gap is not a new one. History does show that there have been many instances where financing schemes have been deemed necessary (Siebel 2005). Post the Grameen Bank's success of enabling micro-credit to female entrepreneurs in Bangladesh (Yunus 1999), there has been an acceleration of microfinancing schemes internationally in the attempt to regenerate small businesses and

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reduce poverty. These schemes have brought about a paradigm shift and a new modernity from classical financing through the provision of loan credit to creditworthy (low-risk) individuals to the microfinancing of loans and the provision of microfinancial services to vulnerable (high-risk) individuals.

Beck's (1992) thinking has been that in the new modernity there is a need to be reflexive in a sense that involves not only structural changes but "changing relationships between social structures and social agents" (p. 2). Microfinancial services by their very nature of financing service provision involve small sectors of individuals with tight links to the local social structures, with a focus on sub-sector entrepreneurs such as women entrepreneurs, capacity enhancement through financial and other education and, importantly, food production and management. The socially and financially excluded groups or vulnerable groups, however, have largely remained invisible. Schemes created by the Grameen Bank in Bangladesh and Velugu in India have been proactive in raising the profiles of such groups.

Social Exclusion, Vulnerability and Food Security

Levitas et al. (2007) define social exclusion as *"a complex and multi-dimensional process. It involves the lack or denial of resources, rights, goods and services, and the inability to participate in the normal relationships and activities, available to the majority of people in a society, whether in economic, social, cultural or political arenas. It affects both the quality of life of individuals and the equity and cohesion of society as a whole"*. Kurzban and Leary (2001) state that stigmatization or social exclusion arises because individuals or groups possess particular characteristics that exclude them from the norms of society. This could be not only financial but also racial or caste (Steele and Aronson 1995) and in respect of sub-culture of violence, criminality, drug dependence and squalor (Beall 2002).

Generally, social exclusion is related to poverty and this relationship is a relatively recent phenomenon (e.g., Lenoir 1974; Townsend 1979; Levitas 1996, 2000, 2005). Lenoir (1974) spoke of the "excluded" community in France which includes persons suffering from poverty, deprivation, and physical and mental conditions and those deemed to be social misfits or

out of social norms (such as single parents, women households, etc.). This social exclusion creates conditions of resource deprivation, with none or limited access to resources, exposure to social, financial and environmental risks, and food insecurity and inadequate food storage (Yodmani 2001).

Vulnerability has been holistically defined as "an aggregate measure of human welfare that integrates environmental, social, economic and political exposure to a range of potential harmful perturbations" (Downing 1992). Yet the studied concept of vulnerability assumes that vulnerability remains a static state of play. However, vulnerable groups can move in and out of vulnerability in as much as individuals and groups may not be vulnerable, socially excluded or poor all the time (Yaqub 2000; Morduch 1994).

With regard to food security (as determined by World Food Summit 1996), the relational factors are integral to food security for vulnerable individuals, especially as food meets more than an hunger need as in many countries food is part of social ritualization such as celebrations or funerals. Also importantly, vulnerable groups, by the nature of their vulnerability, are subject to adverse food supply effects, for example crop failure or no access to hygienic food outlets (Dreze and Sen 1989, 1990).

However, not all vulnerable individuals are equally vulnerable to hunger. In fact, it is not always the vulnerable who have a food security risk. Sen's (1981) notion is that of different commodity bundles or mixes of food sources derived from one's own production, labour or market exchanges, and donations or relief. However, if the concept of vulnerability is confined to shocks that affect food supply, access, production or retention, then it opens up the arena of vulnerability to all that suffer this, irrespective of the conditions of birth or social grouping. In other words, non-vulnerable groups can become vulnerable at any given time.

Vulnerable Groups and Food Security and Risks

Vulnerable groups, therefore, subject themselves to high-risk livelihood portfolios that may not be effective against shocks. Studies by Rosenzweig and Binswanger (1993) and Dercon and Krishnan (2000) showed that poorer and excluded households are more risk-averse and opt for low

returns from safe crops. The key problem for these groups is not only developing portfolios but also food security and access to finance. Food security, as defined by the World Food Summit in Rome (1996), "exists when all people at all times, have physical and economic access to sufficient, safe and nutritious food to meet their dietary needs and food preferences for an active and healthy life". Furthermore, they are vulnerable not only to hunger shocks arising from their vulnerability but also to human rights risks such as land grabs. Liversage (2010) sees these land grabs "done by national and local elites, competing land users (e.g., pastoralists and crop farmers), and land grabs within families, typically men from women and, where the incidence of HIV/AIDS is high, from widows and orphans" (p. 3). This accelerating social risk of the vulnerable and in respect of food security is shown to have an acceleration effect on poverty (Fosu 2010), which in turn can have implications for risk aggregation. These vulnerable groups have a low risk-bearing capacity because of downside consequences (such as underinvestment, few productive assets and borrowing capacity) (Kondo 2007) and also because of low access to services such as insurance or insurance substitutes (Stiglitz et al. 2009). Furthermore, it is not clear whether access to a service leads to demand for that service (investment may not materialize into yield) (IFAD 2011).

In this respect, Devereux's (2002) version of vulnerability as "the exposure and sensitivity to livelihood shocks" becomes more defined and that shocks to food insecurity are key to vulnerability. Food is seen to be the basic existence factor and to this extent the lack of food or chronic malnutrition creates a living vulnerability.

Food security has been identified as a priority development issue (Tickner et al. 1995) for vulnerable groups, particularly as the bulk of the shocks arise by way of agro-ecological fluctuation, inadequate and/or poor quality of landholdings, quality of water supply and access to water supply, lack of agro-equipment, lack of effective labour and managerial skills, inadequate hygiene, low purchasing power by families, and generally socially and often includes socially and financially excluded groups (Tickner et al. 1995; Tickner 1996).

Going back to the works of philosophers such as Socrates, Proudhon and Marx food is seen not only as a value for personal sustainability but

as an exchange or tradeable value. At the individual level the ability to ensure trade value hinges on the ability to identify the degree of individual or group vulnerability. Here vulnerability refers to the full range of factors that place individual or groups at risk of becoming food-insecure. Generally they constitute four groups:

1. Those that are chronically vulnerable because of say illness or disability etc.
2. Those that have limited or no funds to generate a sufficient income
3. Those that will be significantly affected by social, environmental and economic shocks, maybe because of location, level of dependency on others, access to financial help or timing of shock
4. Those that are limited by way of little education or access to education

Food access will be affected by the level of each of these factors. It is the last of these factors that critically determines the relationship between food security and vulnerability and to this extent how microfinance institutions seek to redress this inverse relationship. However, before considering the impact of microfinancing we need to understand the notion of the vulnerable householder to enable derivation of conditions in which microfinancing might apply.

The Notion of the Vulnerable Householder

Dreze and Sen (1989) consider the notion of the householder as entitled to food and provide an understanding to the issues surrounding food security and access to finance. Sen, in much of his work, felt that the inequality literature focuses mainly on income (1985, 1986, 1992, 1993, 1995, 1998). Providing access to finance does not itself reduce vulnerability. Sen argues for the case of financing that leads to capability build, that is, building the ability of the individual to increase their income and consumption. In effect it supports the age-old idiom that states that it is better to teach a man to fish so that he can fish for life rather than giving him a fish which he can only eat for a day.

There are some objections to Sen's theory as it is argued that social resources can get devoted to vulnerable groups and that they may not in fact pay attention to inequality above the vulnerability threshold (Tseng 2011), which can affect capability build of individuals within these groups. In effect there is significant literature that seems to indicate that microfinancing the vulnerable householder can in fact increase inequality (e.g., Adams and Von Pischke 1992; Rogaly 1996; Copestake et al. 2001; Copestake 2002; Dichter 2007; Bateman and Chang 2012; Bateman 2010). Sen (1992 p. 40) defines capabilities as the freedom of a person to be able to make choices for his or her well-being.

The notion of the householder and the enabling of capabilities is not isolated to the individual but extends also to a business.

Small businesses and microbusinesses face a wider range of critical risks than large multinationals do. Navare and Handley-Schachler (2016) suggest that a microbusiness tends to be more focused and use a smaller range of resources, and therefore, in theory, it is less able to absorb losses caused by local events or to diversify into industries with low or negative correlations of risk. It may be noted that in most developing countries there are little or no consumer protection laws, which creates an additional risk to the vulnerable householder.

Beck (2009) observed that too often the contemporary vision of risk (to the householder) is from the perspective of the Western world resulting in Western governments producing models of risk, risk management and risk mitigation from their perspective rather than what is appropriate to the local context. Local-level social risks are significantly different. Growing up in poverty, racial/ethnic/caste minority status, living in non-permanent homes and being subject to intimidation from power sources have been associated with a high level of income vulnerability, making it difficult to save and invest. However, the paradigm for capability build goes beyond economic betterment to personal empowerment, which includes not only personal betterment but autonomy and control over economic resources and decisions on food choice (Kabeer 1999, 2001). Kabeer extensively focuses on the three dimensions that define capability build and enabling the determination of strategic choices: access to resources, agency and outcomes.

Economic Instruments

Many economic instruments have been developed to improve the socio-economic conditions of the poor and the most vulnerable. Economic instruments have two main aims: first, to build the social worth of the vulnerable householder by enabling an increase in their income, their purchasing power and their access to financial markets (Zeller et al. 1997) and, second, to stabilize and/or lower food prices by way of targeted interventions such as income transfers, food subsidies or public work projects for those subjected to food insecurity. These economic instruments are in effect instruments of social protection (Sen 1999, p. 24).

The impact of policy instruments, however, needs to address both short and long-term impacts of food security or transitory food crises. Clearly, food insecurity responds both to emergency measures in the short run and long-term structural measures such as enabling access to social services and education that enables behavioural shifts. Microfinance schemes have been evidenced to being effective in alleviating poverty and enhancing capabilities (Robinson 2001; Yunus 1999). It is clear that what is important to enable a household's ability to shift from consumption to welfare is not only access to specific services (formal and informal) but also risk-bearing capacity.

Financing can impact these behavioural shifts towards knowledge build and welfare systems that enable food security in three ways:

1. Physical capital builds. Here consideration is given to alternative build, for example, instead of growing low-yielding crops householders might consider improved seeds and high-yielding crops (Feder et al. 1985). Programmes can be developed to enhance the risk-bearing ability of small farmers. For example, Zeller et al. (1998) found, in their study on smallholder farmers in Malawi, that households with small farms and low risk-bearing ability, participating in agriculture credit programmes, tended to be able to adopt more capital-intensive crops—and to become more risk-taking in their behaviours.

2. Much earlier on, Schultz (1961) observed that to enable such behavioural shifts required investment in human capital, which is the second factor in enabling knowledge and capacity build for the future.
3. It is further argued that enabling human capital build contributes to the development of social capital, which can help small farmers through co-operatives and networks to protect their interest (Brown and Ashman 1996) and, in turn, food security.

Zeller et al. (1997) identified three pathways where financing would have an impact: first, by enhancing householders' and farmers' income generation; second, through asset investment strategies; and third, by way of direct use of credit to finance immediate and long-term needs. The relative importance of income and food security has long been recognized but not applied as more has been done in developing food production than focusing on food security (Mulder-Sibanda et al. 2002). With regard to asset investment strategies, this has not always been high as a research priority, although the need for investment in capital build is acknowledged not only to enable farms to grow but also to improve productivity of labour and food security (HLPE 2013).

Food Security, Intra-Householder Processes and Access to Credit

It is known that access to credit has a direct impact on vulnerable householders' income. However, what is less known is whether it is a potent means to increasing food security. Zeller and Sharma (1998) found that in the majority of country studies undertaken "there was a significant and sizeable importance on access on income and household food security" (Zeller 1999, p. 3). The concept of the poor paradigm is well documented; although it is mainly considered in the context of poverty, in a sense it considers vulnerable people with low income and consumption per capita. The social justice theory criticizes this by suggesting other parameters for consideration such as Sen's capabilities approach. We suggest considering the poor paradigm from a food security perspective. This perspective considers ownership factors such as ownership over human

resources and allocation of labour (Maxwell 1995). Studies by Guyer and Peters (1987) and Folbre (1986) suggest that intra-household processes should also be examined to understand the forces driving urban farming and in turn food security. The processes are not individual but are dependent on the distribution and allocation of resources and responsibilities between household members including gender roles within the processes. To this extent intra-household dynamics involves not only economic considerations but also socio-economic and institutional ones. There has been significant research considering the relationship between intra-household dynamics and food security (e.g., Behrman 1988a; b; Rosenzweig and Wolpin 1988; Pitt et al. 1990; Thomas 1990, 1991; Behrman and Deolalikar 1990) evidencing the link between householder income, resource allocation, food security and householder health. What is not included in this relational equation is the access to credit ability.

There have been studies indicating gender access to credit and health status. For example Pitt et al. (2003) observed that women's (more so than men's) household bargaining power and therefore better access to micro-credit in rural Bangladesh showed a significant improvement in children's health outcomes.

The three-way relationship between intra-household processes, food security and credit access can be determined in three ways: actual borrowing uptake, membership in credit programmes and the credit limit (i.e., the maximum available for borrowing). The first two factors are voluntary and deemed endogenous (David and Meyer 1980). It may well be that parents who are proactive in managing health and food security might avail themselves of the loans and also the loan may not always be taken to the full limit. The food insecurity perspective of vulnerability has been largely explained through various lenses such as the poverty lens (Sen 1981), where access to food is limited or householders do not have bank accounts (Demirguc-Kunt et al. 2015); the socio-cultural lens, where accessibility may be restricted for reasons other than need such as castes and religion (Scully 2004); the property ownership lens, where there is no asset ownership or there is discrimination in the labour market (World Bank 2008); and the gender lens, where there are considerations of inequality (Holmes and Jones 2009). Such vulnerability and household consumption shocks are seen to create large fluctuations in income.

Financial Services and Consumption Smoothing

As Zeller (1999) observed, there is more focus on the role of microfinance for consumption smoothing but less so in respect of micro-credit and micro-insurance and micro-savings other than their role in "mobilizing capital". The vulnerable are subjected to two risks: income smoothing and consumption smoothing. It is difficult for vulnerable households to smooth income risks as they are subjected to adverse income fluctuations and in many instances have little savings to manage their income fluctuations. As the same time, they have heightened vulnerability as again vulnerable groups may not have the luxury of risk management choice either through insurance through their networks or insurance to enable stable consumption patterns (Morduch 2004).

It is clear that what is important to enable a household's ability to smooth income and consumption is not only access to specific services (formal and informal) but also risk-bearing capacity. In this respect, attention should be paid to financial services, that is, the provision of micro-insurance (Morduch 1999, 2006), micro-savings and micro-credit.

There are three key ways to develop service infrastructure for the vulnerable:

1. Savings build for consumption smoothing (community banking)
2. Credit build for current expenditure and investments (microfinance instruments)
3. Savings through regular payments to a pool or a fund (micro-insurance)

Rutherford (1998) points out that the poor often pay heavily for the chance to save (the problem with informal loans, which can be very expensive). Furthermore, microfinance does not always reach the poorest or the most vulnerable (Scully 2004; Simanowitz 2001). However, there are three key problems for financial service providers:

- The first problem is the existence of moral hazard (Linnerooth-Bayer and Mechler 2009), where collaterals may be ineffective (Bond and

Rai 2002); there may be collusion (Bond and Rai 2002; Valenzuela 1998; Counts 1997); and a high degree of moonlighting might exist.

- The second problem is that financial institutions have to deal with the paradox of adverse selection in their portfolios for demonstrating social justice (Stiglitz 1990; Varian 1990; Wydick 1996; Van Eijkel et al. 2007).
- The third problem is that trying to smooth consumption and income can be costly (Morduch 2004; Rosenzweig and Binswanger 1993) as vulnerable households have a high exposure to risk and a low risk-bearing capacity.

In reality there are a number of problems that the vulnerable suffer in accessing financial services, even though there may be opportunities to access these services.

Some Workable Solutions for the Vulnerable Householder

Deaton (1992) suggested that householders could hold buffer stocks in the form of assets that can be liquidated in the event of an income shock (these could be physical and other tradeable assets). These of course have their own vulnerability as safety from opportunists and thieves might be an issue.

Diagne et al. (1998) identified credit holds in their Malawi and Bangladesh case studies or reserves to overcome consumption smoothing. In other words, they hold the option to borrow and use their credit when it is needed the most.

Also there is evidence that human capital build (such as extended family or having a large family) can bring about greater opportunities and avenues for income and consumption smoothing.

Finally, Grootaert (1998) observed that precautionary savings in the form of social capital (e.g., investing in personal relationships and memberships in social institutions) can impact food security and consumption. They observed that having more social capital "can increase one's (insurance) claims towards society" (Zeller 1999, p. 9).

Conclusion

There is evidence supporting the fact that microfinancial services can promote food security and income and consumption smoothing for vulnerable households (Zeller and Sharma 2000; Olivares and Santos 2009; Ahlin et al. 2009). Although there seem to be problems that cannot be ironed out just by providing access to these services as vulnerable householders are subjected to immense social and financial pressures. However, there are mechanisms supporting vulnerable groups to be more empowered and enabling capacity build to overcome income and consumption shocks and thus reducing vulnerability.

It is worthy of future research to consider the social stigma that affects food security risk and the stresses undertaken by these vulnerable groups in accessing financial services and to observe whether these stigmas and risks vary between the urban and rural spheres where these vulnerable groups exist, for example vulnerable groups within urban slums.

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8

Innovative Agri-Food Value Chain Financing in Greece

Ioannis E. Chaniotakis

Introduction

Globalization has increased the role of internationally traded agricultural commodities in the world food economy. In addition, increased international awareness is observed regarding the importance of agriculture as a generator of income, employment, foreign exchange, tax revenues, as well as for poverty reduction and preservation of natural resources (see, e.g., Ahmed et al. 2012). Further, the increasing commercialization of agriculture, i.e., the production by agricultural households of food and raw material for the market rather than for their own consumption, links poor agricultural household to markets and increases their need for finance and credit, implying an increasing requirement for agricultural finance as a facilitator of economic development. Furthermore, consumers of agricultural

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products demand information not only on the availability of a food product but also about the characteristics of its production and processing activities. Therefore, the entire agri-food supply chain has become important because there is increasing public awareness and concern about the availability and safety of the food being consumed (Handayati et al. 2015). As a result, agricultural finance is related to a number of issues, including the production of agricultural commodities for the market, poverty reduction, and preservation of natural resources, food security and sustainability (Echeverria and Beintema 2009).

Access to agricultural finance differs from market to market because the situation on the ground in each market is different. For this reason, a successful agricultural finance innovation in one country may not be suitable in another. For example, constraints on access to agricultural financing are related to factors that vary from one country to another (Gashayie and Singh 2015). It is argued that although most agricultural finance constraints are common in almost all countries and have been identified by international research (operational, capacity, vulnerability and politico-legal), their importance in different countries in slowing down the availability of agricultural finance may be quite different, depending on the specific country characteristics. To alleviate such country-specific constraints, agricultural financing innovations are evolving with each country facing different challenges in implementing such innovations (Gashayie and Singh 2015). For this reason, before discussing the implementation of agricultural finance innovations, it is important to discuss the importance of the characteristics of each market, related to conditions not only of the value chain but also of the country and the entire banking system.

The main body of literature on these subjects refers to developing countries, with particular emphasis on African and Asian countries. It is interesting, however, to examine the case of an innovation introduced in the financing of Greek agriculture and its possible wider application. It is claimed that innovation in agricultural finance should be identified in more complex solutions than by the traditional banking loan characteristics (e.g., duration, grace period and repayment schedule). It seems that agricultural finance should be considered in the context of its total effect, not only on the borrower but also on the whole value chain in which the borrower participates, and even on the local economy. Thus, in the first section, in a brief literature review, the main terms and methodologies of agricultural

finance are presented. Next, the particularities of the Greek agri-food sector are briefly summarized and their importance for agricultural finance is highlighted. The following section illustrates the innovative agricultural financing model applied in the Greek agricultural market, based on the value chain finance approach, with particular attention to the "Contract Farming Financial Program," offered since 2013 by Piraeus Bank.

Agricultural Credit, Value Chain Finance and Contract Farming

Agricultural Credit

The term agricultural credit, in its broader sense, is used to describe the system of banking finance that covers the field of primary production, the processing and trade of agricultural products, and the distribution of agricultural inputs (seeds, plants, agrochemical products). In a stricter sense, agricultural credit is limited to primary production, which is usually not the focus of the banking system's attention due to its organizational model and the particular attributes that characterize the agricultural sector. Constraints to agricultural credit access have been identified in the theoretical and empirical literature, referring mainly to developing countries and vary depending on each country's particular context. Jessop et al. (2012), among others, designate as significant constraints high delivery cost, weak farming practices, lack of collateral, exogenous risks, government intervention and weak collaboration among farmers. Moreover, Temu (2009), examining rural finance challenges in Africa, mentions that there are constraints on agricultural credit related to high transaction costs, asymmetric information, low-income cash flows and capital bases, and highly risky commodity and financial markets.

Furthermore, Miller (2008) identifies some key challenges for rural financial service provisions that are currently recognized as obstacles that should be overcome for an effective agricultural credit system. These challenges are related to several constraints, such as vulnerability, operational, capacity, political and regulatory constraints. These constraints affect the progress of expanding agricultural financing and limit its success. According to Gashayie and Singh (2015), donors and governments

that had invested heavily in agricultural development banks and agricultural credit in the 1980s and early 1990s found that their efforts did not produce the expected results and withdrew their support. It was hoped that private commercial banks would step in. However, many researchers (Chalmers 2005; Zeller 2003) reported that financial institutions have demonstrated a lack of interest in agriculture finance.

Carroll et al. (2012) identify five alternative "pathways" to address smallholder finance demand:

- Replicate and scale existing financing models, such as the one of the social lenders
- Innovate new financial products beyond short-term export trade finance
- Finance out-grower schemes of multinational buyers in captive value chains
- Finance through alternate points of aggregation in the value chain
- Provide finance directly to farmers

Each of these pathways has advantages and disadvantages. According to Carroll et al. (2012), they differ in cost structures, value chain typologies, geographies and crops. Thus, some types of institutions are better suited to be the lead financial operator than others for any given pathway, in different markets and credit conditions. However, in all cases, better industry coordination is required to address the smallholder financing gap. Thus, the holistic view of the value chain is critical.

The evolution of agricultural finance, especially for smallholder farmers, has passed from the farm credit era to the microfinance donor era, to the Commercialization of Microfinance Financial Institutions and finally to value chain financing (Gashayie and Singh 2015).

Value Chain Finance

A value chain is the series of steps and related actors that transform raw materials into finished products. "Value chain finance," according to Miller and Jones (2010), refers to the flows of funds to and among the various links within a value chain. More specifically, they mention that

value chain finance is any or all of the financial services, products and support services flowing to and/or through a value chain to address the needs and constraints of those involved in that chain.

The term is broad and refers to both internal and external forms of finance that are developing along with the agricultural value chains that they serve. The "internal value chain finance" is one which takes place within the value chain (e.g., an input supplier provides credit to a farmer, a lead firm advances funds to a market intermediary). The "external value chain finance" is that which is made possible by value chain relationships and mechanisms (e.g., a bank issues a loan to farmers based on a contract with a trusted buyer) (Miller and Jones 2010).

Gashayie and Singh (2015) believe that value chain finance offers a challenge to expand the financing opportunities for agriculture, improve efficiency and repayments, and consolidate value chain linkages among participants in the chain. Also, they argue that the potential is becoming greater as there is an increased involvement of the private sector in the value chain finance. Moreover, some have suggested that financing along the agro-food value chain that links small farms to global value chains is the best antipoverty strategy, increasing food security and sustainability (see, e.g., Mergos 2015).

The "agricultural value chain finance" aims to structure financing along the value chain effectively, as well as maximizing efficiency and minimizing costs and risks. For doing this, it adopts a systemic approach that analyzes all the actors, processes and activities associated with the chain. Thus, Soundarrajan and Vivek (2015) state that, to improve the quality and efficiency in financing agricultural chains, the following steps are required:

- Identify the financing needed to strengthen the chain.
- Tailor financial products to suit the needs of the participants in the chain.
- Reduce the financial transaction costs through the direct discounting of loan payments at the time of product sale.
- Use value chain linkages and knowledge of the chain to mitigate risks to the chain and its partners.

Quiros (2006) has identified as prerequisites for a successful value chain financing the existence, among others, of the following:

- Buyers who are willing to participate actively in the value chain
- Strong financial institutions that (a) are committed to the rural sector, (b) have branches close to the producers and (c) have staff with the appropriate know-how to manage the process
- Reliable market data through public sources and/or other value chain participants
- Appropriate legal systems that enforce contracts and provide landownership documentation

Contract Farming

Contract farming is considered by da Silva (2005) as the most common value chain approach. Little and Watts (1994) define contract farming as the "forms of vertical coordination between growers and buyers-processors that directly shape production decisions through contractually specifying market obligations; provide specific inputs; and exercise some control at the point of production." Furthermore, Vermeulen and Lorenzo (2010) describe contract farming as pre-agreed supply agreements between farmers and buyers that usually specify the purchase price, or how it will relate to prevailing market prices, and may also include terms on delivery dates, volumes and quality. In this context, according to Will (2013), the buyers normally provide embedded services such as upfront delivery of inputs (e.g., seeds, fertilizers, plant protection products), pre-financing of input delivery on credit (explicit rates not always charged; see insert) and other nonfinancial services (e.g., extension, training, transport and logistics). As a result, in many cases, buyers seem to substitute the role of financial institutions with agricultural credit providers.

Contract farming is not a new concept, as there is evidence of its use already in the nineteenth century in Asia and Latin America. In the twentieth century, the concept spread to the USA and Europe and was introduced in North and sub-Saharan Africa (Bijman 2008). Its development has been reported to be significant in many countries and sectors. For example, it accounts for 75 % of poultry production in Brazil, 90 % of cotton, 50 % of tea and 40 % of rice in Vietnam, 60 % of tea and sugar in Kenya and 100 % of cotton in Mozambique (UNCTAD 2009). Despite this wide use of contract farming in developing countries, its use in industrialized countries

is not as common as could have been assumed, given its advantages over spot market conditions, mainly due to the lack of trust between potential business partners and the possibility to achieve similar prices through other distribution channels (Will 2013). The World Bank (2007) suggests that contract farming plays an important role in the integration of smallholders in agribusiness chains and includes it as one of its core recommendations to promote commercially orientated smallholder farming in order to "bring agriculture to the market" (Oya 2012).

The Context of Greek Agriculture

Innovation in agricultural finance, as it is claimed in this chapter, should be identified with respect to the more general market environment than by the characteristics of the product (loan). Agricultural finance should not be described merely as a flow of liquidity to the market, but it should aim at the elimination of structural problems of agricultural production and marketing in each market. Seen in this context, an innovation in agricultural finance will maximize the benefits for all participants in the market and will minimize the risks involved. To this end, a case study research has been designed, presenting the Piraeus Bank Contract Farming Program, which has been implemented in the Greek agricultural credit market. Apart from the author's experience on the project, the sources of information are based on interviews with the following:

- Five managers of food-processing enterprises and cooperatives
- Ten farmers that participated in the bank's Contract Farming Program
- Five bank employees of banks that were directly involved in agricultural finance
- Two academic experts in the field of Agricultural Economics

The Agri-Food Sector and the Greek Economy

Greece has been a member of the European Union (EU) since 1981. According to Eurostat (2016), the Greek agricultural sector contributes 3.4 % to the Gross Value Added (GVA) 13 % to total employment, while

Table 8.1 Greek versus EU-28 Agriculture's fundamentals

Key data	Indicator	Greece	EU-28
Rural population	% of total	44.1%	22.6%
Average size of agricultural holdings	Ha	6.8	16.1
Agriculture	% of total employment	12.9%	5.1%
Agriculture, hunting and fishing	% of total GVA	3.4%	1.3%
Crop output	% of total output	71.6%	55.6%
Animal output	% of total output	28.4%	44.4%
Total intermediate consumption	% of total output	56.0%	65.7%
Agricultural products trade—Exports	% of total exports	17.8%	11.0%
Agricultural products trade—Balance	million €	−1,154.1	4,278.2

Source: European Commission Directorate-General for Agriculture and Rural Development (2015)

the contribution of the entire agri-food sector (i.e., the agricultural sector and the "food, beverages and tobacco industry") to the Greek economy is increasing to 7.2 % to the total GVA and 15 % of total employment. A few key figures of the Greek agricultural sector are shown in Table 8.1.

The trade balance of agri-food products in Greece is negative, although recently this trade deficit has been reduced following an improvement in the agri-food sector's export performance. It should be noted that agri-food products are the third largest category of goods exported, with a value of €5.2 billion, accounting for 19 % of total Greek exports (*Lekkos and Leventakis* 2015). It should be noted that most of the agricultural trade of the country is carried out with other member states of the EU. About 80.2 % of imports and 65.6 % of exports of agri-food products in Greece are traded with EU countries (*Eurostat* 2016). The major products with strong quality advantage are olive oil, olives, raisins, fruits, vegetables, tobacco, tomato paste, yogurt, rice, and so on.

The strengths of the Greek agri-food sector include, among others, favorable climatic and soil conditions, a strong food-processing sector, a strong position in the Mediterranean diet products market and some mass-produced and traditional agricultural products, resilience of the agri-food sector in employment during the economic crisis, agri-food

value chain importance in the economy, significant production of agricultural products and foodstuffs with protected names of quality (PDO, PGI, etc.), rich biodiversity in species, ecosystems and landscapes, agricultural activity inextricably linked with the local traditions, creating a favorable environment for the development of rural tourism.

The weaknesses of the Greek agri-food sector include, among others, small farm size and land fragmentation, regional inequalities and intrasectoral disparities, low degree of integration of innovation in the sector, imperfect system of short food supply chains, imperfectly developed system of organization of farmers, inability of producers to claim a strong role in the supply chain of agricultural products, low value added by primary production, small interface between the agri-food sector compared to other sectors, inadequate training particularly in the agricultural labor force, large percentage of farm-holders aged over 55, high production cost of agricultural products, low agricultural income compared with the European average, low labor productivity in the agricultural sector and large agricultural trade deficit particularly in certain livestock products.

The favorable demand trends for Mediterranean products offer a strong growth prospect for the Greek agri-food sector, and consequently for the improvement of agricultural income in Greece (*EU Agricultural Outlook* 2015) provided that some of the weaknesses identified are addressed and efficiency of the agri-food value chain is increased. Moreover, considering that the market for high-quality products is expected to expand, a significant challenge for the Greek agri-food sector is to adjust its productive model progressively toward this direction. The Greek food-processing sector, thanks to the availability of high-quality raw material and specialized expertise, presents an enormous potential for increasing agri-food production value added and exports.

The Challenge

Credit is a vital ingredient for the development of the agricultural sector in every country and directly affects its efficiency. Financing needs are changing rapidly, following the rapid shifts and developments in the market. The prerequisite for credit organizations to operate schemes of

agricultural finance is to understand the specificities of the agri-food sector, the complex problems of its operation and to be able to synthesize, analyze and interpret the above data. In every country, agriculture is characterized not only by the fundamentals shown in Table 8.1, but also by a number of other operational characteristics that are related to the natural environment and the socioeconomic conditions of the country that determine the set of strengths and weaknesses of the sector.

Piraeus Bank recognized early that the agri-food sector is an important one for the national economy and strategically labeled it as a target market. Moreover, since 2009, when the country faced a deep recession, it became one of the bank's top priorities to make an effective contribution to the national economy. In 2012, the acquisition of the ATE Bank (Agricultural Bank of Greece) portfolio, the only specialized agricultural credit institution in the country, by Piraeus Bank accelerated its efforts to apply a new approach to agricultural financing. Since its establishment in 1929 ATE Bank has been the main lender to the agri-food sector as a specialized bank. Piraeus Bank after its acquisition of the ATE Bank entered a reevaluation of the existing financing system of the agri-food sector, searching for more efficient and innovative models of operation.

By the beginning of 2013, market research had shown that many farmers:

- Faced barriers to gain access to agricultural credit because of their low-income levels and the collateral required.
- Used farm loans in an inefficient way in a yearly cycle, such that they increased their real interest expense and, as a result, the cost of their production.
- Used farm loans not only for production purposes but also for their consumer needs.
- Could not make an economic plan for their production because there was a lack of stable relationships between them and the processing enterprises or cooperatives due to price-seeking behavior.
- Did not know at which price and whether they could finally dispose of their production.
- Could not feel secure that they would be able to sell their production and sometimes undertook the risk of disposing of it and being paid with significant delay or, in some cases, not being paid at all.

At the same time, processing enterprises and cooperatives:

- Faced the difficulty of ensuring the necessary liquidity for the repayment of their suppliers.
- Could not release current liquidity for other needs, such as investments and promotions.
- Did not have stable suppliers, making it difficult to plan their production
- Could not implement quality standards.
- Had weak relationships with the farmers, based either on their bargaining power or on their ability to compete on price with competitors.
- Faced difficulty in cash flow planning, as they had to estimate quantities, prices, quality levels and the time of delivery available.

Taking into consideration all these factors, the main challenge for Piraeus Bank was the development and enhancement of the relationship between the farmer and the enterprise or cooperative and to achieve it all in an innovative way. In this effort, the bank had some significant advantages:

- Liquidity was crucial for the sector due to the deep recession that the Greek economy faced since 2009.
- Piraeus Bank was well known in the Greek market for its innovative approach to banking. "E-banking" and "green banking" are two examples of innovative services that created innovation waves in the market.
- Piraeus Bank was a market leader in the agricultural sector and had the significant know-how not only in farm credit but also in the financing of the secondary sector of the economy.

The proposed solution was the development of an innovative banking program that could capitalize on the contractual connection between enterprises or cooperatives and farmers, and offer timely financing and ensure payments while, at the same time, it could result in the reduction of the production cost. The contractual partnership has been a traditional international practice since the nineteenth century. However, in

Greece it has been mostly implemented without efficient management and control, resulting in a waste of resources and liquidity, inefficient cash flow planning and irrational use of loans. For this reason, there was a need to change the rationale following agricultural financing to overcome issues related to the old and unsuccessful mentality. The Piraeus Bank "Contract Farming Program" (CFP) could provide partners with motives and a control mechanism and also offer a sustainable solution for the development of the agricultural economy.

The "Contract Farming Program" (CFP)

The CFP Concept

The CFP of the Bank of Piraeus is a new model of tripartite collaboration between producers, processing–commercial enterprises and the bank. For producers, CFP is related to the financing of a part of the production cost, provided that they have signed a contract for the disposal of their products with a particular buyer who participates in PB Contract Farming Financial Program (Processing/Commercial Enterprise, Agricultural Cooperative Producers' Groups, etc.). For enterprises, the CFP pertains to their financing for the purchase of agricultural products from their producers with whom they have signed a contract. For the bank, it comprises a new and innovative way to finance the primary sector. The bank enters into a lending relationship at two levels. The first level concerns the buyer of the crop or the livestock production, to whom a "credit line" is granted. Then, a short-term loan is given to the producers who have concluded a contract with the buyer mentioned above. The access to this loan is facilitated by the use of the "CFP Card" for the procurement of agricultural supplies (e.g., pesticides, fertilizers, animal feed and fuel).

CFP, in the first stage of its implementation, aimed at coordinating and supporting contractual partnerships between farmers and Commercial/Processing Enterprises or Agricultural Cooperatives. In practice, CFP addresses customers' real needs and provides liquidity to both partners, while also procuring production disposal and product payoff with intervention and control through all stages of the transactional cycle. In practice, it

represents an integrated banking model, which provides financing both to commercial/processing enterprises and to individual farmers, within a controlled economic "ecosystem." CFP is the first banking program in Greece that contributes to the rationalization of the primary sector's production by matching primary production with demand and financing both sides at the right time with customized tools. Moreover, CFP boosts the modernization of the transactional cycle, embracing the whole production–supply chain and payment administration.

The Benefits Created by the Implementation of the CFP

Benefits for both producers and enterprises are significant and more complex than just gaining access to liquidity. The producer, above all, secures the disposal of the production through the contract from the beginning of the farming period and can cover his needs for farming/breeding through the ensured financing of CFP. At the same time, the producer receives funds from the bank without additional collateral apart from the contract signed with the enterprise. Moreover, he knows the quantity that he can dispose of and the price that he will be paid upon signing the contract. Thus, he may achieve better income through better financial planning. Finally, the repayment of his loan obligations to the bank and third parties, as well as his net income, is secured through the program.

The enterprise, on the other side, is guaranteed of stable suppliers of raw material; therefore, it can plan its production. The relationship with the producers becomes more stable, resulting in their ability to intervene for ensuring the production of the local product. The bank's program ensures the necessary liquidity for the repayment of suppliers. The enterprise can also plan cash flow more efficiently from the beginning due to the availability of quantities, prices and estimated time of delivery. Liquidity is released and is thus used for other needs.

Even the bank gains benefits as it achieves high levels of customer satisfaction from the participants. Farmers manage to obtain access to liquidity required for their cultivation, secure the disposal of and payoff for their production, perform proper resource planning, improve product

quality and build stable cooperation with involved parties. Enterprises manage to find financial support in a difficult economic period, follow an accurate cash flow programming and act with reliability and extroversion. The bank also achieves high levels of customer experience through the implementation of the customized cards mechanism and, moreover, supports the national economy by providing liquidity to the entire agrifood value chain.

The uniqueness of the Contract Farming Financial Plan originates from the following aspects:

Through CFP, Piraeus Bank mediates between partners, providing coordination, controlled funding and a broad network of appropriately equipped agri-retailers forming in this way the appropriate conditions for the sustainable development of both the agricultural sector and the Greek economy as a whole.

- The provision by the bank to CFP participants of a customized bank credit card enables farmers to make their purchases from certain retailers in a convenient and secure way, monitoring their expenses and planning for their future liquidity needs. In parallel, the card serves as a control mechanism in that it is credited with a certain credit line per customer per period, which is securely and fully repaid upon payoff of the farmer's production by the contract partner's working capital.

The greatest implementation challenge for the bank is to establish a thorough understanding of the program idea by both enterprises and farmers, providing them with the necessary information. Other issues faced during the development process are related to the coordination of all business areas involved and the minimization of time required between the application of an enterprise to participate in the program and the final approval and shipment of the CFP cards.

The Implementation

CFP was initially developed by an inter-divisional team, under the coordination of the Agricultural Sector Division of the bank. After the market analysis (Q4/2012) and the pilot implementation (Q1/2013), the

program was launched in April 2013. During the first year, apart from demonstration to enterprises and agricultural producers, the most significant action was related to the set of a permanent specialized team that would be responsible for the project. The choice of staff related to certain requirements, which included the following:

- Educational background in Agricultural Economics or Agronomy
- Know-how regarding agricultural credit and corporate credit
- Knowledge of the operating institutional framework of productive units
- Communication skills
- Organizational ability to support and coordinate enterprises, farmers and other parties.

At the beginning of 2014, Piraeus Bank set some strategic objectives that directed its expansion. Among these goals were the efforts to

- Expand the product range covered by CFP, so that every farmer who wishes to join will be able to do so.
- Support of extrovert companies and cooperatives.
- Extend cooperation with companies that already have considerable experience in contract farming. Such firms were traditionally operated in this way either due to institutional conditions or because they had already chosen commercial practice.
- Support of environmental protection.
- The support of producers' organizations and enterprises in the country's border regions to contribute to the balanced and sustainable development of the Greek rural economy.

CFP Numbers and Future Plans

Before the end of 2016, more than 240 businesses and 21,000 farmers had participated in the Piraeus Bank CFP. The total approved credit lines, to both commercial and productive units, amounted to more than €700,000,000. The range of the products covered expanded to 55 covering, among others, olives and olive oil, tobacco, cotton, grain, table and

wine grapes, fodder, milk, fruits and vegetables, energy crops and organic products. These products are the "ambassadors" of Greece abroad and, with the support provided by the Program, are directed to more than 75 countries. The value of exports of enterprises and cooperatives that participated in the Program amounted to about €1.5 billion (equivalent to approximately 20 % of total Greek exports). Meanwhile, more than 14,500 people were employed in various positions in these companies.

The next step for the CFP is a double one: first, to implement a new program, the "Contract Banking Program" (CBP), and second, to extend the CFP not only to processors but also to final buyers, such as hotels and other bulk buyers.

Following the successful operation of the CFP, Piraeus Bank leveraged the acquired expertise and the commitment to increased contribution in the agri-food value chain to implement the next step. By applying the extended CBP, Piraeus Bank follows a holistic approach to the financial support of the agri-food value chain. Through the new program, the bank aims to finance the upstream and downstream activities across the agrifood value chain. More specifically, aiming at the reduction of the production cost of agricultural products, the bank offers the appropriate working capital to agricultural input supply stores, improving their access to the respective wholesale market and benefits from preferential pricing stemming from cash payment. In particular, through an automated system for ordering and financial liquidation, the bank is creating the right information technology environment so that agricultural supply stores can acquire agri-inputs timely and competitively priced. At the same time, the actual capital costs are low, as the approved credit is recycled through their sales. The challenge for the marketing chain is to allocate these benefits fairly to the rest of the participants in the chain and to ensure the rational functioning of the chain. Thus, farm products can become more competitive and also support the income of producers. The first pilot collaboration with *Bayer CropScience* started just before the end of 2015.

Moreover, under the CFP, the bank seeks to facilitate the promotion of the sector's products by strengthening the financial connection between the companies and cooperatives involved in CFP and bulk buyers such as hotel units. In practice, the bank offers working capital to hotels to procure branded certified products from enterprises and cooperatives

registered with the CFP. Financing is also based on a contractual basis between hotels and manufacturing companies/cooperatives. In this way, visitors and tourists enjoy on-site high-quality local products, and Greek products build a solid brand name. The next step is that visitors would seek and procure these products either locally or from their country.

The Experience of the CFP and Lessons for Other Countries

The privatization in 2012 of the ATE Bank, a specialized agricultural credit institution in Greece, and its acquisition by Piraeus Bank, a commercial bank that has proved its innovative approach in the financial market of Greece in the past, gave a new impetus to agricultural finance in Greece. Following a market analysis immediately after the acquisition in Q3/2012, a new program, the CFP, was designed and put into place in Q4/2012, based on the international experience of Contract Farming but in a tripartite system, bringing together the producer, the processor and the bank. This tripartite system proved very successful and expanded rapidly throughout that agri-food sector of the country. The experience and success of this innovative program can lead to the following main inferences about the main agricultural finance issues.

Innovation in the agri-food value chain could be initiated even from nontraditional direct sector participants, such as banks, who may offer a new and fresh approach to old issues. Innovation is also facilitated by a continuous review of the business models and cooperation of all partners. Innovation in agricultural finance should not be just on the flow of liquidity to the market, but it should target the elimination of the structural problems in each market. As a result, this will maximize the benefits for all participants in the value chain and minimize the risks involved. Agricultural finance also requires a different approach from market to market because each market has unique characteristics. Thus, the implementation of a new credit system should analyze in depth the conditions and the rules of the target market, identify problems that are linked to the financing and propose the appropriate solutions.

The Greek agricultural sector, as any sector, is unique due to its structure, history, product categories involved, processes, legal environment and participants' mentality. Moreover, its strengths and weaknesses make it difficult to imitate either a northern European market financing model or one from a developing country. Thus, the restructuring of an agricultural credit system, like the Greek one, could be based on current trends, such as value chain finance, but with the appropriate modifications.

Financial institutions that decide to offer value chain finance should have certain characteristics including (a) financial strength, (b) commitment to the rural sector, (c) wide branch network close to the producers and (d) staff with the appropriate know-how to manage the process. Additionally, financial institutions should not be tempted to be involved in the commercial relationship between farmers and processors. They should let the market work by formulating its rules. To facilitate this, financial institutions should offer more than one choice (buyers per product) to farmers for selling their products. Private companies and producers' organizations should be included in the related programs for each product.

The main criterion for the success of a value chain financing program is trust among participants. Thus, as a prerequisite, there should be farmers and buyers who are willing to participate actively in the value chain. In this context, financial institutions should ensure that anyone that on purpose violates the agreed terms in the chain for short-term benefits should be excluded from the financing programs. Value chain financing could positively affect benefits, such as production costs, making products more competitive. Thus, financial institutions should promote ways so that benefits are allocated fairly among value chain participants. This will strengthen trust and create a long-term view of their cooperation.

Benefits from cost reduction may be significant if financial terms lead to the proper use of capital. Targeted financing for professional use only, the time of capital release and the period of use are the main parameters that may ensure proper use of capital available. Credit rules set by financial institutions for value chain financing programs should guarantee that there will not be any barriers in accessing credit for women, young farmers and small farms. The introduction of a new value chain financing scheme requires strong management commitment because of

significant investment resources required and delays in the realization of returns. Thus, the motivation for value chain financing should be robust and clear. Moreover, as value chain financing projects are complex, there is a need for effective cooperation between different units of a financial institution and efficient coordination.

For the successful implementation of value chain financing in the agri-food sector, agricultural economics and credit know-how is crucial. However, more important for success is the ability of the financial institution to learn from the members of the value chain, using appropriate methodological tools. Financial solutions should be tailored to the real needs of each chain under the different characteristics of each market. There are no ready-to-use solutions.

A holistic approach to the financing of the value chain may strengthen trade cooperation, create relationships built on trust, ensure the delivery of safe, certified products of higher nutritional value and contribute to the enhancement of the local economy and social cohesion. This is in accordance to Porter and Kramer's (2011) suggestion about the need of a "shared value" approach, which reconnects companies' success with social progress. More specifically, companies should bring business and society back together, by redefining their purpose as creating "shared value," generating economic value in a way that also produces value for society by addressing its challenges.

Finally, the role of public policy is important in promoting and supporting cooperation of the value chain members, by creating the appropriate legal environment that enforces contracts and provides landownership documentation systems. Additionally, it should offer systems that could provide reliable market data to facilitate business decisions of all three parts, producers, processors and the financial institution.

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9

Extreme Volatility in Agricultural Commodity Markets and Implications for Food Security

Athanasios Triantafyllou, George Dotsis, and Alexandros Sarris

Introduction

Unexpected price changes and large upward/downward price swings have become very frequent and very common in the volatile agricultural markets. Sudden jumps in agricultural prices denote undesirable events for both policy makers and commodity producers, and create difficult situations for countries facing food security challenges. This is because unpredictable price increases raise the cost of food imports. The infrequent nature of these price changes makes it difficult to identify, anticipate and hedge them in a proper and timely fashion. Nevertheless, the nature of such events is important for food security planning. This is because low-income food deficit countries, which number 54 according to the latest 2015 list of the Food and Agriculture Organization (FAO) of the United Nations, may find it difficult to import at reasonable cost what they need in periods of international food commodity price spikes. The purpose of

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this chapter is to explore the nature of large basic food commodity price changes using extreme value theory tools.

Insuring for food price spikes in the context of importing food commodities by food-insecure countries entails hedging strategies which depend a lot on the assumed underlying frequency distribution of such events. An assumed normal distribution of commodity price changes (or returns if percentage changes are considered) implies infrequent occurrence of extreme price events, which appears not to be consistent with the experienced frequencies of such changes. Hence it appears reasonable to assume that the distribution of food price returns is not normal. Mandelbrot (1963) is perhaps the first who showed empirically that commodity returns deviate significantly from the Gaussian normal distribution. He found that the tails of the empirical distribution of cotton price changes were much thicker compared to the tails of the normal distribution, implying that prices spikes are more frequent than predicted by simple Gaussian distributions. The empirical results in the literature regarding the behavior of commodity price changes indicate that the distribution of agricultural commodity returns are fat-tailed and that the large positive and negative changes occur more frequently than they would if the returns were drawn from a normal distribution. This is important for risk management in agricultural markets in the context of food security planning.

Recent studies show that tools from Extreme Value Theory are more suitable for modeling the risk in agricultural markets. Extreme Value Theory is a branch of statistics that deals with the modeling of extreme deviations and rare events using heavy-tailed distributions. Hilliard and Reis (1999) find that the returns of agricultural commodity futures are not normally distributed while Koekebakker and Lien (2004) show that agricultural price movements significantly deviate from the normality assumption because they exhibit sudden and unexpected jumps. In a recent article, Xouridas (2015) examines the empirical distributions of the returns of 60 agricultural commodities and finds that these distributions are significantly fat-tailed (exhibit a large kurtosis value). Other studies in the literature develop risk management tools that take into consideration heavy tails in commodity returns. Such risk management approaches are particularly important for food security planning, such as hedging import expenditures by low-income food-importing countries. Sam (2010) develops a nonparametric kernel method that

accommodates fat tails and asymmetry in returns to calculate potential maximum losses in agricultural markets. Odening and Hinrichs (2002) find that the traditional value-at-risk methods fail to adequately capture the tail risk in the agricultural sector because of the fat tails in the empirical distributions of agricultural products. They show in their empirical analysis that the tools from Extreme Value Theory significantly improve the tail risk forecasts when used as a complementary tool to the traditional Value-at-Risk (VaR) methods in the agricultural sector. Morgan et al. (2012) provide further empirical support to Odening and Hinrichs' (2002) findings, by applying some techniques of Extreme Value Theory in tail quantile-based risk measures (e.g., VaR and Expected Shortfall) applied to the estimation of extreme agricultural financial risk. Martins-Filho et al. (2012) propose fully nonparametric estimators for conditional VaR and Expected Shortfalls. They show that the proposed estimators have reasonable finite properties and they capture tail risk in the returns of agricultural commodities.

The remainder of the chapter is structured as follows. In Sect. 2 we describe some simple tools from Extreme Value Theory that can be used in order to quantify tail events and in Sect. 3 we apply these tools in the context of food import risk management for three basic food commodities. Section 4 sums up the conclusion to this chapter.

How to Identify Extreme Returns

In this section we study the empirical behavior of the returns of three basic food commodity products and describe some simple statistical tools than can be used for modeling tail risk. The details of the empirical analysis are available from the authors on request. The commodities under consideration are soya, maize and wheat, which are the most important internationally traded food products. We use daily futures data for maize, wheat and soybeans which are obtained from the Chicago Board of Trade (CBOT). CBOT is the major global market for food commodities, and international cash prices for them in most markets are strongly related to CBOT futures prices. We use futures data instead of spot prices because futures markets are more liquid and provide more reliable data at high frequencies. The futures data for maize, wheat and soybeans cover the

period from January 1990 to December 2011. We construct a single time series of data for each commodity using the nearby (close to maturity) futures contracts. We choose the 2-month expiration as a fixed time for nearest maturity commodity futures, since the expiration dates on agricultural commodity futures are the 1st of March, May, July, September and December. If the nearby contract has less than 60 days to expiration, we replace it with the next contract, which always has more than 60 days to expiration. For example, when the nearest futures contract has 75 days to expiration, we keep it only for 15 days and then we change it with the next deferred contract, which by definition will have more than 60 days to expiration to get the best possible approximation of a fixed 2-month horizon futures contract. From the time series data (F) we compute daily and monthly returns. The daily return at day d is defined as $(F_d - F_{d-1})/F_{d-1}$ and the monthly return at the end of month m is defined as $(F_m - F_{m-1})/F_{m-1}$. The behavior of daily returns is of great interest to both farmers and importers who wish to hedge price risk using derivative products, while the behavior of lower-frequency returns, such as monthly returns, is of great interest to policy makers who want to know longer-term trends in commodity prices.

Daily futures prices of the three commodities show strong volatility. Prices of all three commodities are volatile and occasionally display large upward as well downward price swings (e.g., during the period 2007–2009). Table 9.1 reports the descriptive statistics of daily and monthly returns.

Table 9.1 Descriptive statistics of daily and monthly returns of soya, maize and wheat

Daily returns	Soya	Maize	Wheat
Mean	0.02 %	0.03 %	0.03 %
Stdev	1.50 %	1.66 %	1.78 %
Min	−12.19 %	−19.09 %	−9.31 %
Max	19.70 %	22.56 %	11.17 %
Monthly returns	Soya	Maize	Wheat
Mean	0.54 %	0.67 %	0.57 %
Stdev	7.01 %	7.62 %	8.42 %
Min	−23.49 %	−22.80 %	−26.18 %
Max	21.37 %	27.52 %	44.44 %

The data cover the period from January 1990 to December 2011
Source: Authors' estimates

The most volatile commodity is wheat with a standard deviation of daily (monthly) returns equal to 1.78 % (8.42 %) and the least volatile commodity is soya with a standard deviation of daily (monthly) returns equal to 1.50 % (7.01 %). However, the standard deviation of returns may be a misleading measure of risk when returns depart significantly from normality and the distribution is fat-tailed. Soya is the least volatile commodity according to the standard deviation criterion, but it has a maximum daily return which is 13.12 standard deviations above the mean and a minimum return which is 8.14 standard deviations below the mean. If the returns follow a normal distribution the probability of observing a return that is 13.12 standard deviations above the mean is 6.11×10^{-38} and the probability of observing a return that is 8.14 standard deviations below the mean is 1.97×10^{-15}. These are both very small values, implying the non-normality of returns. Maize has a minimum return that is 11.52 standard deviations below the mean and a maximum return that is 13.57 standard deviations above the mean. Wheat has less extreme returns despite the fact that it is the most volatile commodity. The maximum return is 6.26 standard deviations above the mean and the minimum is 5.25 deviations below the mean. Still, if the returns follow a normal distribution, a 6-sigma event is expected to happen once every 4 million years, which is again much too infrequent.

From the analysis of the Q–Q plot, which indicates the quantiles of the daily returns of each commodity (soya, maize and wheat) against the quantiles from a standardized normal distribution, the following inferences are drawn. Under perfect normality, points in the Q–Q plot should approximately lie on a straight line. From the results we observe that in all three commodities under consideration there are substantial deviations from normality in both tails of the distribution. The same inference is drawn if one plots the quantiles of the monthly returns of each commodity. This suggests that the actual price return distribution has many more frequent price spikes and price depressions compared to what would be obtained if the price returns followed a normal distribution.

The most standard approach in the literature to capture heavy tails in the empirical distributions is to use distributions that obey power laws. The tails of power law distributions diminish according to power and the rate of the tail decay is usually slower than the exponential that governs

the normal distribution. The use of power laws dates to the end of the nineteenth century (Pareto 1896). Gabaix (2009) provides an excellent survey of power laws in economics and finance. If the tail of the commodity return distribution obeys a power law then the probability that the commodity return *r* exceeds some large enough threshold *x* is given by

$$P(r > x) = Cx^{-\zeta}$$

(1)

where C, $\zeta > 0$. The C parameter is called the scale and the ζ parameter is called the shape or tail index or power law exponent. The shape parameter determines the thickness of the tail of the distribution. In order to estimate the scale and shape parameters C and ζ the commodity returns are first ordered in descending order from high to low, and then an estimate can be made of the shape parameter and a threshold parameter k that defines the point in the tail of the distribution, below which the distribution of returns is assumed to obey the power law in (1) (Hill 1975). The exponent of the left tail is estimated using the same procedure after multiplying the returns by –1. We estimate the tail index ζ and the threshold parameter *k* using the method based on the goodness-of-fit described by Clauset et al. (2007). The parameter estimates of the tail index for the right and left tails of soya, maize and wheat daily returns are reported in Table 9.2.

Soya has the lowest right and left tail indices, indicating that the tails of the price return distributions are the fattest among the three commodities, and therefore that soybeans is the commodity which is most exposed to (namely has most frequent) extreme returns at both tails of the distribution.

Table 9.2 Estimates of power law exponents using soya, maize and wheat daily returns

	Soya	Maize	Wheat
Power law exponent—right tail	3.30	5.01	4.24
Power law exponent—left tail	3.67	5.51	3.78

Source: Authors' estimates

Risk Management Applications

One of the most widely used risk management measures is the so-called VaR. VaR is the maximum potential positive or negative return over a given time horizon given a prespecified confidence level $(1-\alpha)$. For example, when $\alpha = 1\%$ the left tail VaR in daily commodity returns is the cut-off point in the distribution under which there is only 1 % probability of observing a more negative return and the right tail VaR is the cut-off point in the distribution above which there is only 1 % probability of observing a more positive return. Such measures can be quite useful in food import expenditure planning and hedging for food-insecure countries.

Suppose that the cumulative distribution function is denoted by F. The left tail VaR_{down} is given by $F^{-1}(a)$ and the right tail VaR_{up} is given by $F^{-1}(1-a)$. However, VaR does not provide any information with respect to the size of the returns at the extreme tails of the distribution. A popular risk management measure that remedies this shortcoming of VaR is the Expected Shortfall or conditional VaR. The Expected Shortfall is the conditional expectation of the return given that the return has exceeded VaR. The Expected Shortfall of the left tail (denoted as VaR_{down}) is given by the expected value of the distribution truncated at the left, namely the lowest values, $E(r|r < VaR_{down})$, while the Expected Shortfall of the right tail (denoted as VaR_{up}) is given by the expected value of the distribution truncated at the right, namely the high values, $E(r|r > VaR_{up})$. If VaR_{down} is negative then clearly the expected value of the truncated distribution is also negative.

In commodity markets, left tail risk management measures are useful for farmers, because they indicate the maximum loss from sales, while right tail risk management measures are useful for commodity users and policy makers, as they indicate the maximum cost of purchases (see also van Oordt et al. 2013). The exact values of Var_{down} and Var_{up} depend on the confidence level α at which the truncation is made.

Table 9.3 reports daily VaRs and Expected Shortfalls for soya, maize and wheat using the parameter estimates from Sect. 3 and two probability levels ($\alpha = 1\%$, and $\alpha = 0.1\%$).

Table 9.3 Value-at-Risk and Expected Shortfall of soya, maize and wheat daily returns and 1 % and 0.1 % probability levels

	Right tail VaR		
	Soya	Maize	Wheat
α = 1.00 %	3.15 %	4.45 %	4.57 %
α = 0.10 %	6.33 %	7.05 %	7.88 %
	Right tail Expected Shortfall		
	Soya	Maize	Wheat
α = 1.00 %	4.52 %	5.56 %	5.99 %
α = 0.10 %	9.08 %	8.81 %	10.31 %
	Left tail VaR		
	Soya	Maize	Wheat
α = 1.00 %	−3.59 %	−4.41 %	−5.44 %
α = 0.10 %	−6.73 %	−6.70 %	−10.00 %
	Left tail Expected Shortfall		
	Soya	Maize	Wheat
α = 1.00 %	−4.94 %	−5.39 %	−7.39 %
α = 0.10 %	−9.26 %	−8.19 %	−13.60 %

Source: Authors' estimates

The right tail VaR of soya at 99 % confidence level is 3.15 %, indicating that there is a 1 % probability that the daily return to soybeans is above 3.15 %. The left tail VaR is –3.59 %, indicating that there is a 1 % probability that the daily return to soybeans is less than –3.59 %. The corresponding right tail Expected Shortfall is 4.52 % and the corresponding left tail Expected Shortfall is –4.94 %, and these are the expected gains and losses respectively during these infrequent times when the soybean prices are above or below the respective VaR values. The corresponding values of VaR in the maize and wheat markets are larger in absolute value, implying that the levels of daily gains or losses that can occur with 1 % probability or smaller are larger than those of soybeans. In other words, if we specify a given extreme value of a daily price gain such as 4 %, it is more probable that such a gain will happen in soybeans than in the maize and wheat markets. Nevertheless, the results indicate that there is sizable risk in tails of the soya, maize and wheat return distributions, implying that the frequencies of very high or very low prices are larger than what would be implied by simple normal distributions.

From a policy-making perspective it would be useful to examine if it is possible to forecast extreme positive returns at low frequencies. We define as extreme positive returns the monthly returns which are larger than

one or two monthly standard deviations. We measure monthly historical standard deviations using daily returns within each month. The categorical binary variables which indicate the 1-sigma and 2-sigma price spikes are the following:

$$one\_\text{sigma}\_\text{spike}_t = \begin{cases} 1 & \text{if } r_t \geq \sigma_{t-1} \\ 0 & \text{otherwise} \end{cases} \tag{2}$$

$$two\_\text{sigma}\_\text{spike}_t = \begin{cases} 1 & \text{if } r_t \geq 2\sigma_{t-1} \\ 0 & \text{otherwise} \end{cases} \tag{3}$$

To predict extreme events we use as forecasting variables inventory data, hedging pressure and 3-month Treasury Bill. We search for commodity-specific forecasting variables of price spikes in maize, wheat and soybeans futures markets since many studies have identified significant linkages between inventory levels, uncertainty and agricultural commodity prices (Deaton and Laroque 1992; Pietola et al. 2010; Cooke and Robles 2009; Tadesse et al. 2014; Triantafyllou et al. 2015; Zawojska 2010). Motivated by the relevant literature which links monetary factors and commodity prices (Frankel and Hardouvelis 1985; Frankel 1986; Frankel 2008; Gilbert 2010; Gordon and Rouwenhorst 2006) we add into our information variable set the level of the short-term interest rate (3-month US Treasury Bill rate).

We obtain quarterly inventory data for maize, wheat and soybeans from the National Agricultural Statistics Service of the USA for the period 1990 till 2011. We construct monthly data for these variables from quarterly observations, using the method of polynomial interpolation. We take the monthly prices that make the best fit at the polynomial which is being created by the quarterly prices. We use the natural logarithm of these interpolated monthly levels of stocks for each monthly period. The hedging pressure is defined as the difference between the number of short and the number of long hedge positions in the futures markets relative to the total number of hedge positions by large (commercial) traders.

Weekly data for the number of short and long hedge positions for wheat, maize and soybeans futures were obtained from the US Commodity Futures Trading Commission. The data for the 3-month Treasury Bill rate were obtained from the Federal Reserve Bank of Saint Louis and cover the period from January 1990 through December 2011.

In Table 9.4 we present the results form a probit model that forecasts commodity price spikes using commodity-specific and macroeconomic factors. The multivariate probit model uses as explanatory variables the following:

$SPIKE_t$, which is the binary variable that indicates 1-sigma and 2-sigma price spikes given in equations (2) and (3) respectively.

INV, which is the inventory level.

HP, which is the hedging pressure.

RV, which is the monthly realized variance.

USTBILL, which is the 3-month US Treasury bill rate.

All the above variables are lagged by one month in the estimations.

Table 9.4 Probit regressions forecasting 1- and 2-sigma price spikes in the maize, wheat and soybeans market

		Maize	Wheat	Soybeans
		Panel A: 1-sigma price spikes		
Const	Coef.	−1.711	0.844	0.253
	t-stat	(−0.762)	(1.177)	(1.505)
INV	Coef.	0.095	−0.042	0.004
	t-stat	(0.666)	(−0.791)	(0.190)
HP	Coef.	1.191	0.108	−0.065
	t-stat	(1.982)	(0.566)	(−0.608)
RV	Coef.	−7.586	−0.870	−0.947
	t-stat	(−3.222)	(−2.823)	(−3.120)
USTBILL	Coef.	−4.055	−1.038	−0.753
	t-stat	(−0.865)	(−0.738)	(−0.571)
% Mc Fadden R^2		6.6	2.3	2.1
		Panel B: 2-sigma price spikes		
		Maize	Wheat	Soybeans
Const	Coef.	−1.667	0.300	0.342
	t-stat	(−0.559)	(0.714)	(1.902)
INV	Coef.	0.062	−0.015	−0.030
	t-stat	(0.329)	(−0.514)	(−1.194)
HP	Coef.	−0.795	−0.009	0.017
	t-stat	(−1.054)	(−0.115)	(0.237)
RV	Coef.	−9.640	−0.336	−0.593
	t-stat	(−2.284)	(−2.312)	(−2.804)
USTBILL	Coef.	−4.914	−0.471	−1.758
	t-stat	(−0.770)	(−0.879)	(−1.833)
% Mc Fadden R^2		7.6	0.2	3.8

Source: Authors' estimates

Table 9.4 indicates the results of the estimations. We observe that price spikes in the maize market are difficult to predict by macroeconomic or by commodity-specific factors. Inventory, hedging pressure and short-term interest rate are insignificant predictors of extreme events (with the exception of hedging pressure in the 1-sigma price spike). We find a negative and statistically significant coefficient of lagged realized variance when we forecast 1-sigma and 2-sigma spikes one month ahead. The negative coefficient is somewhat odd, as it implies that the lower the past month market volatility, the higher is the likelihood of a price spike. The interpretation and economic justification of the negative coefficient of realized variance could be that low market volatility or uncertainty implies low expectations of a spike in the following month, and hence any unexpected news is likely to lead to overreaction and a spike.

The results of the wheat and soybeans markets are similar. Inventory, hedging pressure and short-term interest rate remain insignificant. The negative and statistically significant coefficient of realized variance may be interpreted as above. These results are in line with those of Vilkov and Xiao (2013), who examine the predictive power of equity market uncertainty on the occurrence of equity market price spikes. They report negative uncertainty coefficients as well, and they interpret this somehow odd result as an overreaction of equity investors. According to them, uncertainty in equity markets increases only after a market crash has occurred, thus it cannot act as an early warning signal of extreme returns. By our empirical analysis, we find that the same thing seems to hold for maize and wheat markets.

Unlike maize and wheat markets, in the soybeans market the short-term interest rate is a significant predictor of 2-sigma price spikes with a negative coefficient. This result indicates that lax monetary policy (the reduction in short-term interest rates) may have contributed to the occurrence of more frequent extreme events in the soybeans market post 2003 (monetary-easing era). These results are in line with those of Gilbert (2010), Frankel (2008) and Frankel and Hardouvelis (1985), who find a negative relationship between the monetary policy stance and commodity price booms. Nevertheless, the above results highlight the difficulty of predicting extreme events in the agricultural commodity market.

Conclusions

Agricultural commodity price spikes are very damaging to economies which depend on food imports to satisfy their food security needs but are difficult to properly anticipate by market fundamentals alone. In this chapter we quantify the occurrence of such events, and search for determinants or early warning signals. We show that the distribution of price returns are non-normal, implying that the extreme events are more frequent than what is implied by a Gaussian distribution of returns. We empirically show that while some macro variables, such as a lax monetary policy and previous commodity market volatility, may signal a possible extreme event such as a price spike, the predictability of such events is very difficult. We also show that a low realized volatility in a previous period seems to signal a high probability of a subsequent extreme price event. The results suggest that the non-normal nature of internationally traded food commodity products implies significant challenges for insuring food imports by food-insecure countries.

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Can MENA Reach the Sustainable Development Goals? An Overview of Opportunities and Challenges for Food and Nutrition Security

Nadim Khouri, Clemens Breisinger, and Hagar Eldidi

Introduction

Persistent poverty, inequalities and growing conflict are among the obstacles hindering the achievement of the Sustainable Development Goals (SDGs) in the Arab world. Achieving food and nutrition security in particular has been an ongoing challenge. Despite much effort and progress over the years, this challenge is now being further compounded in the context of emerging conflicts and economic challenges. The regional conflicts of the Middle East and North Africa truly became global in 2015, as evidenced by the massive increase in people fleeing violence and its consequences: threats against

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Refugees and the Arab world
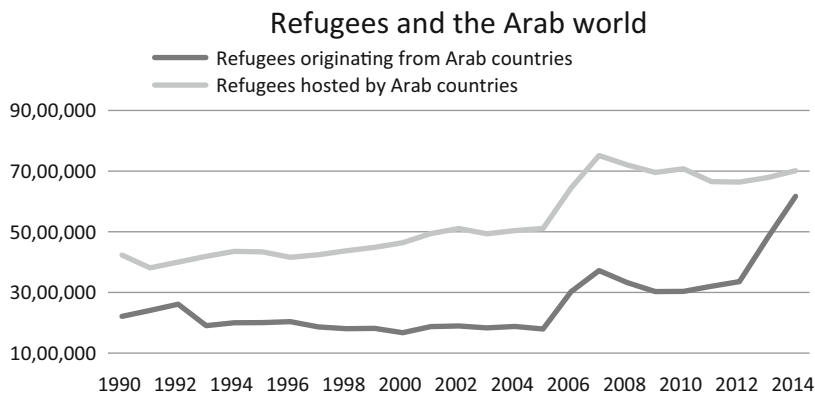
Fig. 10.1 Refugees hosted by and originating from Arab countries. Source: Authors' calculations based on World Development Indicators 2015 (World Bank 2015). WDI use data from the United Nations High Commissioner for Refugees (UNHCR 2015b), Statistical Yearbook and data files, complemented by statistics on Palestinian refugees under the mandate of the UN Relief and Works Agency for Palestine Refugees in the Near East (UNRWA) as published on its website. Data from UNHCR are available online at www.unhcr.org/statistics/populationdatabase. Note: The Arab world is composed of the 22 member states of the Arab League

their lives, deprivation, and hunger. The Syrian conflict alone has caused the death of 200,000 people, the internal displacement of 7.6 million people, and the fleeing of more than 4 million people (UNHCR 2015a). While the flow of refugees from Syria and other conflict-ridden countries to Europe garnered major media attention, neighboring countries—including Jordan, Lebanon, and Turkey—have been challenged by a much bigger inflow (Maystadt and Breisinger 2015). In fact, all Arab countries[1] combined hosted about 7 million refugees in 2014 (Fig. 10.1), or about 40 percent of all refugees globally. On the flip side of the coin, more than 6 million of the refugees in the world originate from the Arab region.

In addition to armed conflict and the refugee crisis, external factors have also buffeted the region in 2015. China's economic downturn has diminished oil demand, further decreasing the price of the region's main export. The oil revenues of the Arab Gulf Cooperation Countries (GCC) were expected to fall by more than 50 percent in 2015 compared to 2014,

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[1] In this chapter, we refer to the MENA region as the Arab Region, which comprises the 22 member states of the Arab League of Nations.

forcing governments of oil-rich Arab countries to make significant budget cuts or increase debt levels. Oil-importing countries, including Egypt, Jordan, and Lebanon, are beginning to suffer from the resulting decrease in demand for goods and services from the GCC, which is counteracting some of the positive impact of lower fuel import bills (ESCWA 2015a).

Across the Arab region, there is a renewed consensus on the urgency of addressing the conflicts, the refugee crisis, and economic challenges posed by the international environment, which are impeding development. Consensus-building around regional priorities for the newly launched Sustainable Development Goals (SDGs), along with some key food policy changes in the region, may afford a new opportunity to address food security, nutrition, and poverty needs and contribute to regional stability (Maystadt et al. 2014). Applying evidence-based policies will be key to help achieve these goals. With that comes the renewed need for relevant data, which represents another challenge given the lack of reliable, accessible data in the region (Breisinger et al. 2012).

Continuing Conflict Undermines Advances

The Arab revolutions that began in late 2010 halted, and in some cases reversed, the region's progress in achieving the Millennium Development Goals (MDGs). Just when peace was needed for the final push to achieve the MDGs by the 2015 deadline, conflicts intensified in Iraq, Libya, Syria, and Yemen, and their effects spilled over into Egypt, Jordan, Lebanon, and Tunisia. The Gaza Strip has not yet recovered from the destruction of its infrastructure in July 2014, and tension persisted in Bahrain and other countries in the region.

However, even accounting for notable setbacks in recent years, the Arab region had been on track to reach most of the MDGs by 2015 (UN and LAS 2013; Abu-Ismail et al. 2014). Notable region-wide progress has included improvements in education, sanitation, child mortality rates, and maternal health. But these advances hide great disparities among subregions and individual countries. The Least Developed Countries (LDCs) in the region (in particular Comoros, Djibouti, Mauritania, Somalia, Sudan, and Yemen) were not expected to achieve most of the MDGs on schedule. For the region as a whole, progress has been weakest toward the goal of

cutting the levels of poverty and hunger and malnutrition by half (MDG 1). Setbacks have been serious. Current estimates suggest that poverty has risen above the 1990s level, with more than 7.4 percent living in extreme poverty as of 2012 (UN and LAS 2013). And with an estimated 50 million people still undernourished, "the region is far behind on meeting the target of halving undernourishment" (ibid). The picture is worse in Arab LDCs, where extreme poverty rates are estimated at more than 21.6 percent for 2012, undernourishment affects more than 29 percent of the total population, and more than 35 percent of children under five are underweight.

Overcoming Regional Data Availability and Access Challenges

In many cases, lack of data availability in the region also obscures the clarity of the picture, hindering the ability to design and implement effective policies. This partially ties back to a political context characterized by instability and conflicts in many countries, limiting the application of evidence-based policy (Sutcliffe and Court 2005). Limited or flawed data lead to building policy on unrealistic baselines, and can also lead to financial losses (Maystadt et al. 2014). Food and nutrition security progress has been slowed significantly, likely due to lack of reliable data. For example, poverty data estimates only exist publicly for half the Arab countries. Many Arab countries retain data of social indicators and carry out household surveys, yet restrict access to more detailed information such as the underlying raw data with which more detailed policy analysis could be conducted. There is also a clear need to improve the region's data quality and disaggregation, as it matters for evidence-based decision-making at the subnational and household level (Nyirenda-Jere and Kazembe 2014). Many Arab countries do not have sufficient data to allow tracking of the forthcoming Sustainable Development Indicators, and in many cases only show aggregates rather than subnationally classified data (Maystadt et al. 2014).

Evidence-based research and better data can significantly impact policy and lead to improving well-being and reducing poverty. For example, between 2000 and 2003, two pilot districts in Tanzania saw over 40 percent reductions in infant mortality rates when the government implemented health service reforms informed by data from household disease

surveys (ODI 2015). There is also evidence that the United Nations Children's Fund's (UNICEF) widely implemented Multiple Indicator Cluster Surveys' (MICS) direct input has been useful in informing the Tajikistani government's poverty reduction policies (UNICEF 2014).

Having the right tools to analyze and visualize the data in ways that would meaningfully benefit policy is equally important. The recent rise of online food security and nutrition monitoring tools and databases represents an opportunity to aid policy effectiveness through availability of reliable, accessible data. This kind of data, including open source data, should be an integral part to achieving the SDGs (ODI 2015).

A recent trend of online monitoring tools (particularly a number of food-security-related policy monitors) provides valuable, open access data. These include the World Bank's Food Price Crisis Observatory and the Food and Agricultural Organization's Food and Agriculture Policy Decision Analysis (FAPDA) tool. The latter has clear policy classifications by sector, food security dimensions, and targeted food commodity (FAO 2016), while the latter provides classifications by policy instrument (World Bank 2016). The Agricultural Market Information System (AMIS) is another example monitoring and analyzing market statistics of four major global food commodities (AMIS 2016). The policy database is classified by type and measure of agricultural policies. However, the Arab region remains underrepresented in many monitoring tools. For example, AMIS includes only two Arab countries.

The recently developed Arab Spatial Food and Nutrition Security Analyzer is one example of such a database and monitoring and evaluation tool, which fully focuses on the Arab region (Arab Spatial 2016). It is an online database for food and nutrition security which aggregates data from international organizations and governments, providing food security and nutrition information on maps and charts, including monitoring several SDG indicators. It offers data on regional, national, and subnational levels of the Arab world, mapping out the food security and nutrition situation across governorates. Users have the ability to map different indicators and overlay spatial and tabular layers to link and analyze data through customized maps.

The availability of such detailed information for policy makers can provide clarity on how to best address food insecurity and poverty, and helps concentrate efforts in areas that need it the most. For example, gov-
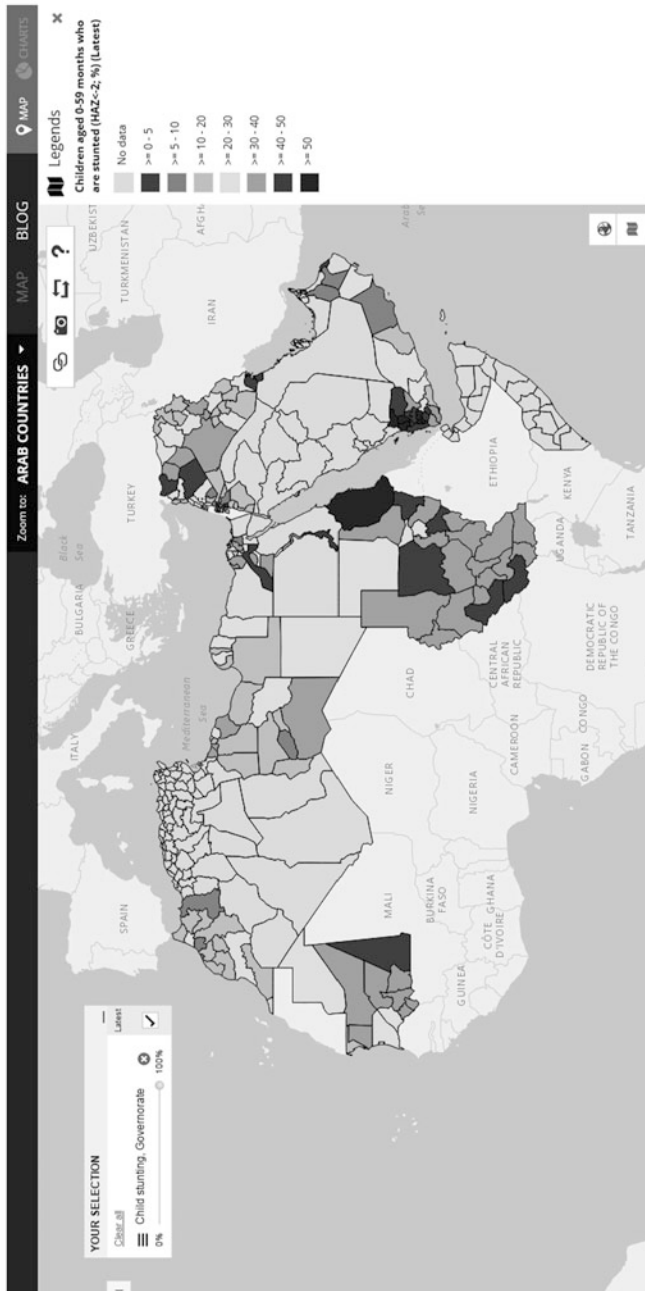
Fig. 10.2 Child malnutrition by governorate. Source: Arab Spatial: Child Stunting (Governorate). http://bit. ly/1UI8zvw4. Data based on WHO Global database on child growth and malnutrition Online (based on DHS, MICS, Country-specific Maternal and child health survey (MCHS) and Family Health Surveys (FHS))

ernorates with high household food and nutrition insecurity levels can easily be identified (see Fig. 10.2) to better direct resources. More generally, promoting such data sharing among policy makers and researchers in the Arab region would ultimately result in a better understanding of how to combat poverty and food insecurity. It could help identify biases in rural–urban expenditure and pinpoint governorate-level allocations and expenditure gaps (Breisinger et al. 2012).

Prioritizing Food and Nutrition Security SDGs

The Arab region participated in the global dialogue that developed the 17 new SDGs adopted by the UN General Assembly in October 2015. Emerging regional consensus has established food security as the priority goal (ESCWA 2015b), based on the final version of SDG 2 (which promotes the integration of sustainable agriculture with food security and the necessity of ensuring support to women), and has specifically highlighted the importance of nutrition (ibid.). The goal of eliminating extreme poverty (at the level of US$1.25 per day) also has regional acceptance. Notably, the consensus recommendations recognized the importance of improved governance and peace to development (ESCWA 2014).

Prioritizing food security (SDG 2) is consistent with the latest estimates and research-based evidence on the development needs of the Arab region.[2] National-level food insecurity remains "serious" or "alarming" in most Arab countries, reflecting pervasive vulnerability (Fig. 10.3). The Arab region will remain dependent on food imports, despite a persistent but important discussion in the region on the desirability of "food self-sufficiency at any cost." While most Arab countries spend less than 20 percent of their foreign exchange earnings on food imports (Fig. 10.3), any discussion of self-sufficiency needs to explore the feasibility and true cost of this idea, which is likely to be high.

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[2] See, for example, Arab Forum for Environment and Development (AFED), Food Security: Challenges and Prospects 7, annual Report of the Arab Forum for Environment and Development (Beirut, Lebanon: AFED, 2014); C. Breisinger, O. Ecker, P. Al-Riffai, and B. Yu. Beyond the Arab Awakening: Policies and Investments for Poverty Reduction and Food Security, IFPRI Food Policy Report 25 (Washington, DC: International Food Policy Research Institute, 2012); World Bank, FAO, and IFAD, Improving Food Security in Arab Countries (Washington, DC: World Bank, 2009).
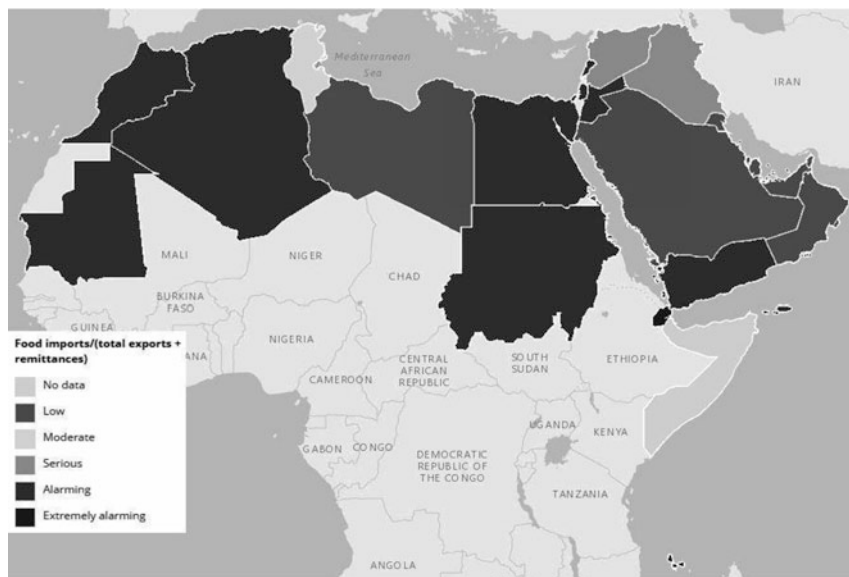
Fig. 10.3 National-level food security. Source: Arab Spatial: National Food Security, http://bit.ly/1ST6ECv. IFPRI calculations based on the formula: food import/(total exports + remittances). Food import data: Food and Agriculture Organization of the United Nations, Statistics Division database; Total export and remittance data: World Bank, World Development Indicators (WDI) Databank. Note: A country's macro-level food security is defined as the share of food imports divided by total exports plus net remittance inflows (food imports/[total exports + net remittance inflows]). All indicator values are generally computed as three-year averages over the period 2010–2012. For more information, see C. Breisinger, O. Ecker, P. Al-Riffai, and B. Yu, Beyond the Arab Awakening: Policies and Investments for Poverty Reduction and Food Security, IFPRI Food Policy Report 25 (Washington, DC, International Food Policy Research Institute)

Some Arab governments prioritize domestic availability of food for stability reasons. International markets are perceived to be unreliable, especially because food price shocks compound fiscal strains for non-oil-exporting Arab countries that subsidize food (Lampietti et al. 2011). GCC do not yet face high levels of food insecurity but are also vulnerable to food price shocks as oil prices decline. Whims of producing countries, thinness of the international grain markets (e.g., only 6 percent of global rice production is actually exported), and world conflicts add a certain level of anxiety regarding a continued supply. Further, the present social contract

in most Arab countries implies that governments provide cheap food and security for which the people give up on some of their demands for freedoms and good governance. Thus, relying on imports may introduce a measure of weakness/loss of control that is not favored by the authorities (Devarajan and Mottaghi 2015).

While there is much focus on domestic food availability in countries' development strategies, food security does not equal self-sufficiency (Breisinger et al. 2010). Other pillars for achieving food security, including reliable international availability, but more importantly household access as well as food nutritional components carry significant importance. Securing future national and household access to food in Arab countries should thus be based on a mix of domestic and international investment strategies. Decreasing the gap between production and consumption in a sustainable way may present positive outcomes. This may be achieved through domestic investments targeted at reaching a fuller potential of agricultural production, with a particular focus on targeting remote or "lagging areas" to decrease historical and present issues of rural–urban disparities in youth unemployment and access to education and services (e.g., see Fig. 10.4).

Another more realistic and beneficial strategy for reducing food insecurity may be to further improve trade and trade infrastructure, including storage. In several countries, domestic agriculture, including rain-fed
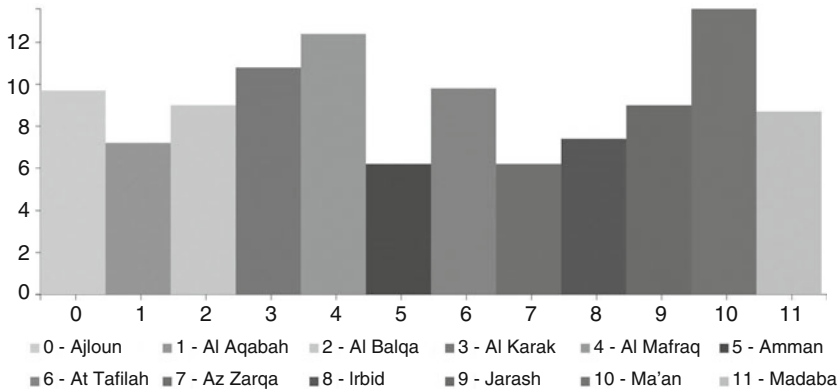
Fig. 10.4 Percentage of women in Jordan with no education (Governorate 2012). Source: Arab Spatial: http://bit.ly/1Sb9ymd. Country survey reports and MEASURE DHS STATcompiler (based on Standard and Interim Demographic and Health Surveys (DHS)); UNICEF Multiple Indicator Cluster Survey (MICS) and Family Health Survey (FHS)
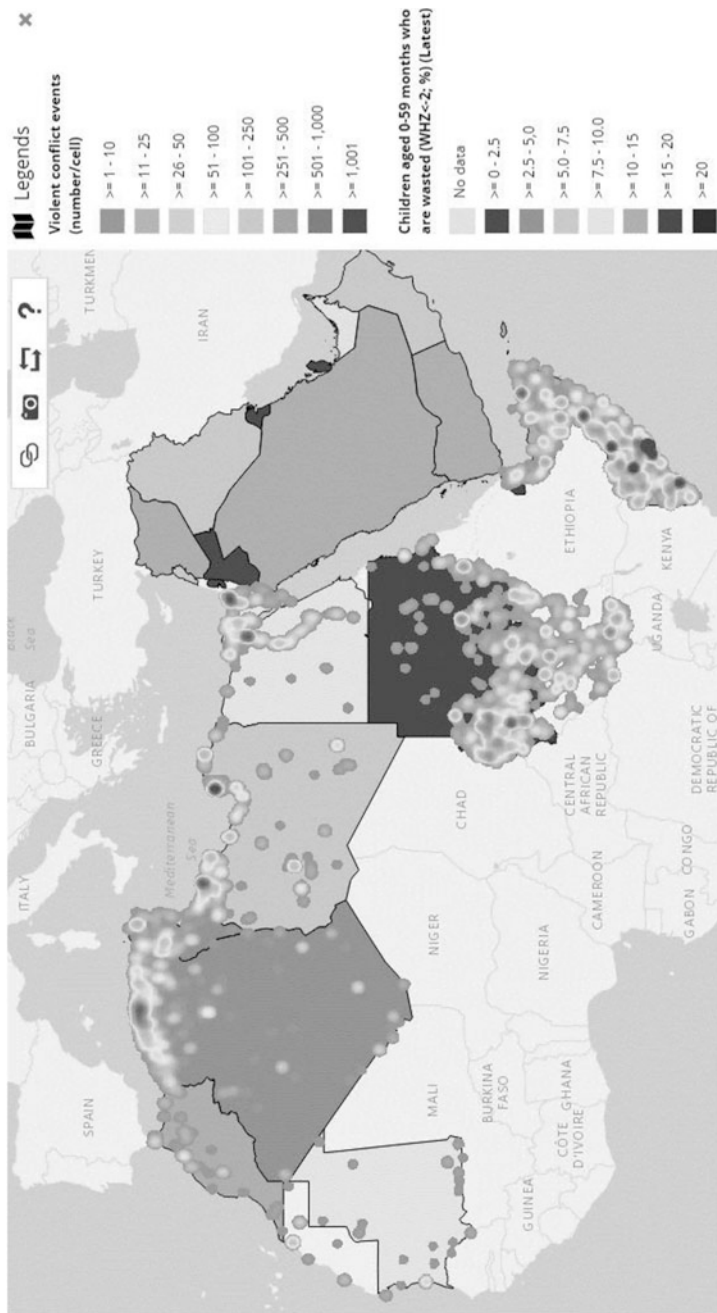
Fig. 10.5 Regional violent conflicts and food insecurity. Source: Arab Spatial: http://bit.ly/1PTDoHH. Violent conflicts data: Raleigh, C., Linke, A., Hegre, H., and Karlsen. J. (2010). Introducing ACLED-Armed Conflict Location and Event Data. Journal of Peace Research 47(5) 1–10; Child wasting data: WHO Global database on child growth and malnutrition Online (based on DHS, MICS, Country-specific Maternal and child health survey (MCHS), and Family Health Surveys (FHS)). Note: The density map displays all violent conflict events that have occurred between 1997 and 2014 in North Africa
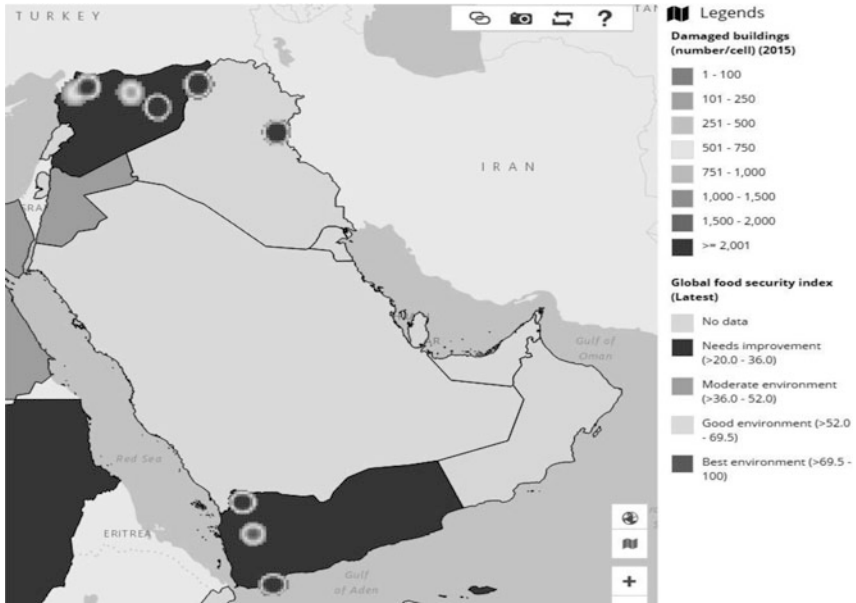
Fig. 10.6 Damaged buildings and food insecurity (selected countries struck by war). Source: Arab Spatial: http://bit.ly/1Vwkcqa, Damaged buildings data: United Nations Institute for Training and Research (UNITAR), Operational Satellite Applications Programme (UNOSAT); Food insecurity Economist Intelligence Unit (EIU). 2015. Global Food Security Index. Note: the map displays damaged and destroyed buildings in 2015 for some cities facing armed conflict

agriculture, has the potential to increase its contribution to regional food security. However, given regional water scarcity, any efforts to increase agricultural production or productivity will need to address sustainability issues for food production systems, as laid out in the SDGs. Conflict management will also be central to improving household-level food and nutrition security, including eliminating hunger, which is often concentrated in areas undergoing conflict (Figs. 10.5 and 10.6).

Nutrition interventions should focus on child stunting, obesity, and the combination of both, the so-called double burden of malnutrition. Stunting levels in many Arab countries are significantly higher than per capita income levels would suggest, with more than 20 percent of children too short for their age in ten Arab countries (Fig. 10.7) (Breisinger et al.

Arab Countries - Child stunting, Country (Latest)
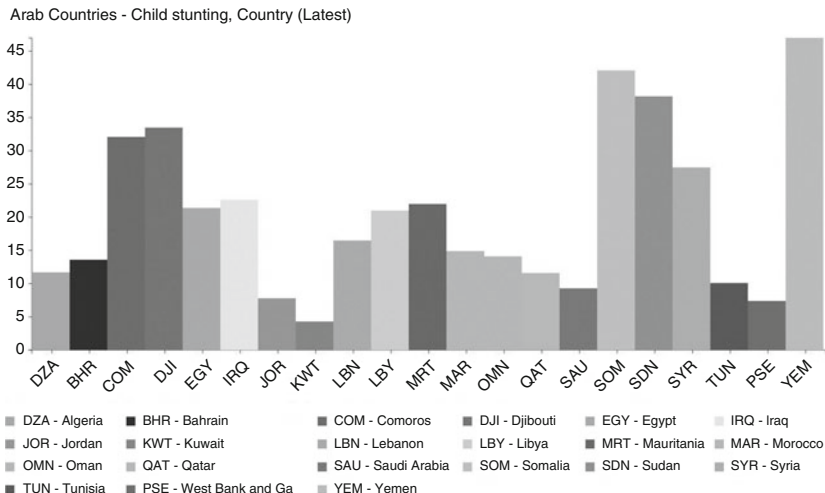
Fig. 10.7 Latest available data on child stunting in Arab countries. Source: Arab Spatial: Child Stunting (Country), http://bit.ly/1nZg98F. Data from WHO Global database on child growth and malnutrition Online (based on DHS, MICS, Country-specific Maternal and child health survey (MCHS), and Family Health Surveys (FHS))

2015). Several countries, including Djibouti, Egypt, Kuwait, Somalia, and Syria, experienced a decrease—rather than the desired increase—in the annual rate of reduction in child stunting in recent years. At the same time, obesity rates in the region are among the highest in the world. An estimated 45 percent of adults are severely overweight, with serious health consequences, including for children of obese mothers (IFPRI 2014).

Major Food Policy Developments in 2015

The primary regional organization, the Arab League, does not have the capacity to engage with all the security and political problems of the region. Instead, the Arab League has focused on increasing trade integration within the region, which may offer a feasible first step toward resolving the region's seemingly intractable political issues. A longstand-

ing plan to create a region-wide Arab Customs Union (ACU) in 2015 has now been put on hold, and a more limited subregional Customs Union composed of the GCC was established. Several other regional cooperative efforts were initiated in 2015. The Arab League launched the Climate Nexus Initiative in Cairo in November, which will support the development of greater regional policy coherence across the SDGs for climate change, disaster risk reduction, food and water security, and social vulnerability.[3] The World Bank and the Arab Monetary Fund launched an initiative that, among its key objectives, aims to secure financing for small and medium enterprises as well as other links in the food and agriculture value chain (World Bank 2015a). And in a promising sign for future coordination of water distribution from the Nile, Egypt, Ethiopia, and Sudan signed an agreement of principles on Ethiopia's Grand Renaissance dam project in March 2015.

At the country level, policymaking activity has often increased in Arab countries in times of crises, such as the 2008 and 2011 global food crises and the Arab awakening. But such policy changes are often neither fiscally sustainable nor well targeted at the poor (Bordignon and Breisinger 2015). In 2015, with large territories and populations affected by extreme violence, countries are finding it even more difficult to focus on long-term sustainable development solutions. Even for the countries that have avoided getting pulled into the violence, the ongoing conflicts distract from critical development priorities, including participatory and representative government, the rule of law, and equitable development.

Egypt is among the few exceptions. The Egyptian government continued its effort to reform subsidies, including cutting environmentally and socially detrimental fuel subsidies, which created overall economic and distributional gains. Reforms were also made to the food subsidy system, including (i) boosting the dietary value of the basket of subsidized food through the addition of a greater variety of eligible foods; (ii) transfer of most users to smart cards, which allow for electronic replenishment of

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[3] For more information, see O. Ecker, J.-F. Trinh Tan, and P. Al-Riffai, "Facing the Challenge: The Recent Reform of the Egyptian Food Subsidy System," Arab Spatial Food and Nutrition Security Blog, December 19, 2014, http://bit.ly/1kzNZjE

food assistance funds, thus increasing efficiency and reducing the risk of corruption or misuse of food assistance funds; and (iii) initiating a new food-waste reduction project (Ecker et al. 2014).

Conclusions and Outlook for 2016

The outlook for the Arab region for 2016 is not much improved, particularly if conflict persists. However, there is hope that the mounting evidence of the costs of inaction will sway decision makers to support policy reforms to improve governance, fight corruption, and increase the competitiveness of Arab economies (World Bank 2015b). Three high-priority areas for policy intervention to improve food and nutrition security in the Arab countries are (a) peace-building through development activities at local and national levels, (b) education and subsidy reforms to improve nutrition, and (c) research and improved data gathering and analysis on rural development and food security.

Peace-building through development activities at local and national levels. Consensus is emerging on the need to aggressively innovate in pursuit of peace through development. Although overall and permanent peace may remain elusive, there is growing agreement on the need to prioritize and sustain food security assistance—innovation is needed to go beyond the temporary emergency relief measures. In October 2015, the Committee on World Food Security agreed to a set of nine principles and implementation strategies, known as the Framework for Food Security and Nutrition in Protracted Crises, designed to guide governments and assistance agencies in stepping up their development engagement, including in conflict zones (CFS 2015).

Education and subsidy reforms to improve nutrition. Outside of conflict areas, following the model of the emerging success in Egypt, for example, governments should focus on ending harmful subsidies and strengthening safety nets in order to improve nutrition for the truly poor and food insecure, including addressing the double burden of malnutrition.

Research and improved data gathering and analysis. Ultimately, there is hope that more inclusive and participatory societies will emerge from the present regional chaos. Sound data and information for decision-making on rural development and food security—as well as demonstrable solutions suitable for scaling up—are needed. Development of these tools while the turmoil is still ongoing may even hasten peace. The turmoil started in peri-urban and rural areas—perhaps if rural development is addressed, that is also where it will end.

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11

Food Security and Vocational Education and Training: Exploring the Links in the Egyptian Case

Salma Soliman

Introduction

Of the numerous definitions of food security, the one adopted by the World Food Summit in 1996 offers a comprehensive explanation: it "exists when all people, at all times, have physical, social and economic access to sufficient, safe and nutritious food which meets their dietary needs and food preferences for an active and healthy life" (FAO 1996; World Food Programme 2013). Food security in this sense is a strategic objective which has become more challenging to realise especially for low-income, food-deficit countries such as Egypt. The complexity of the issue makes it unrealistic to be solved in the short run but every measure should be taken to avoid further deterioration of the problem in the long run.

At a time where the problem has reached an alarming level, it is useful to analyse it from new perspectives to attempt to contribute to the

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long-term solution of food security. This chapter focuses on the role of education, including vocational education and training (VET) in particular, in reducing the problem of food insecurity in Egypt. The chapter starts with a discussion of the problem of food insecurity in Egypt, followed by an exploration of the links between the problem of food security and education and training. The chapter finally concludes with a discussion of the constraining factors that limit the effectiveness of VET and its potential contribution to the problem of food security.

The Problem of Food Security in Egypt

Food security in Egypt is a multifaceted problem caused by an amalgamation of national and international factors. On a national level, the food gap—the difference between food demand and supply—is increasing due to two main pressures: (i) population growth and (ii) domestic production. The relatively high levels of population growth pose a serious challenge to the Egyptian government to achieve food self-sufficiency (Ianchovichina et al. 2014). Egypt's population growth rates were 2.2 % between 2011 and 2015, which is higher than similar Southern and Eastern Mediterranean (SEMED) countries such as Morocco and Turkey at an average of 1.4 % and 1.2 %, respectively, for the same period (World Bank 2016). This pressure increases food demand year on year at relatively high levels in a manner that *eats up* development efforts to maintain sustainable food supply. Not only did domestic production fail to keep up with the high rates of population growth but it accumulated various inefficiencies since the 1960s due to historical institutional deficiencies that contributed to a deceleration in productivity.

Prior to the 1952 revolution, Egypt was a food exporter but this did not last long under the Nasserist regime in which the agricultural sector went through important changes, mainly land reforms, which disturbed domestic production and the strategic development of the sector. The Nasserist regime called for land reforms to achieve an equal distribution of land and wealth to all Egyptians. Restrictions were imposed on the maximum amount of landownership for individuals, and families and peasants were given the opportunity for the first time to be landowners. From a social perspective, this policy seemed to be successful, especially

as it was part of a larger social contract where people were given extra social benefits in return for state-repressive policies.

However, ineffective planning of the process eventually had negative implications on the agricultural policies of Egypt, which was left in a worse position than it was in prior to the revolution, and in the 1960s Egypt started relying on food imports. Further disturbance to agricultural policies took place under the subsequent Sadatist regime, which retaliated against this *social contract* and supported private landowners as part of its general policy towards economic liberalisation. Previous landowners were able to reclaim at least some of their land and emphasis was put on maximising export returns from certain profitable crops, regardless of local demand, which in time exhausted the already limited arable land in Egypt (Bush 2007, 2009). The availability of a clear and strategic vision of agricultural development was largely lacking in the 1970s and 1980s during which agricultural productivity suffered and its growth rates were around 0.8 % and 1.1 %, respectively (Belloumi and Matoussi 2009).

In the meantime, total investments in agriculture by the government reached 8 % in the 1970s after reaching 23 % in the 1960s (Belloumi and Matoussi 2009). The lack of political willingness to prioritise investments in the agricultural sector was the main reason why it floundered in subsequent years. Meanwhile, reliance on food imports increased throughout the same period and, by the end of the 1980s, Egypt's food imports represented more than half of the overall national food consumption (Bush 2007). The agricultural sector trade balance fell considerably, reaching in the mid-1980s a deficit of US$3 billion though it was in a surplus of US$300 million in 1970 (Bush 2007). Negligence of the agricultural sector was concomitant with negligence of peasants, rural development and agricultural education and training, all of which contributed directly and indirectly to the current problem of food insecurity.

The institutionally inherited challenges facing food production are further complicated by different ecological and environmental factors. Egypt's already limited arable land, which represents only 3.6 % of the total area, suffers a number of environmental threats such as soil drainage and salinisation (FAO 2016; Karajeh et al. 2011). This threatens the effectiveness of arable land and its productivity and could potentially reduce the productive capacity of these areas. The scarcity of water resources is another challenge. Agricultural irrigation represents more

than 80 % of Egypt's total water consumption. Given population growth, water resources are expected to become scarcer by time. On a different geo-political front, supply of water from the Nile River, which represents 73 % of total water supply, is threatened by the construction of Ethiopia's Grand Renaissance Dam. The latter is expected to significantly disturb water flows in the Nile River and ultimately have considerable impact on Egypt's share of water from the Nile (Gebreluel 2014). Water supply is also expected to be negatively influenced by climate change with anticipations of high increases in temperature as a result of global warming. These will have a direct effect on the levels of productivity of some important crops, such as maize and wheat (El-Nahrawy 2011; Karajeh et al. 2011).

Another major risk of climate change is the rise in sea levels that will put Egypt's Low Elevation Coastal Zone and the Nile Delta, which has the highest density of arable lands, at risk, ultimately influencing agriculture and other economic activities (El-Nahrawy 2011; Karajeh et al. 2011). Egypt has taken some measures to reduce environmental risks such as developments to the irrigation system to preserve water; however, the enforcement of these measures remains limited due to various reasons but one of the main challenges is farmers' and workers' limited awareness, education and training.

To bridge the food gap, Egypt relies on external sources of food: international food aid and imports, both of which depend on international markets and factors. Food aid has been a consistent source of food since the 1960s; for instance, in 1963 Egypt was the largest per capita recipient of US food aid worldwide (Burns 1985) and is still a major recipient of food aid from the USA. However, Egypt's reliance on food aid is not as significant as food imports. The latter is the major source of food supply to Egypt, fulfilling almost 50 % of total food demand. As a net importer, the country is left with many challenges as a result. Egypt's reliance on food imports aggravates its susceptibility to global food price shocks. This was evident in the 1970s food crisis which resulted in an unforeseen food price inflation that prompted President Sadat to reduce food subsidies in response to the increased bill of food imports. Egyptians responded with a series of food riots throughout the country and as a result Sadat withdrew this decision. Food subsidies have since been considered a major tool for maintaining social stability and the Egyptian government has been eager to sustain its food subsidy programmes at any expense.

Currently, the government relies on two broad categories of food subsidy programmes: (i) ration cards that enables eligible people to buy basic food items based on certain quotas and it is currently being replaced by smart cards; and (ii) subsidised *baladi* (peasant) bread. The latter represents 61 % of all food subsidies and represents 71 % of food available to the poor though it is available to all citizens regardless of their income (Breisinger et al. 2013). These policies put high economic pressures on the government, especially given its significant reliance on wheat imports, the main ingredient in the subsidised *baladi* bread. These pressures became increasingly challenging after the global food crisis of 2007/2008 which Egypt struggled to cope with (Breisinger et al. 2013; Trego 2011; World Food Programme 2013).

Social and Economic Implications of Food Import Policies

The global food crisis in 2007/2008 directly contributed to the increase of food price inflation, which reached an unprecedented level of 35.5 % in 2008 (World Food Programme 2008). The Egyptian government responded to the crisis by increasing the level of its food subsidies to an amount that exceeded US$5 billion for 2007/2008. Such an unpredictable and unaffordable bill put further strains on the Egyptian economy, which was already facing budget deficits (Ghoneim 2014). Despite these measures, the rate of poverty could not, in the least, even be sustained and more people slipped into poverty whose levels rose by 15.2 % from 2009 to 2011, twice the rate of those who moved out of poverty in the same period (Breisinger et al. 2013). The food crisis also increased the levels of general inflation by 15.5 % from August 2007 to 2008, all of which aggravated social discontent with the government and its policies. These events have contributed to increased social tensions and instability, which is argued to be one of the main causes of the January 2011 uprisings (Harrigan 2014).

The uprisings in Egypt on 25 January 2011, which are widely known as the Arab Spring, portrayed the significance of the problem of food insecurity in Egypt. Although food security was not the main purpose of the uprisings, the unprecedented inflation in food prices sparked massive

social discontent that contributed to the initiation of the Arab Spring. This is not only evident in the slogans used in the uprisings, the most popular of which is the call for *bread, freedom and social justice*, but also in the food riots that took place as a result of the global increase in food prices in 2007/2008 (Zurayk 2012). The increased levels of food inflation hit all segments of Egyptian society. In 2011, the Central Agency for Public Mobilisation and Statistics (CAPMAS) reported the average spending of Egyptian households on food to be 40.6 % of income (Breisinger et al. 2013), which is relatively high in international terms. It is therefore not surprising that the uprisings were led by middle-class young professionals and students to call for *bread*.

Reliance on food imports seems to be an inevitable route for the Egyptian government given the available national pressures as well as the increasing ecological constraints. One of the proposed solutions to reduce food imports is what became known as the *land grab* policies (Dixon 2014; Harrigan 2014). It is a practice whereby food-deficient countries make agricultural investments in foreign arable land in abundant countries to satisfy their local food demand. Reliance on this policy is increasing in the Middle East region, especially amongst the rich Gulf countries. Egypt has been involved in the practice and is currently investing in Uganda and Sudan to produce strategic crops for domestic consumption such as wheat. Nevertheless, the policy is controversial and is expected to face different challenges in the future (see Harrigan 2014:126 for a detailed discussion). The other available option is to maximise domestic productivity. Given the limited natural resources available for Egypt for deployment in agriculture the only realistic resort would be the application of all possible measures to reduce resource and food wastes as well as maximise productivity.

These goals have been entrenched in Egypt's *Sustainable Agricultural Development Strategy 2030* developed in 2009. The strategy includes six major objectives as follows: "(i) sustainable use of agricultural natural resources; (ii) improving agricultural productivity; (iii) increasing competitiveness of the agricultural products in local and foreign markets; (iv) achieving higher rates of food security in strategic goods; (v) improving opportunities for agricultural investment; and (vi) improving livelihood of rural inhabitants" (Abul-Naga 2009). These build on former

Agricultural Development Strategies of the 1980s and 1990s and one of the recurring themes across the strategies is the need to improve the skill base of Egyptian labour to be able to support and maintain developments in the agricultural sector. This signifies the resilience of the problem of ineffective VET, which had limited success in supplying labour with the required level of skills for decades as well as limited success to achieve the intended positive contribution to the food security problem.

Food Security and Education

International organisations, such as the World Bank and the Food and Agriculture Organisation (FAO), have advised on the important role of education in enhancing food security (see e.g. World Bank et al. 2009). The emphasis was put on the role of education in (i) enhancing individuals' awareness of the problem of food security; (ii) enhancing the quality of diets; and (iii) combating the problem through better family planning. The problem of high levels of population growth is more evident in rural than in urban areas and it is argued that increased awareness through education would help lessen the problem. Education would also enhance individuals' awareness of the nutritional requirements of young children and adults which would eventually result in nutritionally balanced diets and reduce demand of cereal products. The latter has the largest share of consumption in Egypt at 62.3 % of total food consumption (FAO and EBRD 2015), which directly influences the levels of food imports.

Nutritional education and awareness is also a critical matter given the health problems prevalent in Egypt, particularly amongst children. Chronic malnutrition amongst children is alarming as it increases the proportion of stunted children under the age of five to 30 % on average reaching as much as 39 % in the poor neighbourhoods of Upper Egypt Egyptian adults suffer from relatively high levels of obesity, especially women above the age of 15. Currently 48 % of women in this age group are affected, for which the main reason is considered to be the consumption of non-nutritious, calorie-rich foods which are cheaper and hence affordable by, at least, 25.2 % of the population with low

income (Breisinger et al. 2015; UNFPA 2010). These are two of the main health challenges facing the Egyptian government as a result of malnutrition, which is directly related to the issue of food security. Education is expected to directly contribute to these problems though its impact will remain limited given the increasing levels of income poverty.

However, the emphasis put by international organisations is limited to basic education. Less, if any, attention was given to VET and its potential role in solving or reducing the food security problem. A probable interpretation of this is the World Bank's direction towards supporting basic education over tertiary education since the 1990s. This was a diversion from an increased emphasis on VET from the 1950s until the 1980s when investments in VET by the World Bank represented 25 % of its total investments in education (Middleton and Ziderman 1997). A shift in this trend occurred at the beginning of the 1990s when VET was criticised for its ineffectiveness in attaining its intended objectives, such as increasing employment and reducing poverty. From a neoliberal perspective, it was argued that VET would be best left to the forces of market supply and demand whereas the World Bank would better redirect its educational development support to basic education (Canagarajah et al. 2002; Yamada and Matsuda 2007). This direction became popular, especially with the Economic Reform and Structural Adjustment Programs (ESRP), which started in 1990/1991 in Egypt. By 1996, the World Bank's investments in VET represented only 3 % of total expenditure on educational development (Bennell and Segerstrom 1998).

However, educational development efforts in Egypt were insufficient to accommodate the relatively high rates of expansion in enrolment rates and over time the system suffered from scarcity of resources and the deterioration of the quality of its graduates. The system of VET also suffered similar deficiencies but on a wider scale given the already lowered levels of investments it receives, which resulted in a noticeable decline in technical knowledge and skills available in the economy in ways that hampered Egypt's international economic competitiveness. For instance, in 2010 ineffectiveness of skilled labour was perceived to be the third most problematic factor for doing business in Egypt (Hanouz and Khatib 2010; Schwab 2010). In 2014/15, this factor moved to the seventh most constraining factor to doing business in Egypt (Schwab 2014).

This shift was not due to improvements in education and training policies but rather due to the emergence of more problematic factors related to the 2011 uprisings, such as political stability and foreign currency regulations. The problem of ineffective VET is hence seriously influencing the international competitiveness of the Egyptian economy, including the agricultural sector, which renewed international donors' interest in investing to develop the sector in the past decade. It is argued in this chapter that developments in agricultural VET could enhance the sector's productivity and competitiveness in ways that would directly contribute to reducing the severity of the food security problem. More generally, VET development across different sectors is expected to enhance Egypt's international competitiveness and contribute to the development of the Egyptian economy, both of which would positively impact Egypt's ability to respond to international fluctuations in the global food market.

The Relationship Between Food Security and VET

In response to national pressures, changing environmental conditions and challenging international factors, the Egyptian government needs to (i) maximise the efficiency of its operations to preserve the scarce natural resources; and (ii) reduce wastes throughout the agricultural value chain as indicated by the *Sustainable Agricultural Development Strategy 2030*. An effective system of VET could potentially contribute to these goals. In addition to its capacity to raise awareness about social and health-related issues, such as family planning and nutritional diets, an effective VET system is capable of raising the skill levels of human resources across the value chain. Human resources represent a very valuable resource for the Egyptian economy that is available in abundance given the size of the population. However, if these are not qualified to positively contribute to the economy, especially young people, this valuable resource will turn into a massive burden on the economy through, for instance, unemployment, poverty and increasing consumption rates without an equivalent productive capacity.

The agricultural sector is short of qualified individuals with the right mix of knowledge and skills to maximise productivity. This forces Egyptian agribusinesses to rely on foreign labour in many instances to make up for the shortage of skilled Egyptian labour. The limited effectiveness of Egyptian workers on the job and the relatively high levels of wasted resources that result from low levels of education and training were cited as the most enduring reasons to support reliance on imported labour (Soliman 2011). This response is not uncommon across the private sector but affordability of foreign labour is not always available especially for smaller businesses. The latter are most prone to the negative impact of inefficient labour skills and struggle to find qualified and efficient farmers and workers (Soliman 2011).

The potential contributions of VET to food security mainly through enhanced levels of labour productivity and reduced levels of wastes of resources, both of which are necessary to enhance levels of domestic production, are limited by the ineffectiveness of the system of VET. Furthermore, the current VET system, particularly in agriculture, negatively influences the levels of productivity and efficiency on a general level. VET development in this sense is part of the overall capacity building and sustainable development of the agricultural sector as a whole and it would be erroneous to underestimate its potential (Maguire 2011). Hence, the challenge at this stage lies first on the means by which the government can enhance the effectiveness of the VET system to be in a position to contribute to addressing the problem of food insecurity in the future.

Challenges to VET Development

VET and its development face a number of challenges, some of which are more strongly embedded in the institutional configuration of the economy than others. An extensive discussion of VET ineffectiveness and its challenges extends beyond the scope of this chapter. However, reference is made to the challenges that are central to the problem and that have resulted in the perceived detachment of VET from the needs of the market. Policy makers need to prioritise an effective solution of these challenges to capture the potential benefits of an effective VET to different social and economic issues, including food security.

Ineffective coordination of development activities is amongst the major challenges to the system and its development. There are more than 24 public bodies responsible for VET development in Egypt and coordination of development efforts across these is negligible. This has resulted in the duplication of development efforts and competition for the already limited resources available for VET development (Bardak 2006). There have been attempts to minimise the fragmentation of the system, such as the initiation of the Supreme Council for Human Resource Development, to unify VET development efforts under one umbrella. However, the initiative which was proposed in 1982 and reactivated in 2000 did not result in any fruitful coordination or cooperation of VET bodies and stakeholders (ETF and World Bank 2006). Another more institutionally entrenched challenge is the relatively high levels of VET centralisation. The latter contributed to the marginalisation of important institutional actors to VET development. The state plays a central role in running VET; it is responsible for the design of VET programmes, its delivery and certification with little, if any, input from key institutional actors, such as workers and employers. This has deprived the system of valuable inputs to improve the system and reliable labour market information, both of which have contributed to the perceived detachment of VET from the demand of skills in the marketplace (e.g. ETF and World Bank 2006; World Bank 2007).

The Egyptian state's tendency to exclude key institutional actors from VET and its development has historical roots. The Nasserist regime was antagonistic to workers as well as employers in the private sector and hence cooperation with these key institutional actors was dismissed as threatening to state dominance. This trend changed under President Sadat, who supported private sector development as part of his economic liberalisation policies or *Infitah* (also known as the Open Door policy) although the marginalisation of workers continued as part of state policies. However, unlike Nasser, the Sadatist regime did not give workers the same benefits or, in other words, broke the unspoken *social contracts* with workers which Nasser maintained under his regime. This led to further weakening of the voice of workers in the economy, especially with the co-optation of unions by the state, a policy that continued till the Mubrak era (Alissa 2007; Bank and Richter 2010). Business elites gained

a stronger foothold under the Mubarak regime, especially after the World Bank/IMF ESRP and repressive policies towards workers were heightened. Ineffective state–employer–union cooperation negatively influenced VET as the system failed to represent the inputs and balance the conflicting interests of all institutional actors. It is thus not surprising for employers to perceive VET as irrelevant to their needs.

The marginalisation of workers, who are in the best position to advice on VET development needs at a grassroots levels, increased the irrelevance of VET. Curriculum development is largely divorced from reality and teaching relies on memorisation and rote learning with little, if any, emphasis on practical training. The deteriorating quality of the system and its graduates reinforced the widespread perception that VET accommodates failing students as a means of reducing social exclusion. The quality of VET was further affected by the limited financial resources available for VET which were significantly reduced by the shift in international donors' investments away from VET and into basic education, as indicated earlier. These issues need to be addressed on a national level to enhance VET effectiveness and tackle the problem of inadequately skilled labour in agriculture and other sectors.

Conclusion

The problem of food insecurity in Egypt is becoming increasingly challenging as a result of the numerous internal and external pressures that have accumulated over the years. The country's reliance on food imports, despite its risks, seems inevitable in the near future. However, every measure needs to be taken to enhance food self-sufficiency, which could be achieved through a strategic plan to maximise resource use efficiency, minimise wastes, improve productivity and rationalise consumption.

In addition to the provision of enhanced levels of awareness of food consumption, nutritional diets and family planning, which have an impact on the problem of food security, an effective VET system is also capable of positively contributing to reducing the food gap. The latter could be achieved through the provision of skilled workers across the

agricultural value chain with the required levels of efficiency to enhance production and reduce wastes of the already scarce natural resources. Nevertheless, the current system of VET fails to fulfil this role as a result of various institutional inefficiencies.

Some of the challenges facing VET and its development are more historically entrenched than others; however, a strategic and unified vision by the government to address these challenges could result in noticeable improvements in the medium and long terms. Hence, as a first step the government needs to work on addressing the challenges facing VET development with the aim of contributing (i) directly to the problem of food security enhancing domestic production and hence lower reliance on food imports; and (ii) indirectly through enhancing Egypt's overall international competitiveness and strengthening of the economy to be able to withstand fluctuations in the international food market and reduce the severity of the food security problem in Egypt. So, in conclusion, VET could potentially contribute in a positive manner to the reduction of the problem of food insecurity; nevertheless, a positive impact would only be possible under an effective VET system.

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12

Food Security, Competitiveness and Trade: The Case of Tunisian Agriculture

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Introduction

The Mediterranean policy of the European Union (EU) was deeply affected by the Arab spring. A big number of trade negotiations between the European Union and their Mediterranean Partner Countries (MPC) marked the last five years. In fact, there are two main programs established as a European reaction to the last events in the MENA region:

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the European Neighborhood Program for Agriculture and Rural Development (ENPARD), running from 2014 to 2020, and the Deep and Comprehensive Free Trade Agreements (DCFTA). These European initiatives could present an important opportunity for Mediterranean countries to deal with the existing social and trade issues. Even without mobilizing funds, the European support can be relevant to the MPC by sharing experiences and helping in capacity building (García Álvarez-Coque and Martinez 2016). Besides, the EU is trying to refine a new Mediterranean policy adapted to each country in the Southern shore, as it would be inappropriate to understand the area as a block.

In the beginning, the DCFTA was an initiative launched by the EU to create a free trade area with Georgia, Moldova and Ukraine. In 2011, preparation sessions for negotiations were begun to implement Deep and Comprehensive Free Trade Areas with Egypt, Jordan, Morocco and Tunisia. In 2015, there was a plan to start negotiations of DCFTA with Morocco, Tunisia and Jordan. Focusing on Tunisia, the third meeting of the preparatory process for the negotiations of a DCFTA took place on 19 June 2015 in Tunis and the Tunisian Prime Minister announced that Tunisia is ready to launch the DCFTA negotiations on 13 October 2015. The DCFTA guarantees the access of associated countries to the EU internal market in selected sectors as well as ensuring the European investors the same regulatory environment in the associated country as in Europe. Bilateral negotiations on trade liberalization in services and establishment will be integrated into the DCFTA. However, bilateral negotiation on agriculture remains open and controversial. In the Mediterranean region, the actual situation is a severe dependence on foreign supplies of food which could present an important threat to food security in the region (Abis 2012). Regarding the most basic staples, the northern African countries account for about 20 percent of world wheat imports with only 2 percent of world population. Indeed, all countries of North Africa are very dependent on agricultural imports with a deficiency in agri-food trade balance. In the case of Tunisia, traditional agri-food policies aimed at alleviating the import bill by exporting products with comparative advantage. While this strategy to ensure food security has been questioned (see Akesbi 2011 for Morocco and Petit 2015 for the region), it is still worthwhile to identify the degree of export competitiveness of Tunisian products on key markets in order to enhance food security in the country.

Trade could be a driver of prosperity for Tunisia if European efforts turn to the economic development, political stability and achieve essential goals such as food security. However, several critiques are emerging about the benefits of DCFTA to the southern economies. In this sense, the main concern is about the readiness of the Tunisian market to benefit from the DCFTA-planned gains in the agri-food sector.

Against this panorama, the main objective of this chapter is to assess the competitiveness of Tunisian agri-food products in respect to Europe and Maghreb before signing DCFTAs. In addition, this chapter aims to identify and assess the main points of controversy related to the DCFTAs between the EU and Tunisia and the ways to mitigate them from the Tunisian point of view, by exploring some of the issues related to the rural communities and market actors in Tunisia.

The chapter is organized as follows. After presenting a framework of the situation, the agri-food sector and trade in Tunisia and the expected advantages and costs of the DCFTA are described in Section "Agri-Food Sector, Trade and DCFTA in Tunisia". In Section "Expected Benefits and Shortcomings of the DCFTA", we present the competitiveness indicator computed and Sect. 4 shows the results of the calculations to illustrate the competitiveness of the agri-food sector in Tunisia just before signing the DCFTA. The chapter ends with some conclusions and policy implications drawn from the analysis.

Agri-Food Sector, Trade and DCFTA in Tunisia

Since its independence, Tunisia has considered agriculture as a key sector for its economic development and a national priority. Nevertheless, since 1996, the agri-food sector share in the gross domestic product (GDP) has decreased sharply from about 16 to 9 percent in 2014 (Fig. 12.1).

In spite of the aforementioned reduction, agriculture remains one of the driving forces of economic and social development in Tunisia. The Tunisian agriculture is the only source of income for nearly half of the rural labor force (45 percent) (African Development Bank 2012). Agriculture employs between 16 and 20 percent of the total active population (INS 2014).

Tunisia has undergone a revolution and is experiencing a long democratic transition, which leads to much economic turbulence, such as trade deficit. Five years after the Tunisian revolution, the trade deficit has rapidly increased from −8603.5 to −12047.4 MDT in the period 2011–2015 with an average annual growth of 8.78 percent (Table 12.1).

The agri-food balance follows the same trend of trade deficit. It can be explained by the strong increase in domestic demand. In the period 2005–2013, the gap between imports and exports grew. The persistence of a deficit in agri-food trade endangers food security in Tunisia as it raises the dependence on international markets (Fig. 12.2).

Tunisian agri-food exports are highly dependent on few commodities, being olive oil and dates considered as flagship products. Indeed, Tunisia is an international leader in exporting olive oil and it has the highest
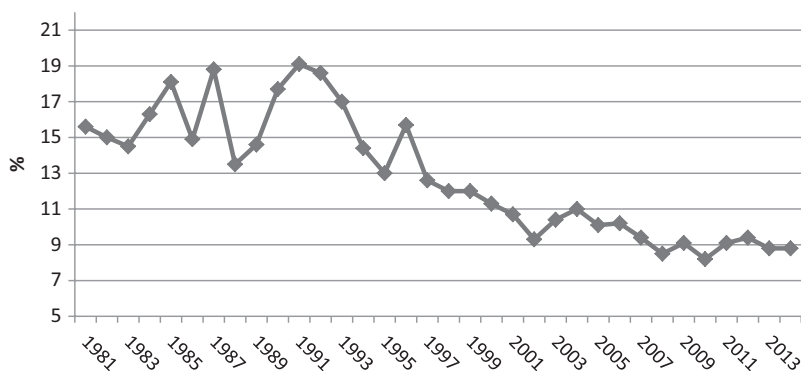
Fig. 12.1 Agriculture value added share in Tunisia's GDP (%) (1980–2014). Source: Authors' elaboration (World Bank, World Trade Indicators (WTI)) 2016

Table 12.1 Tunisian Trade balance 2011–2015

Year	Annual exports (MDT)	Annual Imports (MDT)	Trade balance (MDT)
2011	25092.0	33695.4	−8603.5
2012	26547.6	38178.0	−11630.3
2013	27701.1	39509.4	−11808.2
2014	28406.8	42042.5	−13635.7
2015	27607.1	39654.5	−12047.4

Source: Author's elaboration (INS), 2016

market share in exporting date to the international market. In 2014, the agri-food export is composed mainly of olive oil (484,35MDT); fruits (509, 82MDT, of which 388,43MDT of dates) and fish and crustaceans (231,45MDT). Olive oil, dates and fish exports represent together about 50 percent of the value of Tunisian agri-food exports (Table 12.2).

These products are an important source of foreign currencies, which can help considerably to compensate the country's cost of seed oil imports and other primary products such as cereals (Sai and Msallem 2005). Indeed, Tunisian imports of cereals and seed oils in 2013 represented about 50 percent of its agri-food imports (Table 12.3).
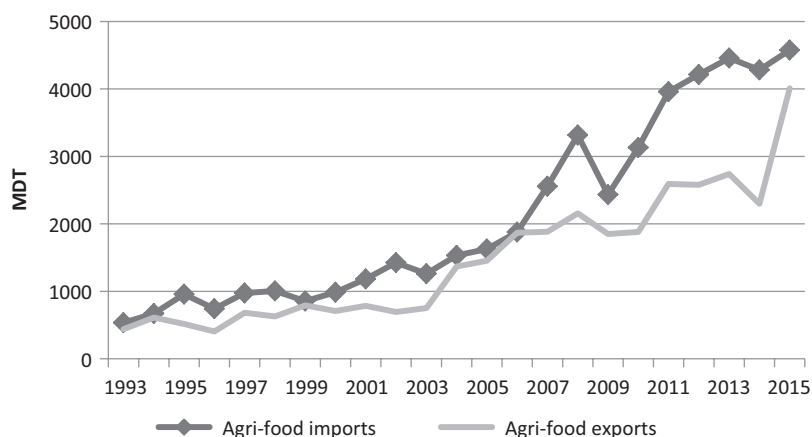
Fig. 12.2   Evolution of Tunisian's Agri-food imports and exports (1993–2015). Source: Author's elaboration (INS) 2016

Table 12.2   Structure of agri-food exports (%) 2009–2014

Year	Olive oils	Fish and crustaceans	Dates	Other
2009	28.84	9.84	12.85	48.47
2010	23.65	9.82	15.22	51.31
2011	15.57	9.78	11.48	63.17
2012	23.02	8.26	13.36	55.36
2013	29.93	8.16	13.86	48.05
2014	21.08	10.08	16.91	51.93

Source: INS 2016

To date, the EU is by far Tunisia's main trade partner in agri-food products, although reciprocity is not the case given the size of the country in comparison with the EU. In 2014, Tunisia imported 50.7 percent of its agri-food needs from EU countries and exported over 40 percent of its exports to the EU. These exports experienced a growth rate of over 62 percent from 2001 to 2014, whereas imports grew at an estimated average annual rate of 15 percent (see Fig. 12.3).Trade preferences given to MPCs by the EU do not impact on the export dynamics but reinforce the traditional trade pattern of these countries with the EU. In fact, there has been a limited impact of the Barcelona Process on agricultural trade (Abis 2011; García Álvarez-Coque and Martinez 2016).
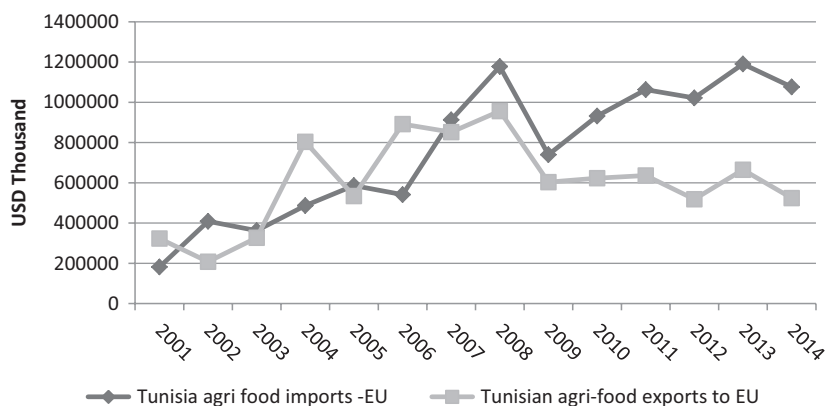
Fig. 12.3 Evolution of Tunisia's agri-food imports and exports from the EU (2001–2014). Source: Authors' elaboration (ITC) 2016

Table 12.3 Structure of agri-food imports (%) 2009–2013

Year	Cereals	Seed oils	Sugar	Others
2009	25.11	12.07	7.57	55.25
2010	34.72	11.76	9.17	44.35
2011	31.77	16.92	11.98	39.33
2012	31.66	13.47	8.75	46.12
2013	37.19	10.31	6.8	45.70

Source: INS 2016

Expected Benefits and Shortcomings of the DCFTA

The new DCFTA will facilitate trade between the EU and Tunisia. Indeed, only the agricultural sector will benefit from tariff reduction, as tariffs on industrial products are already eliminated. Agricultural tariffs on Tunisian imports from Europe will be reduced by 80 percent while tariffs in the European market on imports from Tunisia will be mitigated by 95 percent (Ecorys 2013).

Simulations indicate that the expected effect is that Tunisian exports will increase and enhance trade balance. This will have a positive effect on wages in general and on agricultural revenue in particular, leading to considerable increase in the purchasing power of producers (Ecorys 2013). The national income of both the EU and Tunisia is likely to increase in the long term as a result of this agreement. Given the size of the economies, Tunisian benefit in GDP is expected to be bigger than the European one. As a result, such an agreement would be in favor of Tunisia and consolidate its privileged partnership with Europe (Ecorys 2013).

In spite of the importance of expected benefits of the DCFTA to Tunisian economy, it is worth noting several negative effects that it can have. On the one hand, Tunisian producers might face high competition in exporting agri-food staples to Europe given the similarity of products produced in the Mediterranean area. Thus, producers may lose their comparative advantage due to aggression from the other EU providers.

As a dynamic effect, the new trade environment may lead small Tunisian producers to adapt not only to a new type of competition with European products and neighbors such as Morocco and Turkey, but also to the European food safety standards and rules (Compés López et al. 2013).

In the domestic arena, another shortcoming of the DCFTA is the additional drop in the levels of protection (Ecorys 2013) and the subsequent increase in competition caused by the availability of foreign agri-food products in the Tunisian market. In turn, this may result in the impoverishment of small domestic producers. Currently, most agricultural programs in Tunisia include subsidies to increase production level and protect the family farm model (see next section).

It is worth mentioning that the integration of agriculture in DCFTA negotiations is complicated even on the European side. One reason is

that agriculture, especially the fruit and vegetables subsector, is considered to be one of the main sources of conflict in the relation between the EU and the MPC (Jordán et al. 2011; García Álvarez-Coque et al. 2008) due to the increased competition that EU producers face from the MPC.

Support to Agriculture in Tunisia

The Tunisian agricultural policy has focused traditionally on maximizing production by intensifying the use of inputs such as chemical supplies and fertilizers, seeds and improved varieties, or on improving irrigation and water infrastructure. Thus, agricultural activities were planned according to national guidelines and objectives of food self-sufficiency by supporting agriculture production prices and subsidizing most agricultural inputs (AFDB 2012). Before the Tunisian revolution, the deepening of trade liberalization was always accompanied by severe supervision by interprofessional groups to limit competition and improve market efficiency (Elloumi 2006). However, pricing of agri-food products is no longer under the control of the interprofessional organizations but is determined by market forces. These organizations' roles have been limited to the coordination between the different stakeholders, such as producers and exporters.

The Nominal Protection Coefficient for Producers (NPCp) is the ratio between the average price received by domestic producers for their products at the farm gate (including payment per ton of current output) and the border price that they would receive if the product were freely traded according to international market conditions. An NPCp greater than 1 means that the producers of the commodity are protected by border measures influencing prices (OECD 2011).

FAOSTAT and INS data have been used to compute NPCp. Table 12.4 presents the NPCp of beef, poultry meat and bread wheat. We have chosen these products given their importance in the Tunisian market.

In general terms, the changes in NPCp over the period considered show a diminution of protection for these three basic food products. This fact can be explained by a gradual trend toward more neutral support to producers in the framework of more liberalized markets, which leads to a reduction of tariff protection.

Table 12.4 Nominal Protection Coefficient for Producers—Tunisia

Year	1					2					3				
	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Bovine meat	0.73	0.63	0.55	0.56	0.59	0.48	0.56	0.49	0.54	0.53	0.50	0.53	0.53	0.53	0.49
Average	0.61					0.52					0.52				
Poultry meat	1.27	1.32	1.23	1.03	1.24	1.42	1.18	1.02	1.07	1.06	0.72	1.05	0.85	0.82	0.90
Average	1.24					1.15					0.87				
Soft wheat	2.25	2.47	2.17	1.91	1.59	1.66	1.63	1.73	1.44	1.04	1.20	1.71	1.31	1.06	0.93
Average	2.08					1.50					1.24				

Source: Authors' elaboration, based on Food and Agriculture Organization of the United Nations (FAO, 2016) and INS data

The evolution of NPCp for beef over a period of 15 years (1998–2012) shows that domestic producers were not protected by government measures affecting prices. In addition, the average nominal protection coefficient of poultry meat decreased to less than 1. It dropped from 1.15 during the second period (2003–2007) to 0.87 during the third period (2008–2012). Regarding soft wheat, the protection factor is always greater than 1 with the exception of the last year in that period, reflecting the importance of this product in domestic agricultural policies. However, a downward trend since 1998 is noticeable. More generally, cereals continue to receive substantial attention within the support policies and take advantage of financial support at the expense of other sectors such as beef and poultry meat.

In this sense, an additional liberalization of agri-food trade raises a question about its impact on Tunisian local markets and on food security. The debate is whether additional trade liberalization can enhance food security via the increment of exports. In this context, it is fundamental to analyze the evolution of the economic competiveness of the Tunisian agricultural sector since Tunisia has become a member of the free trade European–Mediterranean area. Such an analysis may help policy makers to study the impact of the DCFTA based on previous experiences.

Methodology: Measuring the Competitiveness of Tunisian Agri-Food Products

Several definitions have been used in previous literature to define competitiveness. It changes depending on the purpose of the analysis and the studied product. Indeed, various approaches have been used to analyze the competitiveness of international agri-food trade. In this chapter, the Revealed Comparative Advantage (RCA) index is used to assess the competitiveness of Tunisian products with respect to its partners (the EU and the Arab Maghreb Union, UMA). Data on Tunisian exports by HS chapter are obtained from the National Institute of statistics (INS) and include exports by commodity from chapters HS01 to HS23 and partner country from 2007 to 2012. Values are presented in Tunisian dinars.

Balassa Revealed Comparative Advantage (RCA) index

This index was used for the first time by Liesner (1958) and improved by Balassa in 1965. It came to be known as the "Balassa Index" and it measures normalized export shares of a country, compared to exports of the same industry in a group of reference countries.

Balassa (1965) defined the RCA index as the ratio between exports of certain products (HS2 chapter) of a country (in this study Tunisia) and total exports of this country to the rest of the world (or the geographical reference area; in this study we consider the EU and UMA as a geographical reference area), and world exports (or the geographical reference area) of the same product to the total world exports (or the geographical reference area) (Vollrath 1991; Bojnec 2001).

RCA can take positive or negative values. Positive values of RCA are interpreted as meaning that the country has comparative advantage. The Balassa RCA is defined as

$$RCA_i = \frac{X_i - M_i}{X_i + M_i} - \frac{\sum(X_i - M_i)}{\sum(X_i + M_{i.})}$$

where

X_i represents exports from Tunisia of HS2 sector (i);

M_i represents imports of HS2 sector (i)

While the index is not free of shortcomings (see Cai and Leung 2007), it is still widely used for a first approximation to the measure of competitiveness. As an instance, at the end of the previous century, Chebbi and Gil (1999) presented a general diagnostic of Tunisian agri-food sector competitiveness with the EU during the period 1975–1995 using the RCA index. An overview by groups of products revealed that products of animal origin present a slightly higher competitive advantage compared to other subsectors thanks to the high competitiveness of HS2 03 (fish and crustaceans) and the strong Tunisian marketing strategy to promote fishery exports. In addition, the authors found that the competiveness of the vegetable subsector deteriorated over the period of study. They pointed out to the irregularity and low production level, of which a major

proportion is absorbed by domestic demand (Arfa 1995). On the other hand, they showed that the competiveness of dates and olive oil was improved due to their competitive prices and improved quality compared to those of their direct competitors.

Results and Discussion

Empirical results of our calculations are reported in Table 12.5. They reveal the current competitive position of the Tunisian productive sectors. Beginning with the three traditional subsectors of relevance in Tunisian exports and the EU market, our findings show that Tunisian exports of fish and crustaceans are competitive, in spite of the fact that over the last decade there has been a loss of competitiveness given the significant decline in the RCA from 84 percent in 1995 (Chebbi and Gil 1999) to 26 percent in 2012. Many efforts have been made by the government in previous years to promote fish and crustacean exports and to implement more effective management of fisheries. In terms of services, the government has decided to launch an upgrade program with the French Development Agency to prepare Tunisian firms for the new phase of liberalization. These efforts could be extended to other sectors and used as lessons of competitiveness-enhancing policies. Modernization of the production fleet which is very old and traditional and better organization of the subsector will enhance the competiveness of local producers and can reverse the negative trend detected.

Regarding animal or vegetable fats, oil and wax products, the RCA has decreased from 48 percent in 1995 (Chebbi et Gil 1999) to 21 percent in 2012. However, it is still positive and Tunisia remains competitive. A major part of this competiveness stems from olive oil exports. Nonetheless, there is an ample margin to improve competiveness of this sector since a major part of olive oils is exported to the EU under Inward Processing Relief Traffic (IPRT) conditions. Indeed, Tunisian olive oils are re-exported under European brands after processing or just bottling (Anania and Pupo d'Andrea 2011).

Fruits also show a positive RCA over the period of study, as vegetables do during most of the period. Overall, our findings prove that these

Table 12.5 RCA index of the Tunisian agri-food products with the EU and UMA (%)

HS2 chapter	Tunisia—UE						Tunisia—UMA					
	2007	2008	2009	2010	2011	2012	2007	2008	2009	2010	2011	2012
01—Live animals	−144	−134	−136	−138	−132	−140	189	175	182	193	197	189
02—Meat and edible meat offal	−127	−121	−149	−112	−123	−139	−32	4	7	14	−133	−174
03—Fish and crustaceans	37	35	1	22	42	26	−147	−142	−120	−80	−100	−94
04—Dairy, eggs, honey and edible products	−132	−123	−139	−121	−117	−128	102	126	106	114	87	114
05—Products of animal origin	62	72	55	73	76	65	−155	−156	−108	−44	−52	−17
06—Live trees and other plants	−29	−18	−40	−41	−29	−48	64	74	70	87	78	38
07—Edible vegetables	−57	2	−49	26	17	1	−52	−45	−31	−78	11	8
08—Edible fruits and nuts, peels of citrus/melons	65	76	59	77	80	71	17	13	16	14	17	11
09—Coffee, tea, mate and spices	62	70	50	54	45	36	90	94	90	114	134	132
10—Cereals	−132	−123	−139	−121	−117	−128	90	169	0	0	191	198
11—Milling industry products	−132	−123	−127	−90	−113	−127	46	2	18	63	62	30
12—Oil seeds/Misc. grains/med. plants/straw	−66	−80	−96	−78	−59	−81	−34	4	25	62	13	19
13—Lac, gums, resins, etc.	−132	−123	−130	−116	−117	−124	75	35	108	140	33	89
14—Vegetable planting materials	62	69	54	74	62	71	36	34	24	41	8	37
15—Animal or vegetable fats, oil and waxes	45	54	33	54	27	21	48	70	59	71	82	71
16—Edible preparations meat, fish, crustaceans	5	49	44	58	62	53	19	19	19	18	28	37
17—Sugars and sugar confectionery	−133	−114	−142	−135	−127	−135	61	81	105	54	64	113
18—Cacao and cocoa preparations	−124	−101	−102	−129	−129	−138	82	82	87	96	96	92

(continued)

Table 12.5 (continued)

HS2 chapter	Tunisia—UE						Tunisia—UMA					
	2007	2008	2009	2010	2011	2012	2007	2008	2009	2010	2011	2012
19—Preps. of cereals, flour, starch of milk	−87	−71	−91	−81	−79	−88	*40*	*29*	*33*	*29*	*27*	*31*
20—Preps. of vegetables, fruits, nuts, etc.	−108	−46	−63	−54	−65	−84	*69*	*38*	*42*	*54*	*37*	*48*
21—Misc. edible preparations	*2*	−3	*8*	*7*	−9	−33	−26	−29	−38	−22	−9	−40
22—Beverages, spirits and vinegar	−12	*12*	−8	−13	−1	−44	−84	−47	−38	−77	−33	−15
23—Residues from food industries, animal feed	−48	−56	−94	−109	−119	−118	*147*	*172*	*168*	*159*	*157*	*172*

Source: Authors' calculation

sectors could take advantage of the free trade with the EU as chapters 07, 08, 09 and 14 display high competiveness. Particularly, dates are included in chapter 08. Despite the strong performance of the dates sector, several structural weakness and handicaps have been identified in this sector. Literature mentions several possible causes such as the insufficient production material and techniques, the lack of research and marketing services, weak farming organizations, the irregularity of the trading system and the inconsistent quality of the packaged products, as well as a high rate of product infestation (APIA 2008; Jemni et al. 2014).

Turning now to the relevant products that show negative competitiveness, the RCA of live animals has substantially decreased to reach an indicator of −140 percent compared to Chebbi and Gil's (1999) results. They computed an RCA of −60 percent in 1995 before Tunisia was engaged in the Barcelona process. Furthermore, the meat and edible meat offal subsectors display a similar trend suggesting that these Tunisian sectors do not have any comparative advantage to export this type of product to Europe. The decreasing protection shown earlier may be the cause behind the low competitiveness of local production. On the other hand, at the policy level, the RCA of the meat subsector could be improved as long as farmers' performance can be enhanced through information campaigns, training actions and extension services.

Despite the relevant importance of the cereal sector within the Tunisian agricultural policies, the RCA indicator continues to be negative indicating that local producers are less competitive than their European counterparts. In fact, Tunisia does not have a comparative advantage to produce cereals and indeed imports from the EU are still very important. Many factors are behind the low competiveness of this sector. In Tunisia, farmers are far from the international cereal production standards (Bachta 2011). Furthermore, increasing input costs borne by Tunisian farmers reduce their competiveness compared to their EU counterparts. On the other hand, the potential of production in Tunisia is not yet achieved due to the spread of small farm size, which represents about 75 % of the total. Thus, local production cannot take advantage of economies of scale.

With respect to another geographic trade area (UMA), it is worth noting that the countries of UMA have a similar economic structure with the dominance of the agricultural sector. Indeed, they offer similar agri-food

products. In general, it appears that Tunisian products are more competitive than their UMA counterparts. However, it is important to note that the agri-food trade flows with UMA countries are limited and restricted to a small number of agri-food products.

Conclusions

The EU and Tunisia share common interests for expanding the cooperation in terms of agri-food products. So Tunisian authorities will deepen the aggressive trade liberalization agenda by signing the DCFTA. However, several issues that require the employment of proactive strategies will be crucial to avoid negative impacts of the DCFTA in some subsectors. Indeed, the liberalization process needs an institutional and legislative adaptation to the EU's standards and rules which could affect Tunisian agri-food exports and lead to various social costs. Hence, it can put some basic domestic agri-food products at stake due to increased competition.

Food security and self-sufficiency constitute the major concerns of Tunisian government, especially with trade liberalization. One strategy to achieve food security consists on relying on exports of competitive products to compensate for the bill of basic food products. In this context, the analysis of the competitiveness of agri-food trade with the EU and neighboring countries makes this study especially interesting.

Our empirical findings reveal that the biggest relative increase in Tunisian exports is expected to come mainly from the sectors of fruits, fish and olive oil given the high competiveness shown at the EU market. Moreover, these products are likely to expand in terms of value added, which would lead to positive spillover effects. Then, Tunisian efforts could focus on obtaining more significant trade benefits in these sectors. Marquez and Martinez-Gomez (2016) show that this strategy has been fruitful to enhance Moroccan exports of fruits and vegetables.

Another point to stress, consistent with Chebbi and Gil's findings (1999), is that the competiveness of the Tunisian agricultural sector differs significantly according to geographical areas of trade. The three most competitive sectors in the EU market are not so competitive in the UMA market. Otherwise, the rest of the products increase their competitiveness

at the UMA. Hence, one Tunisian policy option would be to deepen the UMA trade so that export of competitive products increases to Maghreb partners and then, through a learning-by-doing process, they can raise their overall competitiveness and become ready for the global markets.

Indeed, in the short term some agri-food subsectors, mainly animal products, milk and dairy products and cereals, remain unprepared to support the costs of the DCFTA due to their low competitiveness. Then, Tunisian authorities could propose a progressive trade liberalization strategy with the EU.

In the meanwhile, Tunisia could encourage foreign direct investment in these sectors to improve their competiveness. Another measure to foster producers' competitiveness is to promote the adoption of adequate varieties with quality control and certification facilities.

Beyond the "pure" export strategies, Petit (2015a, b) and Petit et al. (2015) emphasize the role of civil society organizations and local institutions to enhance agricultural and rural development for sustainable food security in Mediterranean countries, and point out to the ENPARD funding and European experiences to achieve this goal.

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Food Security in Mongolia: A System Innovation Perspective

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Introduction

Mongolia covers a vast area of land, its terriroty being larger than the combined area of the UK, France, Germany and Italy. However, of the 80% of the land covered with grassland and arid areas, less than 1% is available for the cultivation of crops (FAO, UNICEF et al. 2007). The Mongolian population of 2.84 million (2013) is relatively highly

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concentrated in cities, creating a low density of population in the country (1.7 people per sq. km). Most Mongolian households and communities in rural areas are isolated. The poor transport infrastructure and extreme weather conditions create further challenges for the food and agriculture industry. Traditional nomadic pasoral customs dominate the agriculture industry: Most Mongolians across the generations have a deep understanding of traditional animal herding and traditional food-processing practice, including slaughtering, processing of meat and storing of food through cold seasons. Only 7 % of milk production and 3 % of meat production follow an industrialised system (FAO, UNICEF et al. 2007). Such low levels of modern food processing create several issues in food safety. Moreover the industry cannot meet the country's demand for food. The main crops of Mongolia which comprise the staple food of Mongolians are wheat, potato, vegetables, milk and meat. Domestic production supplies 98.2% of potato demand, 47.3% of vegetable demand and 25% of flour demand, respectively (Galanbuyan 2008).

Of the 38 % of the whole population living in cities, such as Ulaanbaatar, many people still go outside the cities on Friday afternoon to spend their weekend at yurts in the fields. In addition, most herders in the rural areas of Mongolia only keep animals without cultivating crops (FAO, UNICEF et al. 2007). Any loss of animals, therefore, results in a huge negative impact on most herders in Mongolia (FAO, UNICEF et al. 2007). For example, the 4.5 million animal heads in the period 1999–2002 worsened households in rural areas due to unfavourable water and weather conditions (FAO, UNICEF et al. 2007).

As in other low- and middle-income countries, food and agriculture industries represent a significant part of Mongolia's gross domestic product (GDP). Employment in the food and agriculture industry is 40% of the total population (Galanbuyan 2008). The food and agriculture industry occupies 21.7% of the Mongolian GDP (Galanbuyan 2008). In particular, the livestock sector produces 80 % of the total agriculture and food industry production (Galanbuyan 2008). More than 170,000 households work for 364,000 herders. It has been estimated that this will result in 45 million heads of livestock (Galanbuyan 2008).

The total funding of "donor funded projects and programmes in the food and agriculture sector" is 77.5 million US dollars (Galanbuyan

2008). There are 3 soft loan projects and 19 grant aid and technical assistance projects in Mongolia (Galanbuyan 2008). The food sector of Mongolia comprises 27.6 % of total manufactured goods, more than 720 processing firms, with more than 7000 workers, and manufactured products worth over 117.7 billion tugriks (Galanbuyan 2008).

Literature Review

The system of innovation refers to "the determinant of innovation process in all important economic, social, political, organisational, institutional, and other factors that influence the development, diffusion and use of innovations" (Edquist 2005: 182). As Edquist (2005) elaborates, Nelson (1993) places the emphasis on national R&D conducting empirical studies, whereas Lundvall (1992) develops the theoretical foundations of system innovation with a focus on learning and interactions as a new approach and identifies two significant aspects: production structure and institutional foundation.

In system innovation, it is important to identify organisations and institutions as the main components within a certain system (Edquist 2005; Chaminade and Edquist 2006). Edquist and Johnson (1997) identify organisations as formal entities intentionally designed to implement specific objectives, while they interpreted institutions as sets of behaviours, customs, cognitions, repeated social patterns and approved social rules. Often the following entities are chosen as organisations: governments, universities, firms and public intermediaries with responsibility for regulations and innovation policies (Edquist 1997). Institutions can be like universities and distribute their new knowledge to the industry or specific patent laws affecting inventors' innovation activities (Edquist 2005).

The literature of system innovation indicates three kinds of learning: innovation in new products and processes, R&D and competence building, such as training and education. Innovation learning can create the "structural capital" of a firm which is organisational learning managed by companies (Edquist 2005). R&D often leads to innovation of science and technology, the driver of manufacturing and other high-value industries. The main players in R&D are universities, national research

centres and companies' research centres. Competence building is related to individual learning through training and education of schools, universities and workplaces. Skilled labour becomes an important contributor to innovation in an organisation (Edquist 2005).

Food Security in Mongolia

Food security in Mongolia is closely related to the issue of rural poverty (Chimeddulam et al. 2008). Before the collapse of the Soviet Union and the subsequent breakdown of Mongolia's centralised economic planning, there was no serious problem of indigence in the population according to national statistics. However, after the economic and social transition, the unemployment rate and inflation rate have surged. Rural poor people are made up of "women who are heads of households," "members of households with more than four children," "families with small herders," "unemployed people," "people without basic education," and "vulnerable groups, such as the elderly and disabled people and orphaned children" (RPP 2016). One of the reasons for such rural poverty is that the rural poor are isolated in a small group, are nomadic and are scattered across remote regions: "Huvsgul, Arhangai, Bayan-Olgiy in the north-west, Dorno-Gobi in the south-east and Bayanhorngor in the south-central part of the country" (RPP 2016). Herders are most vulnerable people in terms of poverty and food security in Mongolia. Some herders move with their cattle, living in a traditional tent called *ger*, while some live in *soum* in order to obtain access to health care, education services and other group benefits.

The main source of livelihood and income for most herders is livestock production (FAO, UNICEF et al. 2007). The number of livestock per herder decreased by more than 50% between 1990 and 2000, while the herder population has increased from about 150,000 in 1990 to 420,000 in 1999 (RPP 2016). The livestock industry of herders has been seriously hit by harsh winter conditions, called *dzud*, in 2009/10 and in 2105/16. The unusual cold temperature is as low as −46 °C, and the high levels of snowfall killed 9.7 million animals in 2009/10 (OBG 2016). Although most herder families need at least 10 heads of cattle or

70 sheep, approximately 20 % of the herders have less than 10 animals (RPP 2016). Herders with less than 10 animals are struggling hard with long-term poverty and survival, as well as coping with deteriorating pastures, harsh winter conditions, contagious animal diseases and lack of water (RPP 2016). To support rural families in Mongolia, a food stamp programme has been implemented (ADB 2014).

The poverty level in rural areas is 35 % of the population, whereas in an urban setting it is 23.3 % (Theunissen 2014). In addition, most herders face problems in creating job opportunities for future generations (Theunissen 2014). Many people moving towards urban areas fail to settle in cities, and choose to stay in the *ger* district located on the outskirts of cities (Theunissen 2014). The *ger* district is not intended for settlement or housing communities by the government, so there is no proper infrastructure, such as water, electricity, sewage and heating; nor are there, any social services, such as schools, kindergartens and job training centres (Theunissen 2014). Such a lack of education leads to a high rate of unemployment and low-paying jobs or self-employment (Theunissen 2014). The largest city, Ulaanbaatar, with more than 60% of the whole population of Mongolia has a high poverty level, recorded as 19.8% in 2012. In addition, high inflation (12.4% in 2013) worsens the economic and living conditions in Mongolia (Theunissen 2014).

Markets for access to food in Mongolia are generally well developed. People in urban areas can access food easily through markets, whereas herders in rural areas live mainly on their own meats and dairy products. Therefore, it is important for people in rural areas to access other main food products, such as flour.

In 2007 it was estimated that 1.13 million tons of food was needed in Mongolia in 2007, but domestic production of food would provide only 75 % of the whole demand (Soninbayar 2010). In order to overcome this food production gap, Mongolia created and implemented the National Food Security Program (NFSP) for 2009–2016. With the co-operation of the government, private industry and the public, the goal of the programme is to create a stable food supply system to produce and distribute affordable, good, nutritious and trustworthy food for the whole population (Soninbayar 2010). The Rural Poverty Reduction Programme funded by the IFAD also supports the NFSP to aid food security and

supports rural people in cultivating potatoes and vegetables. Thanks to such efforts, the food production of staple food was almost met in the period 2006–2007: meat 98.3% (100% of the government target), milk 95.2 % (100% of the government target), potatoes 74.3% (55% of the government target) and vegetables 45.3% (65% of the government target) (Soninbayar 2010). Although Mongolia has faced various challenges, such as an economic downturn, widening economic inequality and an increase in poverty, it recently achieved improvement in food self-reliance.

Continuing economic growth in Mongolia has contributed to relieve its poverty levels from 38.7% in 2010 to 27.4% in 2012, but economic inequality has increased (Theunissen 2014). Many people in Mongolia have a tendency to believe that those engaging in the mining industry have more economic and social benefits, such as education and job opportunities, than others (Theunissen 2014). Drops in the price of the main Mongolian exports - minerals, coal and copper-, and the decline in foreign investment of 54% compared to that in 2013, due to the conflict of international contracts in the mining industry and insecure regulation systems, led to the downturn of the Mongolian economy (Theunissen 2014).

From the first food security programme, Mongolia learned five key lessons (Soninbayar 2010): (1) Mongolian law seems inadequate to monitor entities, industry and consumers; (2) overlapping responsibilities/tasks exist for too many Mongolian entities; (3) there are low efficiencies in policy implementation, due to complication of too many goals and subgoals; (4) there is a need for the reliability and quality of data collection and analysis in order to improve monitoring, evaluating and forecasting; and (5) it is necessary to raise the productivity of the livestock industry by focusing on breeding quality. In addition, other lessons for food security are (1) how it can help poor urban people in early spring; (2) how it can support the urban poor and vulnerable communities given the higher prices of staple foods; and (3) how it can create innovative schemes (e.g., vouchers, social cards) for vulnerable groups.

The second NFSP focused on a "proactive," "pro-poor" approach to curtailing poverty with specific strategies along with private industry (Soninbayar 2010). The main factors to consider are (1) the traditional

nomadic industry system in rural areas; (2) the vulnerable conditions of farmers and herders; (3) the remote isolation of households and communities in rural areas, and the unique nature of their food consumption and seasonal patterns; and (4) increasing urbanisation and urban population. With these focal considerations, the second NFSP is to put policy intervention on "food security to improve food self-reliance," "food safety to rationalise and make food management/control systems 'fit for purpose'," and "nutrition to reach the Millennium Development Goal 1 of halving hunger and under-nutrition by 2015."

The NESP has four initiative areas: "enabling environment," "food security," "food safety" and "nutrition" (Soninbayar 2010). Enabling environment is about "building capacity to make necessary reforms in food policy and institutional frameworks to meet modern needs," "promoting food research, information and monitoring and evaluation," and "developing innovative financing and credit schemes for the agricultural investments, such as the Agricultural Development Fund." Food security has two focal features: (1) the increase of national food production by the privately owned agriculture industry and the gradual increase of income in rural areas and (2) the diversification and intensification of food production of rural households and easier access for urban households to good-quality and affordable food. The focus on food safety introduces and distributes modern food processing and food management systems in terms of highly cost-efficient systems. For nutrition, the main agendas are "increasing public awareness," "managing research and information," "preventing micro-nutrient deficiency," "supporting food fortification," "reducing non-communicable diseases" and "promoting clean water supplies."

According to the National Programme for Food and Security 2009–2016 (2009), Mongolia's objectives are (1) to create a positive business environment in the food and agriculture sector; (2) to provide sustainable development in the sector; (3) to increase productivity; (4) to introduce new technologies; and (5) to provide increased production of a high-quality food supply. Funding sources for implementing the programmes are the State budget (35%), donor assistance (35%), external soft loans (18%) and the private sector (2%) (Galanbuyan 2008). The Mongolian National Science and Technology master plan (MoECS 2007) includes a specific R&D plan for food security.

Mongolian System Innovation of Food Security

Analysed through the concept of system innovation, Mongolian conditions of food security can be described as falling into three learning areas: Innovation, Research and Development (R&D) and Competence Building. First, innovation can be delivered by a new product and a new service (Edquist 2004). Innovation for food security is related to the quality of final and middle-level products and services. In order to improve national food security, both the productivity of the agriculture industry and agricultural products and services need improvement. In other words, it is important to cultivate the competeiveness of the Mongolian food industry. For such innovation, the main participants are entrepreneurs and enterprises. In Mongolia, for these firms' innovation in food and agriculture, the UFC group and the Mongolian National Chamber of Commerce and Industry are the main players in the food industry. However, from the perspective of learning capabilities, apart from a few domestic entities, such as the two mentioned above, the organisation scale is too small to accept new knowledge and to build a new learning system. Most Mongolian firms are rarely ready to absorb new knowledge and learning systems for the food and agriculture industry.

For learning schemes for innovation, it would be better to implement learning for entrepreneurs, rather than an artificial learning programme. It is important to provide a learning system for entrepreneurs. This could be, for example, by creating business opportunities for entrepreneurs to work with international multinational enterprises (MNEs) by joining one of the food supply or food distributing chains. However, the important aspect is that once the enterprises obtain international standards, the experienced entrepreneurs should work with domestic business opportunities in the food industry. Eventually, it is important to create/establish internationally competitive companies in the food industry to compete with MNEs at some point. However, before reaching this point, it would be better to create rich business opportunities by entrepreneurs.

Second, R&D in the food industry refers to research and development activities conducted by government institutes, universities and private firms (Edquist 2005). Such R&D activities can directly lead

to the improvement of productivity in the food industry and natural resource management (Allison and Hobbs 2006). If a country leads/depends on science and technology in the food industry, the country will be dependent on other countries for food security. Currently, for Mongolian national R&D activities, different government ministries are in charge of R&D: (1) Ministry of Science and Technology, (2) Ministry of Industry, (3) The Ministry of Education, Culture and Science and (4) Ministry of Food and Agriculture. Under the latter, there are important entities: "Veterinary and Breeding," "National Centre for Animal Gene," "Crop Promotion Fund," "Livestock Protection Fund," "The State Veterinary and Sanitary Central Laboratory," "City Veterinary Office," and "Agriculture Goods and Raw Materials Exchange Office of the Coordination Council." Beyond the governmental structure, there are domestic/local and international non-governmental organisations (NGOs) and foreign international aids. In addition, under the Ministry of Science, the Mongolian Academy of Sciences has 17 research institutes and centres and 9 scientific production corporations. For university R&D activities of the Ministry of Education, Culture and Science, currently the Mongolian State University of Agriculture plays an important role. Also, under the Ministry of Education, Culture and Science, the National Science Council has played a critical role in R&D activities of science in Mongolia. Although Mongolia has developed sound plans for food security, technology and sustainable development, it seems there is a lack of co-ordination of R&D activities across different ministries with limited domestic funding and international funds.

Third, competence building is related to establishing sound human capital among local people (Edquist 2005), in particular, herders and farmers in Mongolia through training and education. Schools and universities in Mongolia are important as well. Although the country has very high education and literacy levels, there is a serious lack of continuous and regular training and education for herders and farmers in remote regions. Training and education programmes launched by international entities and foreign countries have seldom succeeded in creating voluntary training and education for local herders and farmers. In particular, in the case of herders, it is very hard to create and run such programmes because they keep moving pastures in small groups across different seasons including extremely cold winters.

Recommendations

For Mongolia, it is important to distinguish between building learning capabilities and having projects of competence building. Currently, Mongolia has conducted many capability-building projects, but these need to lead to a long-lasting and continuous learning system, rather than providing one-off benefits. In this regard, we make the following recommendations: "policy co-ordination," "entrepreneurial learning" and "public awareness of food security." Such recommendations for learning capabilities are not isolated, but overlap and are interdependent on one another in terms of their impact on Mongolian food security. These three learning dimensions can also be interpreted or analysed at the national, regional, community, firm and individual levels in various contexts.

Policy co-ordinations refer to how governments organise various roles, rules and norms of food security. Mongolia has conducted various research projects independently or with international collaboration. For example, the government recently had discussions for research on livestock with other countries, such as Germany. The United Nations (UN) and its agencies have directly conducted some studies on Mongolian food security. Now, however, Mongolia faces the unsolved question as to why these efforts and projects by Mongolia or international entities have only rarely led to the next stage for enhancing food security in the country. Indeed, the issue of food security is a problem not only in Mongolia, but also for many other countries. The lack of policy co-ordination can be summarised as having two effects on the food security system. First, it reduces the scale-up of the outcomes of pilot studies of food and agriculture. Second, it duplicates efforts as it rarely co-ordinates the many studies and projects on food security with many international aid projects.

In terms of policy co-ordination we need to focus on Mongolian policy at four levels: (1) to support the creation of a food economy and industry; (2) to co-ordinate foreign research and pilot projects for food security; (3) to raise the regulations and standards for food industry and food production; and (4) to support science and technology in food science and food production including educating the next generation of scientists.

Entrepreneurial learning refers to how industry, including government-owned companies and private companies, can take the initiative for the food and agriculture industry. No policy on food security can succeed without the industry's voluntary participation. In order to attract industry into the food and agriculture industries, it is important to show business potential. Furthermore, it is critical to teach and show tangible business opportunities to business people and existing farmers and herders. By doing so, Mongolia can create a business momentum in the food and agriculture industry. These learning capabilities for food business opportunities can be obtained through collaboration with MNEs in the food industry. In an initial stage, Mongolian local firms can learn the food industry business by collaborating as one of the supply chains of MNEs (mainly as one of the food distributors). It takes a long time to build business ties based on trust with international collaborators.

Public awareness of food security for herders and farmers is high and suggests that notions of food security can penetrate successfully into the Mongolian public. This is important in three ways. First, without public support, government policy and practices often fail. Second, food security eventually depends on national food production capabilities and natural consumption trends, where public recognition is significant. Third, to enhance other aspects of food security, such as R&D and business opportunities, good skilled workers and high-quality business people are needed and will have to be trained and developed. The public will not be attracted if there are no opportunities. Therefore, it is important to show business opportunities in the food and agriculture industry to the public. Furthermore, local people who recognise the importance of food security will become voluntary monitoring powers to protect Mongolian food and agriculture markets. Additionally, it is anticipated that this raised public recognition will lead to the formation of NGOs for food security.

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14

Household Behavior on Food Security During an Economic Crisis

Irene Kamenidou, Konstantinos Rigas, and Constantinos-Vasilios Priporas

Introduction

Food security as a concept attracts the attention of policy makers, practitioners, and academics around the world (Jones et al. 2013), as it is considered one of the key essentials of life (Pfeiffer et al. (2015), since it is related to individual well-being (Magaña-Lemus and Lara-Álvarez 2015) and because food scarcity or food insecurity can affect almost every facet of society (Jones et al. 2013). A household (microlevel) is considered food-secure when it has the ability to acquire the food needed by its members (Pinstrup-Andersen 2009). Timmer (2012) asserts that

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understanding the behavioral dimensions of food security is an important step in learning how to prevent food crises.

The recent global economic crisis in 2008 and the considerable increase in food prices have vitalized international debate and reopened the debate on food security (Solaroli 2014). The Economist Intelligence Unit (2012) points out that food security is still a challenge in many Mediterranean countries, especially the southern and eastern ones. This is also documented in the study by Pfeiffer, Ritter, and Oestreicheret (2015) which indicates that in Greece around 18 % in 2012 answered "Yes" to the question "*Have there been times in the past twelve months when you did not have enough money to buy food that you or your family needed?*", while in 2006–07 that figure was under 10 %. On the other hand, in non-Mediterranean European countries there was a considerable decline in domestic food shortages; in Germany it declined from around 7 % to under 5 % and in the UK from 10 % to around 8 %.

The concept of food security has been used extensively at the household level as a measure of welfare and attempts have been made to make the concept operationally useful in the design, implementation, and evaluation of programs, projects, and policies (Pinstrup-Andersen 2009). Past studies have centered on developing nations (e.g., Atkinson 1995; Floro and Swain 2013; Maxwell 1995; Zezza and Tasciotti 2010); however, for developed countries it is much less researched (e.g., Coleman-Jensen, Gregory and Singh 2014; Pfeiffer et al. 2015), especially from an economic perspective. Hampson and McGoldrick (2013) point out that empirical research on consumer behavior (at individual or household level) during the economic crisis remains limited.

To fill this gap, the aim of this chapter is to discuss the empirical findings of a study on the impact of the ongoing economic crisis in Greece on households' perception of food security, and the actions undertaken by households in order to be food-secure. More specifically, the research objectives are threefold and aim to identify the following:

1. The impact of the ongoing economic crisis on households
2. The actions taken by households to protect their members so as to be food-secure
3. Household segments based on their food security actions

This chapter is further organized as follows. The next section presents the theoretical background to the concept of food security followed by a brief discussion of the economic crisis in Greece. Subsequently, the methodology and a discussion of the study's findings are presented. Finally, the last section presents the main conclusions, the limitations of the study, and policy implications.

Food Security: The Concept

The concept of food security originated in the early 1970s as the outcome of the global food crisis (extreme instability of agricultural commodity prices), as a result of the unfavorable global economic situation (Berry et al. 2015; Clay 2002). Food security historically referred to the overall regional, national, or even global food supply and its shortfalls when compared to dietary requirements. Recently it has been applied at a local, household, or individual level despite the overall adequacy of supply (Maxwell, D 1996a; Pinstrup-Andersen 2009). The concept of food security has evolved and changed during the decades and it has been gradually enlarged (Berry et al. 2015; Solaroli 2014). Initially, it mainly focused on the availability of food and on food production; then it was expanded to explicitly include the accessibility of food (physical, economic, and sociocultural), its utilization, and lastly to encompass the stability of these dimensions (Berry et al. 2015).

Due to its fundamental importance and its multidisciplinary and multisectoral nature, food security as a concept has various definitions and operationalizations. Many academic disciplines use the concept, such as agriculture, anthropology, economics, nutrition, public policy, and sociology, as do numerous national and international governmental and nongovernmental agencies (Jones et al. 2013). Thus, Maxwell, D (1996b, 5) refers to food security as a "cornucopia of ideas". The most widely accepted and used definition is the one offered by the World Food Summit in 1996: "*Food security exists when all people, at all times, have physical and economic access to sufficient, safe and nutritious food that meets their dietary needs and food preferences for an active and healthy life*" (FAO-World Food Summit 1996). This definition highlights the four following pillars (CFS 2012; Solaroli 2014):

- *Food availability:* The availability of adequate quantities of food supplied via domestic production or imports (inclusive food aid).
- *Food access:* The market accessibility and affordability of food.
- *Utilization:* Utilization of food through adequate diet, clean water, sanitation, and health care.
- *Stability:* To be food-secure, individuals must have access to adequate food at all times. They should not risk losing access to food as a consequence of sudden shocks (e.g., an economic or climatic crisis) or cyclical events (Solaroli 2014).

In order for food security to occur, people must have access to suitable food at any time. Extreme situations such as economic crises, climate change, or cyclical events should not affect the accessibility of adequate food (Solaroli 2014).

Literature shows that many authors have tried to contribute to the measurement of food security (i.e., Clay 2002; Headey and Ecker 2013; Keenan et al. 2001; Maxwell et al. 1999; Santeramo 2015; Sen 1981); however, its multidimensional nature and complexity make it difficult to measure and assess.

Economic Crisis and Households: Greece in the Context of the Economic Crisis

The recent economic crisis, which began in 2008 in the USA and spread worldwide, affected the developed countries much more. It weakened their economies and the households' finances and expenditures (e.g., USA, Spain, Greece), since gross domestic product per capita dropped and in many cases there was simultaneously a dramatic rise in unemployment. Furthermore, signs of growth have been projected to be modest (IMF 2016). Recent studies focusing on the USA (i.e., Hurd and Rohwedder 2010), Italy (Zanin 2015), and Spain (Villar 2015) point out that increasing numbers of households, in comparison with the pre-crisis period, have reduced their expenditures since they have been affected by unemployment, negative home equity, and arrears on their financial commitments (e.g., utility bills, mortgage payments).

Since November 2009, Greece has entered a long period of severe economic crisis, which is the most serious one in its modern history. In an effort to bring public finances back under control the Greek governments have announced rounds of austerity measures and structural reforms as requirements for the three bailout agreements (Memoranda of understanding) with its international creditors, the so-called Troika of the European Union–International Monetary Fund–European Central Bank (Kosmidou, Kousenidis, and Negakis 2015; Priporas et al. 2015). The impact of the financial crisis had obvious negative effects on the Greek economy and consequently the society and its citizens, in particular on the most vulnerable population groups (Arghyrou and Tsoukalas 2011; Christopoulou and Monastiriotis 2016; Markovits, Boer, and van Dick 2014; Priporas et al. 2015; Kentikelenis et al. 2011; Kaplanoglou and Rapanos 2015); Alderman 2013; Makris and Bekridakis 2013; Yannakoulia et al. 2016).

Methodology

In order to investigate the impact of the economic crisis on food security in Greek households, research was undertaken on two axes. The first axis consisted of qualitative research using in-depth interviews. This was carried out with the participation of the heads of 44 households (those in charge of food decisions, in both regions): 27 were conducted in the region of Central Macedonia and 17 in the region of Eastern Macedonia and Thrace. The sample was selected using the convenience sampling method, since random sampling is not a prerequisite in qualitative research (Nickel et al. 1995). However, care was taken to gather qualitative data from different cities and villages in each region, representing rural and urban areas, as well as the different socio-economic and demographic characteristics of participants. In all interviews the same simple questionnaire schedule was used, where discussions were recorded, transcribed, and cross-sectional content analyzed. The words and phrases derived were used to develop the quantitative questionnaire.

Quantitative research was carried out during a six-month period, from the middle of January 2015 to the middle of July 2015, mainly with aided self-administered questionnaires and, in some situations, with personal interviews. Data were collected from the two regions where qualitative research took place: the region of Central Macedonia with a population of

1,880,058 residents (7 prefectures) and the region of Eastern Macedonia and Thrace with 608,182 residents (5 prefectures), according to the census of 2011 (ypes.gr). The multistage stratified sampling method was used for data collection (Kamenidou 1999). Regarding the strata used, the first stratum was the region, the second was each prefecture, and the third consisted of the large cities and large towns (urban–rural areas).

From the last stratum, data were drawn via the random sampling method, and the maps of the cities and towns (where applicable) with their building blocks were used as a sampling frame. Additionally, the head of the family, the person who was in charge of food decisions, was used as the sampling unit (Kamenidou 1999). Due to economic and time constraints, in some rural and semi-urban areas convenience sampling was also applied in this third stratum in the sampling procedure. A total of 1528 questionnaires were collected using this method, from which 1305 were valid, with a valid response rate of 85.4 %.

Results

From the total sample (N = 1305), 46.2 % were from Central Macedonia and 53.8 % from Eastern Macedonia and Thrace. Moreover, 33.4 % were from rural areas and 66.6 % from urban areas. As to the gender, the majority of the sample were female (64.3 %), and the participants' mean age was 42.2 years (Std. = 12.0). The majority were also married (67.4 %), 43.0 % had completed secondary education, and 24.2 % were private sector workers or professionals/businessmen (21.2 %). Lastly, regarding their monthly net family income, the majority (55.7 %) had an income ranging from 600.01 to 1500.00 €.

Impact of the Economic Crisis on the Households

Households were asked to rate the degree to which the economic crisis had had an impact on them (e.g., economic, psychological, or other). A 5-point Likert-type scale was employed, where 5 = very large; 4 = large; 3 = neither large nor small (moderate); 3 = small, and 1 = very small (impact). Of the households participating in the survey, 81.4 % answered that the economic crisis has had a very large or large impact on them; 9.3

% a small or very small impact; and 9.3 % a moderate impact (economically or otherwise). Regarding food security and the ongoing economic crisis in the country, rated on a 5-point Likert scale (5 = strongly agree down to 1 = strongly disagree), 65.6 % agree or strongly agree, 21.4 % neither agree nor disagree, and 13.0 % disagree or strongly disagree that the economic crisis has had an impact on food access. Moreover, 42.9 % believe (agree or strongly agree) that in the future some people will struggle to afford food, 26.6 % are indifferent (neither agree nor disagree), and 30.5 % disagree or strongly disagree with this statement.

Actions for Food Security Undertaken by Households

In order to protect themselves from food insecurity, 696 households (53.3 %) produce food for their consumption, either as agricultural products or by processing agricultural products and producing food products. Also, 75.3 % (977 households) store food; 23.6 % (308 households) salt, cure, or pickle food; and 76.7 % (997 households) freeze food for their needs. Moreover, 22.6 % (295 households) store or freeze foods to serve others and 26.2 % (340 households) have other households (friends or relatives) store or freeze food for them. In this manner, over 90 % of the households in one way or another are engaged in actions to protect themselves from food insecurity. Thirty products that were mentioned constantly in the qualitative research were subsequently assessed in the field research.

The top five products produced are vegetables (79.4 %), sauces (72.6 %), jam preserves (55.6 %), pickled products (52.2 %), and pasta products (42.2 %). Concerning storing, freezing, salting, curing, or pickling foods, the top five products are sauces (79.7 %), flour (77.8 %), olive oil and olives (73.2 %), pasta products (68.7 %), and vegetables (67.7 %).

Underlying Motives for Food Security Actions Undertaken by Households

Additionally, households were asked to state their underlying motives for taking action on food security. They were asked to rate how much they agree (on a 5-point Likert scale) with 12 statements, derived from qualitative research, about potential motives for taking food security actions.

With no statement having a mean score (MS) > 4.00, the underlying reasons why households produced, stored, froze, salted, cured, or pickled food are mainly to develop the self-sufficiency of the household, to avoid dependence on products which are out of season, and to control the quality of the food (Table 14.1).

Table 14.1 Underlying motives for food security actions taken by households (%)

Statements	1	2	3	4	5	MS	StD
Self-sufficiency of household from external forces or 3rd parties and simultaneously save money	40.5	40.9	14.1	42.0	34.6	4.0	1.0
To cover household needs on out-of-season products which I will have stored/ frozen/ processed, and in this way I will not have to buy imported products or out-of-season ones	50.4	50.4	70.7	42.4	39.2	4.0	1.1
Control the quality of food that my family has access to	50.4	50.7	20.9	38.9	29.1	3.8	1.1
Prevention in case of war or other extreme situations	80.9	14.7	22.1	25.5	28.7	3.6	1.3
In case of the event of state bankruptcy	11.0	15.6	24.5	22.5	26.4	3.4	1.3
Prevention in case I cannot produce the raw material needed for the household in order to process food	11.1	21.1	26.2	20.0	21.6	3.2	1.3
In case of future exchange economy	90.3	17.4	26.9	22.3	24.1	3.3	1.3
In case someone in the family gets fired or is unemployed	15.6	16.5	18.8	27.8	21.3	3.2	1.4
To have to eat in the future if something goes amiss (e.g., hunger)	13.7	14.2	22.0	31.7	18.4	3.3	1.3
Prevention in the absence of food suppliers/imports of agricultural products/ raw material for food processing	11.0	23.0	27.2	21.8	17.0	3.1	1.2
Protect household from continuous price increase of agricultural products, food, or beverages	47.7	29.9	13.1	60.2	30.1	2.6	1.1
In order to sell the food if and when needed	37.3	30.5	18.8	90.6	30.9	2.1	1.1

Source: The Authors

Segmentation Analysis

Factor analysis via Principle Component Analysis (PCA) with varimax rotation (Hair et al. 2010) was implemented in order to decrease the number of items and make them manageable for further analysis. The important variables in factor formation that were considered were those with factor loadings > 0.50 (Sharma 1996), and in this way, no item was discharged. Factor analysis (Eigenvalues > 1.0) produced 3 factors (Table 14.2) accounting for 69.6 % of total variance (TV). The PCA revealed the Kaiser–Meyer–Olkin (KMO) measure of sampling adequacy

Table 14.2 Factors derived based on deeper motives for food security actions

Factor–Item	Factor loading
1st:*" **Food security for economic-derived negative situations** ";* 36.8 % of the total variance (T.V.); a = 0.908; Mean Factor Score (MFS) = 3.2 (Std. = 1.0)	
In case of the event of state bankruptcy	0.806
Prevention in case of war or other extreme situations	0.783
To have to eat in the future if something goes amiss (e.g., hunger)	0.779
Prevention in case I cannot produce the raw material needed for the household in order to process food	0.757
In case of future exchange economy	0.742
Prevention in the absence of food suppliers/imports of agricultural products/ raw material for food processing	0.741
In case someone in the family gets fired or is unemployed	0.740
2nd: *"Out-of-season food access, food safety";* 17.2 % of T.V.; *a* = 0.737; MFS = 3.9 (Std. = 0.9)	
To cover household needs on out-of-season products, which I will have stored/frozen/processed, and in this way I won't have to buy imported products or out-of-season ones	0.829
Control the quality of food that my family has access to	0.795
Self- sufficiency of household from external forces or third parties, and simultaneously save money	0.739
3rd: *"Protection from price increase and economic gain":* 15.6 % of T.V.; *a* = 0.822; MFS = 2.0 (Std. = 1.0)	
Protect household from continuous price increase of agricultural products, food or beverages	0.886
In order to sell the food if and when needed	0.841

Source: The Authors

has a value of 0.879 > 0.7 and thus is suitable for the implementation of factor analysis (Kinnear and Gray 1995). Moreover, the Bartlett's Test of Sphericity (BTS) also showed that factor analysis was suitable (Chi-Square = 7026.891; df = 66, and p = 0.000).

The above three factors indicating the deeper motives that dictate the way households engage in food security actions were used to segment the households.

First, a hierarchical cluster analysis was performed in order to explore the initial number of clusters that will arise, and subsequently a K-means cluster analysis was performed (Hair et al. 2010). The analysis resulted in a three-cluster solution. Multivariate statistics indicated statistically significant differences between the three clusters, where all factors contributed to differentiate the three segments. Each segment's Final Cluster Center (FCC), sample size, and the results of the analysis of variance (ANOVA) test are presented in Table 14.3.

Subsequently, chi-square tests with cross tabulation were performed in order to observe whether there were any statistically significant differences between the socioeconomic and demographic characteristics of the households and the three derived clusters. Analysis showed that six out of nine chi-square tests were statistically significantly different, while "gender of participants" (x^2_2 = 2.563; p = 0.279), "region" (x^2_2 = 3.191; p = 0.203), and "ownership of house" (x^2_4 = 1.505; p = 0.828) did not produce

Table 14.3 Segmentation based on underlined motives regarding actions of food security

Factors of underlined motives for food protection actions engaged by households	1st cluster, n = 309	2nd cluster, n = 292	3rd cluster, n = 519	ANOVA Statistics (p)
F1: Food security for economic-derived negative situations	4.41	2.17	2.99	780.683 (0.000)
F2: Out-of-season food access, food safety, and self-sufficiency	3.16	3.69	4.25	448.273 (0.000)
F3: Protection from price increase and economic gain	1.30	3.98	1.64	1152.425 (0.000)

Source: The Authors

significant differences. On the other hand, "age" (x^2_{10} = 21.618; p = 0.016), "marital status" (x^2_6 = 13.161; p = 0.041), "area (rural or urban) of residence" (x^2_2 = 15.193; p = 0.001), "income" (x^2_{10} = 64.097; p = 0.000), "education" (x^2_6 = 31.088; p = 0.000), and "profession" (x^2_{14} = 38.839; p = 0.001) did produce statistically significant differences, indicating that there is a relationship between these socioeconomic and demographic variables and the three clusters' behavior.

Cluster I: "Survivors", representing 27.6 % of the total sample, have the highest FCC for the 1st factor, i.e., "Food security for economic-derived negative situations" (FCC = 4.41), which is the main motive for taking food security actions. Thus, this cluster prepares its household, and wants to be ready, in the event that the country or one of the family members is found in extreme situations. Hence, the households want to be prepared for situations such as bankruptcy or war, where a barter economy might arise, or where there might be lack of agricultural produce or food. Lastly, they also produce, store, freeze, salt, cure, or pickle agricultural products or food, in case someone in the household loses their job and there is not enough family income to purchase food, hence causing food insecurity to the household. This segment is the segment that tries to prevent situations rather than "cure" them. They are indifferent to achieving out-of-season food access, food safety, and/or out-of-season self-sufficiency of the household (FCC = 3.16), while they do not engage in food security actions because they want to protect the family from continuous increases in agricultural or food product prices and/or in order to sell the food, if needed in the future (FCC = 1.30). This cluster, relative to the other two segments, is the most educated one; it represents the highest percentage of households living in urban areas; single or widowed subjects, public employees, and those with a net household income ranging from 2000 to 2500 €/month. This cluster is the most pessimistic of the sample; members of the cluster do not seem to "see light at the end of the tunnel". This segment, probably because it is the most highly educated, believe that after a great economic depression a war can be triggered. This segment is possibly being continuously updated about the economic situation in the country, as well as the difficult conditions in the Mediterranean Sea and the instability in the area. This group is taking precautionary measures to prepare for extreme situations and does not seem to trust the government and/or those jour-

nalists who argue that Greece will come out of the crisis. This segment is getting ready for the worst and prepares itself with food survival strategies.

Cluster II: "Economic focused households" representing 26.0 % of the total sample have the highest FCC for the 3rd factor "Protection from price increase and economic gain" (FCC = 3.98). These are the economically motivated households, trying to save money, or earn money in the future, if possible. Their main motive is to protect the household from the continuous food price increases. This segment consists of urban residents who have a secondary level education and are married; they fall into two age categories: 36–45 (30.8 %) and 46–55 (29.6 %), and are freelancers/businessman and have a net household monthly income up to 1000.00 € (68.0 %). Compared to the other segments, this one has the highest percentage of men and the lowest percentage of homeowners. This segment is the economically insecure segment. This is quite understandable since according to V. Korkidis, the president of the Hellenic Confederation of Trade and Entrepreneurship (HCCE), from the year that the crisis began until 2015, more than 250,000 businesses closed down or filed for bankruptcy (Huffington Post 2015). This segment has a relatively high FCC (FCC = 3.69) for the 2nd factor "Out-of-season food access, food safety and self-sufficiency", which is probably due to the item "Self-sufficiency of household from external forces or third parties and simultaneously save money". This item is one of the variables consisting of the factor, and has to do indirectly with economic decisions. This group of households is the one that, when compared to the other two, has the lowest FCC for the 1st factor (FCC = 2.17). This segment either does not believe that the country will get into unpleasant or extreme situations and, thus, does not feel the need to protect the household from these, or does not care if things go worse, since "the wet person does not fear the rain", as a Greek saying states.

Cluster III: "Food safety orientated households" is the largest of the three segments. It consists of 46.3 % of the households and has the highest FCC toward the 2nd factor "Out-of-season food access, food safety, and self-sufficiency" (FCC = 4.25), which is the main motive for producing, storing, freezing, salting, curing, or pickling food. Moreover, this segment is indifferent toward the 1st factor "Food security for economic-derived negative situations" (FCC = 2.99), and does not engage in food security actions in order to protect the household from price increases or in order to have direct economic gain (FCC = 1.64). This segment, when compared to

the other two, has the following participant characteristics: the segment consists of married or divorced women with children, participants are aged mainly 26–35 (28.1 %) and 36–45 (30.3 %) with an income ranging between 600.01 and 1500.00 €, they have a secondary level education, and are private employees and residents of rural areas. This group, comprising young mothers, is focused on the nutritional aspect of food, and engages in producing, storing, freezing, salting, curing, or pickling food mainly for food safety issues in terms of seasonality and quality control. This could be due to their belief that out-of-season agricultural produce is of lower quality than in-season produce, or that, in order for retailers to suppress prices and be competitive, the marketplace offers lower-quality agricultural and food products. Thus, this segment does not trust the quality of marketed products and/or the governments' quality control actions. Therefore, it considers that consumers/households should engage in actions to protect themselves for food safety reasons, one of the main pillars of food security.

Conclusions and Implications

It is indisputable, from the research findings, that the economic crisis in some way or another has affected the vast majority of the households studied (more than 80 %) as regards food security issues. Almost all households engage in precautionary measures for food security. These include the production or the processing of agricultural products, storing, freezing, and salting, curing, or pickling food. Regarding agricultural production, it mainly focuses on vegetable produce, while for food processing, homemade cooking sauces and jam preserves are the priority. Food storage has to do mainly with flour, sauces, and olive oil.

Twelve motives for food security actions undertaken by households were rated and factor analyzed in order to produce a smaller more manageable dataset, which would subsequently be used for segmentation analysis. The underlying motives for food security actions are a concern for food safety and self-sufficiency, a need to manage extreme out-of-control situations, and a need to save money. Factor analysis produced three factors, namely "Food security for economic-derived negative situations", "Out-of-season food access, food safety", and "Protection from price increase and economic gain".

Furthermore, segmentation of households based on food security actions produced three segments, namely "Survivors", "Economic-focused households", and "Food safety–orientated households", each with different characteristics and behaviors toward food access. This segmentation of households revealed very interesting outcomes. The results indicate that households are trying to find ways to be self-sufficient and independent from third parties by engaging in the production, storage, freezing, salting, curing, or pickling of food. They are also trying to get control of the quality and ingredients of the food they eat, since food safety problems constantly arise worldwide. Additionally, trust issues associated with food quality control and food safety also arose. Results imply that households seem to consider that the control mechanisms of the state which are related to the safety and hygiene of food are inefficient. Households seem to believe that the state does not apply the necessary investigations and checks; nor does it give the required penalties to whom, and when, and where necessary—measures that deliver confidence about food consumption.

Furthermore, there are six items (out of seven) that constitute the factor "Food security for economic-derived negative situations" signifying the first segment, the "Survivors", and which refer to extreme, out-of-control situations, such as probability of war. Participants' concern about food security, extreme situations, and job losses reveals that not only do households not trust that the government will end the crisis, but they also fear that the worst is yet to come.

Since it is quite difficult for the government to restore trust, it is more realistic that solutions be provided by citizens themselves. The households, as consumer entities, should unite and create consumer cooperatives that will act as strong negotiating powers in trading food products, thus monitoring quality and assuring food safety.

An example of such an initiative is the rise of the Potato Movement. Solera (2015, pp. 47–48) mentions that the Potato Movement was an idea of Professor Christos Kamenidis: "*[I]t started with a self-managed public market of potatoes produced in the provinces of Serres and Drama, it became an alternative channel to bypass the speculation on vegetable prices imposed by wholesalers supplying big supermarkets and commercial centres. The campaign, launched in January 2012, was an amazing success, and inspired similar networks all over Greece.*"

Additionally, legislation which enables the farmer markets to function is also very important for consumer food security. Professor Emeritus of Agricultural Marketing, C. Kamenidis, who started the movement regarding the direct sales of agricultural products directly from the farmer to the consumer, or the "potato movement", pointed out that "*[t]he direct sales of agricultural products or food products (i.e., fruits, vegetables, olive oil) directly from the farmer/producer to the consumer can increase the availability of quality food and can promote food security with lower food prices for consumers. So, farmer markets must be organized, and begin to operate in Greece, as they do in the United States, Canada, and Europe*" (Kamenidis 2016).

This research, although subject to limitations, offers a preliminary analysis of the reality of food security actions that have been performed by households in Greece in order to have access to food during the consecutive years of the economic crisis. First of all, this research was self-funded, and as such, due to major economic constraints, it was difficult to access rural areas which, under different circumstances, the researchers would have gathered data from. For the same reasons, the research was limited to 2 out of 13 regions of Greece: Central Macedonia (7 prefectures) and Eastern Macedonia and Thrace (5 prefectures), which were easier to access. Another limitation of the study, also deriving from the economic constraints, is the sampling methodology. At the third stratum, specifically in rural and semi-urban areas, convenience sampling was used in some cases. While the questionnaire was self-reported, there were participants who were illiterate or whose reading skills were very low. In this case, the researchers had to employ a personal interview, thus causing delays in the rural areas visited. There might also be other products that households produce, store, freeze, salt, cure, or pickle that were not included in the research. These were the ones continuously mentioned during the qualitative research procedure. Likewise, other underlying motives for households' food security actions might exist and are not subject to this research. These too were the ones constantly indicated during qualitative research. Similarly, one must take into account that this research was concluded in May 2015, and since then, many changes have emerged in the economic life of the Greek population, such as political changes, continuing instability in the Mediterranean region, and the refugee crisis. Because of this, new research would help validate the findings

of the present research or improve the questionnaires used. Even though this research has several limitations, it is without doubt very important since it records the food security situation, access, and actions undertaken by households in Greece, a country undergoing an economic and financial crisis for six consecutive years.

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