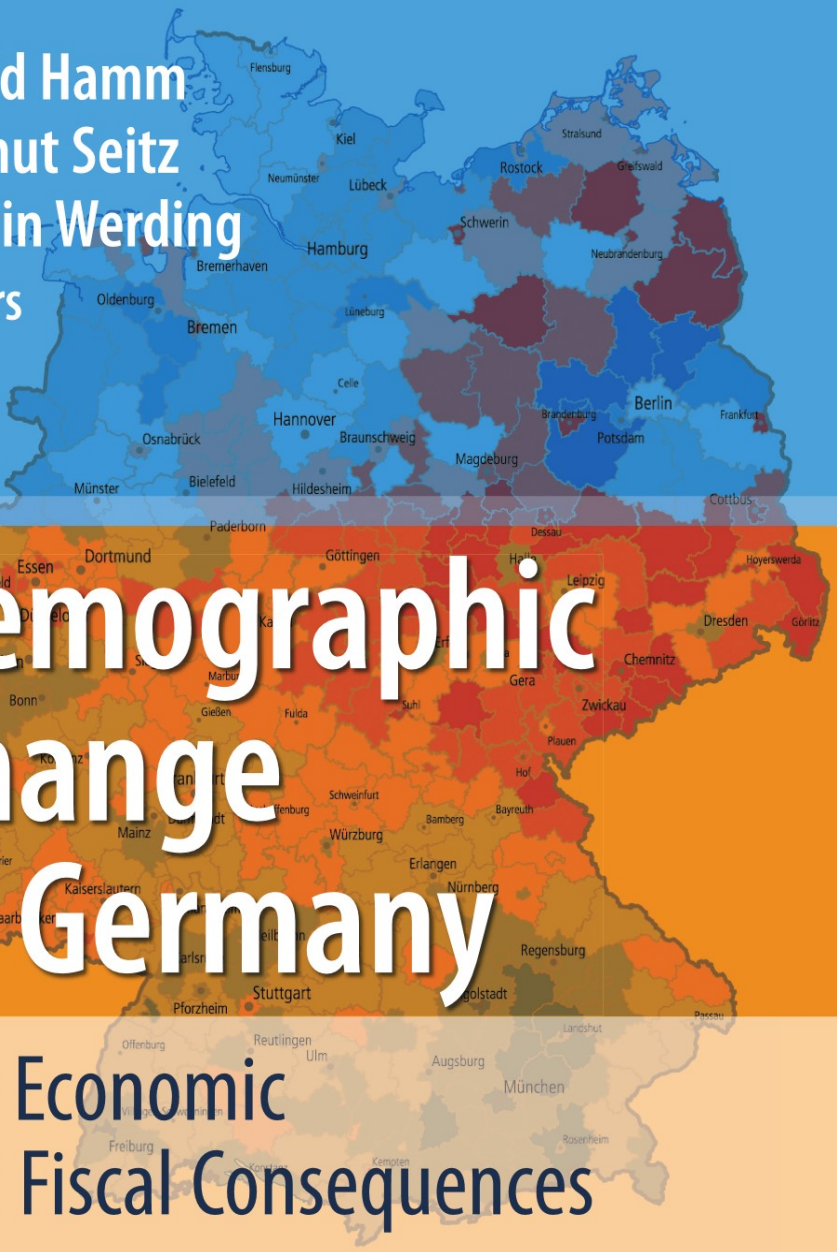
Ingrid Hamm
Helmut Seitz
Martin Werding
Editors



Demographic Change in Germany

The Economic and Fiscal Consequences

Springer

Demographic Change in Germany

Ingrid Hamm · Helmut Seitz
Martin Werding
(Editors)

Demographic Change in Germany

The Economic and Fiscal Consequences

Springer

Dr. Ingrid Hamm
Robert Bosch Stiftung
Heidehofstraße 31
70184 Stuttgart
Germany
sven.mueller@bosch-stiftung.de

Professor Dr. Helmut Seitz
TU Dresden
Lehrstuhl für Empirische
Finanzwissenschaft
und Finanzpolitik
Helmholtzstraße 10
01062 Dresden
Germany
helmut.seitz@tu-dresden.de

Dr. Martin Werding
ifo Institut für
Wirtschaftsforschung
Poschingerstraße 5
81679 München
Germany
werding@ifo.de

Library of Congress Control Number: 2007935108

ISBN 978-3-540-68135-9 Springer Berlin Heidelberg New York

Production: LE-TEX Jelonek, Schmidt & Vöckler GbR, Leipzig
Cover-design: WMX Design GmbH, Heidelberg

SPIN 11947936 88/3180YL - 5 4 3 2 1 0 Printed on acid-free paper

Preface

Just as one might be inclined to think that everything about demographic change has been already said and heard, a new dimension opens up. In fact, this is what makes the topic so fascinating. There is nothing trivial any longer about children, families, age, and care.

Europe is undergoing profound demographic change. Each generation of children is quantitatively smaller than that of their parents; the proportion of children and adolescents among the population is becoming smaller and smaller, while that of the elderly is growing inexorably. Fewer and fewer people are marrying; more and more marriages are failing. Many areas of our society are affected by this; just think about the challenges faced by the social security systems as a result of demographic ageing. Politicians and society are forced to adjust to demographic change. Many people in Europe are concerned about these changes and are looking to politicians and researchers for solutions.

Predictions are never easy, especially not about the future. Demographic indicators are among the safest guidelines into the unknown. Children unborn today will certainly not contribute to social systems during the next years and will not pay back debt accumulated by previous generations. Not many politicians dare to negate the fact that this is about the future of our society. The media have contributed heavily to a general feeling that something has to be done. However, what exactly should be done is widely disputed.

Should we sit and wait, while we sip drinks and listen to music in the vain hope that time will tell? Should we be even happy that nature makes a mighty comeback to some eastern parts of Germany, with a wolf or two in between? What seems to be so bad about living in a land less crowded and less polluted? Or is the entire demography discussion a clever plot by the ruling classes to hide their ambition to increase their share of the pie and cut back on social expenditures, as some allege?

Good scientific analysis is crucial in order to dispel illusions or misrepresentations and refute outright wrong conclusions. This book is a milestone in getting things right. German scientists have contributed excellent pieces of insight. Readers – specialists and the general public alike – will benefit from sound research and results grounded in real data.

The results of expert studies, supported by the Robert Bosch Stiftung, such as the Population Policy Acceptance Study or the Gender and Generations Survey, reflect fundamental transformations. On the one side, we have globalization and the need to become flexible, and on the other side citizens who wish to remain anchored in their local environment and traditional values.

As a consequence of demographic change, Europe is ageing rapidly, both in absolute terms and in relation to a dramatically falling fertility. Although longer life expectancy is a gain for the individual, it leads at societal level to major problems which cannot be solved within the established structures.

If "fear of the future" is specified as a reason for a life without children, this means that the foundation for fresh optimism must be created if fertility should not fall further. This is all the more important given that choosing to have children is a long-term, irrevocable decision based on confidence in future life course.

At the same time, the findings show that there is a need for greater efforts to convince young people to start a family earlier. Surveys also show a general desire for greater flexibility in individual life planning and for more efficient use of financial resources.

There is a divergence of answers in Europe to the question of what governments need to address. It is primarily the State which is considered to be responsible for providing health and work for young people. Not many are aware of the fact that the state profits more from children than vice versa.

Under the current German tax-transfer system, a child born today that turns out to be an average individual in each relevant respect creates a benefit – or positive fiscal externality – over the entire life-span of nearly 77.000 Euro, as a study conducted by Ifo Institute in Munich has shown. It means that whereas costs for children are borne by their parents, benefits are bagged – or socialized if you will – by the state.

The current German fiscal system induces a continuous intergenerational redistribution from young and future age cohorts to older cohorts. Within a given generation, this also implies a redistribution between families with an average or higher number of children to those who have fewer children or no children at all. This can not stand. It is not only unjust, it is myopic in the true sense of the word.

It is also proof that absolute reliance on the State would be misleading and has to decrease. A new discussion about what small entities can accomplish in reaction to demographic challenges is urgently needed. I do not argue for the state being left out, indeed it has tasks to accomplish that

nobody else can do, only to expect everything emanating from it would be fooling oneself.

Although the ageing processes which are underway are considered to be a negative trend, the contribution made to society by the elderly is positively perceived. This approval must however lead to greater willingness to care for the elderly in the sense of generational solidarity. Although there is a general willingness on the part of Germans to work longer in future, assurances that there is an individual willingness to act accordingly can not be given.

It is still not generally accepted that we should be making better use of the capacities of women and men in family and job. Ideological blinders are inhibiting some political parties from seeing the obvious. Traditions are hard to change in some cases, least of all when they seem to be God-given. Germany offers many different ways of life. The eastern territory of the former German Democratic Republic is much more mirroring the Scandinavian way-of-life in its flexibility and emancipation of women, while western and southern Germany is still changing.

Some parts of Germany offer a rare chance to see today developments that will encompass other parts of Europe tomorrow. The economy is more and more based on knowledge and innovation. Therefore qualified, mobile workers with higher education are needed. Skilled workers use the free European labor market to look for better positions. The general numbers of these people is declining.

This will result in a fierce competition among the European regions for the best workers. While economically strong regions will attract the qualified, peripheral, economically weak regions will be losing out. In addition to the movement of the young and qualified workers, well off old people prefer to settle in the same regions that are attractive to the skilled professionals.

Especially poor, less educated and less mobile people are left behind in rural peripheral areas. The competition among the regions creates losers and winners. Regarding the low fertility rate, the loss of human capital in certain regional will be irreversible, because the losses cannot be compensated by a high number of newborns.

In the future, business might avoid these areas. Even if a low wage level is seen as an advantage, companies need motivated and qualified workers, which are increasingly hard to find. Economically weak regions may lose contact to centers of growth forever.

Many regions suffer from a high unemployment rate. Labor intensive production is more and more transferred to low income countries. For these states this is a chance to participate in the economic development of Europe. For the “old” member states, such as Germany, this development

is a burden to the social security systems, especially because it puts many low qualified immigrants out of work. In Germany the unemployment rate of people with a migration background is twice as high as among the long-rooted German population.

Due to the fact that first-generation migrants have a higher fertility than the locals, the number of people with immigration background would rise even without further immigration. As long as these people are disadvantaged on the labor market and in the education system, a clash of cultures is in the range of the possible.

The percentage of foreign migrants differs highly in European regions. In central Portugal or in north-eastern Italy only one percent of the population has a foreign citizenship. In the German state of Hesse 12 percent and in the French region of Île de France 13 percent of the entire population have foreign passports. The integration and education of these immigrants and their children is one of the biggest challenges for the community.

The Robert Bosch Foundation has brought forward projects in all fields mentioned above – education, family and demographic change, age and care, migration and integration. Fostering awareness, research into new ventures, bringing people together, create fresh thinking and ultimately lead to new ways of action will guide us in the years ahead. Demography will be an overarching theme, connecting and uniting seemingly unrelated topics. Seeing the past and the present can help one envision alternative futures. It is our responsibility to influence developments.

I would like to thank all who have participated in the book for their valuable work.

Ingrid Hamm, Robert Bosch Foundation

Contents

Contributing Authors XIII

Consequences of Demographic Change in Germany: An Introduction 1
Helmut Seitz, Martin Werding
1 Motivation for this Book 1
2 The Contributions: An Overview 3

Demographic Change in Germany 9
Charlotte Höhn, Ralf Mai, Frank Micheel
1 Adressing the Issue 9
2 The Demographic Development in Germany 10
2.1 Trends in Fertility 11
2.2 Trends in Mortality 13
2.3 Migration Dynamics 14
2.4 Demographic Balance 15
3 Future Trends Until 2050 17
3.1 Assumptions of the 11th Co-ordinated Population Prospects 17
3.2 Population Decline 18
3.3 Population Aging 18
3.4 Can Population Aging Be Reversed by Demographic Instruments? 20
4 Regional Aspects of Population Dynamics 22
4.1 Fertility and Mortality 23
4.2 Internal Migration 25
4.3 Regional Patterns of Demographic Change 27
4.4 Outlook: Growing or Diminishing Regional Disparities 28
5 Implications for Society, Economy, and Policy Makers: Challenge or Catastrophe? 30
References 32

The Effects of Aging on Labor Markets and Economic Growth 35
Willi Leibfritz, Werner Roeger
1 Introduction 35
2 Main Determinants of Economic Growth 36
2.1 Some Methodological Observations 36
2.2 Past Growth Trends 38
3 Future Demographics and Growth 40
3.1 Impact Through Labor Supply 41
3.2 Impact Through Labor Productivity 43
4 Long-Term Growth Scenarios 50
4.1 Growth Scenarios by the OECD 51
4.2 Growth Scenarios by the EU Commission 55
5 Conclusions 61
References 63

The Impact of Global Aging on Capital Markets and Housing 65
Axel Börsch-Supan
1 Introduction 65
2 The Asset Meltdown Debate 66
3 Aging and the Markets for Productive Capital 69
3.1 A Model of Overlapping Generations: The MEA-OLGA Model 69
3.2 The Development of Household Savings 73
3.3 Trends in Returns on Capital 76
3.4 Diversification Effects of Global Capital Markets 78
4 Aging and Housing Markets 80
5 Summary and Outlook 85
References 87

Social Insurance: How to Pay for Pensions and Health Care? 89
Martin Werding
1 Introduction 89
2 Methodology 91
3 Assumptions and Intermediate Results 94
4 Projections for Individual Branches of Social Insurance 97
4.1 The Statutory Pension Scheme 97
4.2 Public Health Insurance 103
4.3 Public Long-Term Care Insurance 109
4.4 Unemployment Insurance 111
5 Sustainability of the Social Insurance System 112
5.1 Aging and General Government Fiscal Balances 113
5.2 Implicit Social Insurance Debt 116

5.3 The EPC's "Sustainability Gap" 120
6 Policy Options 122
References 125

The Impact of Demographic Change on Fiscal Policy in Germany 129
Helmut Seitz
1 Introduction 129
2 Institutional Framework 130
3 Methodology 137
4 Data and Empirical Results 145
4.1 Estimating Age-Cost Profiles 145
4.2 The Impact of Demographic Change on Public Expenditures, 2004–2030 150
4.3 Building a More Complete Model 152
4.4 Simulation Results 157
5 Summary and Conclusions 161
References 162

Education and Fertility in Germany 165
Michaela Kreyenfeld, Dirk Konietzka
1 Introduction 165
2 Education and Fertility 166
2.1 Theoretical Considerations 166
2.2 Germany's Socio-Political Context 169
3 Data 171
4 Descriptive Results 172
5 Analysis of the Event-History Model 176
5.1 Transition to First Births 176
5.2 Transitions to the Second and Third Child 178
6 Conclusions 180
References 183

Perspectives on the Political Governance of Demographic Change 189
Johannes Meier
1 Introduction 189
2 Demographic Challenges in Germany 190
2.1 Shrinkage 190
2.2 Aging 191
2.3 Heterogeneity 192
3 Challenges for Governance of Demographic Change 195

4 Budget Consolidation as a Core Challenge 196
5 Key Factors of Success for Good Governance of Demographic Change 199
5.1 Experiences from Other Countries 199
5.2 Implications for Germany 200
6 Conclusion 201

Subject Index 205
Name Index 213

Contributing Authors

Börsch-Supan, Axel, Prof., Ph.D.
University of Mannheim
Mannheim Research Institute for the Economics of Aging (MEA)
L 13, 17, 68131 Mannheim
Germany

Hamm, Ingrid, Dr.
Robert Bosch Foundation
Heidehofstrasse 31, 70184 Stuttgart
Germany

Höhn, Charlotte, Prof. Dr.
Federal Institute for Population Research
Friedrich-Ebert-Allee 4, 65180 Wiesbaden
Germany

Konietzka, Dirk, Dr.
Max Planck Institute for Demographic Research
Konrad-Zuse-Strasse 1, 18057 Rostock
Germany

Kreyenfeld, Michaela, Dr.
Max Planck Institute for Demographic Research
Konrad-Zuse-Strasse 1, 18057 Rostock
Germany

Leibfritz, Willi, Dr.
Organization for Economic Co-operation and Development (OECD)
Economics Department (ECO, CS3)
2 rue André-Pascal, 75775 Paris CEDEX 16
France

Mai, Ralf, Dr.
Federal Institute for Population Research
Friedrich-Ebert-Allee 4, 65180 Wiesbaden
Germany

Meier, Johannes, Dr.
Bertelsmann Foundation
Carl-Bertelsmann-Strasse 256
33311 Gütersloh

Micheel, Frank
Federal Institute for Population Research
Friedrich-Ebert-Allee 4, 65180 Wiesbaden
Germany

Roeger, Werner, Dr.
European Commission
Economic and Financial Affairs (ECFIN.A1)
1049 Bruxelles
Belgium

Seitz, Helmut, Prof. Dr.
Dresden University of Technology
Institute for Applied Public Finances and Fiscal Policy
Helmholtzstrasse 10, 01062 Dresden
Germany

Werding, Martin, Dr.
Ifo Institute for Economic Research at the University of Munich
Department of Social Policy and Labour Markets
Poschingerstrasse 5, 81679 Munich
Germany

Consequences of Demographic Change in Germany: An Introduction

Helmut Seitz, Martin Werding

1 Motivation for this Book

Demographic change as it is nowadays observed in many developed countries is largely unprecedented. There are thus certain limitations to systematically analyzing its economic and fiscal consequences, which is the common task of the contributions collected in this volume, using Germany as an illustrative example. Hard, backward-looking empirical evidence on this issue is necessarily lacking. All that remains to be brought forth are theory-based predictions and projections. Yet, like the set of institutions that will be affected by demographic change, and will also shape how its impact is working its way through the economy and fiscal system of a given country, most of the theoretical models that can be applied in this area have been devised under the conditions of growing populations with a relatively stable age composition. Therefore, conventional economic wisdom may fail to fully capture the numerous channels through which the effects of demographic change will eventually spread out.

Important questions that are to be addressed in this book are therefore still unsettled, or cannot be answered in an unambiguous way. Yet, there is a growing body of established knowledge about the consequences of demographic change in many areas that are vital for economic development and public policy in all the countries affected. About two decades of research have resolved at least some of the ambiguities involved and have unearthed new, more specific questions that are a bit further down to road toward understanding the economic, political and social challenges ahead, now that the on-going changes in population size and structure will soon enter an acute phase. In any case, substantial insights can be provided to inform today's policy-makers what they could do, and what they should not do, in the light of current demographic prospects.

When compared to other countries, demographic change in Germany is particularly severe. By international standards, the German baby boom was rather late, peaking in the mid-1960s, and also weak. On the other hand, the subsequent decline in fertility was fast and very pronounced. For more than three decades now, the country has had one of the lowest fertility rates in the industrialized world. At the same time, life expectancy in Germany has increased, and continues to do so, quite as much as it does elsewhere. As a result, a massive change in the age structure of the German population is already under way that will become fully visible in the period between 2015 and 2035. Unlike many other countries, Germany is actually faced with the prospects of a declining population and, with even higher certainty, a shrinking labor force, processes that will start from now on and probably last until 2050 and even beyond.

For this reason, Germany offers an important case study that can be used to illustrate the consequences of demographic change in developed countries in general. As the country is currently one of the largest economies in the OECD world and the largest within the EU, its case may also be interesting in itself, not only from a German perspective but also for an international audience. Drawing on research done all over the world, the present volume is meant to provide an up-to-date reader on the present state of knowledge regarding how Germany with its particular institutional setting – labor market institutions and other regulation, fiscal federalism and large, unfunded social insurance schemes – will be affected by demographic change alongside its many dimensions.

The idea for preparing this book emerged when several of the authors got together on the occasion of a parliamentary hearing regarding the consequences of demographic change in their respective fields of expertise. Over recent years, we have observed that there is growing concern about this phenomenon in Germany, as it is elsewhere. Yet, reliable information regarding its precise nature and foreseeable effects is still limited in a greater public, even among political decision-makers at all levels of government and experts in the public administration or the business community. Also, researchers located in other countries could benefit from in-depth information regarding the consequences of demographic change in Germany, just as we do from their work done at a national level. A comprehensive overview, covering relevant observations and state-of-the-art conclusions on a carefully selected range of topical issues, could thus serve a purpose in filling these gaps, for people inside Germany as well as for outside observers.

We wish to thank the Robert Bosch Foundation for generously supporting the publication of this volume. We are also grateful to Martha Vrobel who acted as an English language editor for some of the contributions and

to Beatrice Scheubel who provided valuable help in finalizing the book manuscript and preparing the index sections.

2 The Contributions: An Overview

We have defined a structure and sequence of topics to be covered in this book with the intention to give a full account of what can be said, and what is worth being said, about the economic and fiscal consequences of demographic change in Germany. Also, we invited leading experts in any of the fields covered to contribute to this effort. As a result, the contributions collected in this book span a broad array of relevant topics, starting from a careful description of current demographic trends and prospects and then discussing their impact on labor markets and aggregate growth, capital markets and, specifically, housing markets, social insurance schemes providing for old age, health care, long-term care and unemployment, as well as public budgets at all levels of government. As the fertility decline is a relatively important driver of demographic change in Germany, and as the political governance of long-term fiscal consolidation appears to be one of the core challenges that arise, these two aspects are being dealt with in specific contributions which round off the contents of this books.

With their initial review of "Demographic Change in Germany", Charlotte Höhn, Ralf Mai and Frank Micheel of the Federal Institute for Population Research (*Bundesinstitut für Bevölkerungsforschung*) are setting the stage for all subsequent contributions. They describe in some detail how past and current trends in fertility, mortality and international migration combined to shaping the demographic development in Germany throughout the 20th century, especially since the post-war period, and how they affect the prospects for future demographic change until 2050. As they see it, the expected shrinkage and aging of the population living in Germany can hardly be influenced for a period as long as until about 2030. For the more remote future, a recovery of fertility rates would be more effective in reverting current demographic trends than a further increase in immigration that has already been substantial in the past. They also comment on regional aspects of population dynamics, since this turns out to be a relevant sub-issue – mainly, but not only, because of German reunification – concluding that regional disparities inside Germany are likely to grow over time, above all through internal migration.

Willy Leibfritz and Werner Roeger who are working with the OECD and the EU Commission, respectively, address the "Effects of Aging on Labor Markets and Economic Growth". They start with some clarifications

regarding how considerable changes in population size and structure in a given economy could affect labor-force participation, employment, productivity and, in turn, economic growth both on per-capita terms and at an aggregate level. They also review the recent growth performance of Germany relative to the US and other developed countries and go on to present current long-term growth scenarios for Germany that were prepared at either of their institutions. Although a number of important uncertainties arise, in particular regarding the impact of demographic change on aggregate saving, capital formation and innovation, their common conclusion is that, under its current institutional framework, GDP per capita in Germany is restricted to grow at an average rate of about 1 to 1.5 per cent a year over the next three to five decades in a meaningful "baseline" scenario, substantially less than can be expected for the US and other European countries, that is. They also look at the impact of potential policy changes, mainly targeted at higher labor-force participation and a reduction in pension benefits, and argue that some improvements in projected per-capita growth rates were feasible via these means, but that long-term growth prospects for Germany are unlikely to become fundamentally better.

An in-depth discussion of "The Impact of Global Aging on Capital Markets and Housing" is then provided by Axel Börsch-Supan, Director of the Mannheim Research Institute of the Economics of Aging (MEA). In particular, he takes up the fear of a large-scale "asset meltdown", i.e., a sharp drop in the value of financial assets and housing wealth in the course of the simultaneous, but not entirely parallel, aging processes expected in quite a number of developed countries. He uses a calibrated equilibrium model of the German economy and major economies in other regions of the world, all hit by demographic change in their domestic labor markets and production sectors as is currently projected. Allowing for international links through capital movements, he shows that the fear of an asset meltdown is often exaggerated. Specifically, he investigates the consequences of demographic change – taken in isolation or in conjunction with a pension reform that implies an increase in individual retirement savings – on private savings and on the rate of return to productive capital. In the scenarios considered, the rate of return never falls by more than 160 basis points, from 7.7 to about 6.1 percentage points, throughout the period until 2050. Most notably, international diversification through investment across the EU or the entire OECD world, can reduce this impact even more. Housing markets may be hit by a stronger asset meltdown. Yet, taking into account potential increases in demand per capita, the effects again need not be worrying. As an important aside, these results imply that building up higher capital reserves for what is now age-related public expenditure, e.g.

old-age pensions, may offer a viable strategy for coping with some of the fiscal consequences of demographic change.

From a different angle, this point is further investigated by Martin Werding of the Ifo Institute for Economic Research in his contribution on "Social Insurance: How to Pay for Pensions and Health Care?" Building on current policies that apply to all branches of the German social insurance system and taking into account the impact of demographic change on the number of contributors and on benefit take-up in these schemes, he provides long-term projections for the future financial viability of the single branches and the overall system of social insurance in its present form. As one might expect, the results point to strong increases in expenditure and contribution rates of the public pension scheme and the public health insurance system, with health care being likely to create an even larger fiscal risk in the long run. Cumulated social insurance contributions (employees' plus employers' share) could climb from a current 41.5% to no less than 59% of gross earnings until 2050. Using several concepts of measurement that have been devised for this purpose, he demonstrates the non-sustainability of this current-policy projection. Major options for reform are an extension of the statutory retirement age, combined with other measures geared at an increase in labor-force participation and employment, and a redefinition of the public–private mix not only in the context of old-age provision, but also in the areas of health care and long-term care.

Helmut Seitz of the University of Dresden then looks at "The Impact of Demographic Change on Fiscal Policy in Germany", paying particular attention to the consequences for public budgets at all levels of government – the federal level as well as the states and municipalities. He starts by presenting the most important features of the German system of fiscal federalism which determine potential channels for demographic change to affect the public budgets at different levels of government. As the main analytical tool, he integrates age-cost profiles for all major categories of public spending, differentiated by levels of government, into a simple model of sustainable public finances, implying that the age-cost profiles are made endogenous in the long run. He then presents empirical estimates of current age-cost profiles and goes on to estimate the impact of demographic change and a number of other factors upon primary expenditures at all three levels of government. The results suggest that demographics will affect public budgets significantly, albeit not dramatically. Neglecting economic growth, behavioral changes and the effects of policy changes already enacted, per-capita spending may increase by about 2% until 2030 across all levels of government as a "pure demographic effect". There should thus be some leeway to accommodate this, plus part of the enormous pressure arising in the German social insurance system, through ad-

justments in fiscal policy as a whole. However, it also turns out that the federal, state and local governments are affected quite differently. While the federal government has to carry a significant demographic burden, subnational governments may effectively experience reductions in expenditure. If the distribution of tax revenues across the three layers of government is not adjusted within the next decades, the federal government may therefore experience a relative loss in its room for maneuver.

In their contribution on "Education and Fertility in Germany", Michaela Kreyenfeld and Dirk Konietzka of the Max Planck Institute for Demographic Research provide an in-depth analysis of fertility behavior in Germany, paying particular attention to the role of women's education. Considering the strong reduction in fertility in Germany, both in terms of annual "total fertility rates" and in terms of longitudinal measures of "completed cohort fertility", understanding this phenomenon appears to be important in general. Furthermore, casual evidence suggests that fertility is particularly low among women with higher education. The authors investigate this point using a representative household data set, carefully distinguishing between first births, second births and third or higher-order births. In their empirical analysis, they control for a number of further determinants, such as the mothers' age at birth, her activity status, the education of her partner, if any, or the sex of previous children. They show that childlessness is indeed highest among women with a university degree, but that this is predominantly true for older age cohorts. At the same time, childlessness and a more limited number of higher-order births have become a lot more wide-spread over time among women with lower levels of education. When interpreting their findings, the authors argue that changes in attitudes and aspirations of females, most notably their stronger labor-market orientation, have played a major role in the fertility decline observed all over the developed world, but that the way in which a given country's institutions are framing these changes do also matter. There are thus good reasons why German policy-makers, with their current, renewed interest in family policies, should think about the family model they want to support through new instruments, also taking into account the interplay between participation in educational systems, labor-force participation and family formation.

"Perspectives for the Political Governance of Demographic Change" are finally addressed more broadly by Johannes Meier, member of the executive board of the Bertelsmann Foundation. Against the background of a shrinking and aging population, an increasing heterogeneity of living conditions across the country, and changes in voting behavior and political and societal participation that are hardly predictable, he identifies a number of governance challenges that are created through demographic change

in Germany. As a core challenge, which also provides a perfect example of the difficulties that arise, he then discusses the need for budget consolidation in the face of the long-term effects of demographic change for the social security system, public debt and annual fiscal balances. Building on the experience gathered in other countries, he specifically suggests measures aiming at higher transparency for the public, institutionalized forms of policy advising and experts' assessments of policy proposals with an eye on the long-run consequences of today's choices, and the installation of fiscal rules with automated control mechanisms which constrain the annual budgeting process and visibly sanction any failure on the commitments that have been made.

Demographic Change in Germany

Charlotte Höhn, Ralf Mai, Frank Micheel

1 Addressing the Issue

In most developed countries two long-term demographic trends are observed: below replacement fertility combined with rising life expectancy. The consequence is a major demographic change with a shift of the age composition: demographic aging. Demography is one of the few sciences that are mainly focused on the future. On grounds of the long-term scale and the inertia of demographic processes, demographers are able to project future trends with a rather satisfying likelihood. The rapidly growing importance of demographic analyses and projections comes from the notion that aging societies will face increasing problems within the next decades.

Our purpose is first to show how the past developments of the demographic change affected the current size and age composition of the population in Germany (Sect. 2). Second, we will present projections displaying a shrinking and aging population. Scholars agree on the fact that once demographic aging is in progress this trend cannot be reversed in the short term by demographic instruments, such as higher fertility or larger flows of international migration. However, in the long run the most important factor to reverse future aging and shrinking of the population is a higher fertility level (Sect. 3). Third, the regional patterns of demographic change can differ substantially from those at the national level. Although aging also results in severe problems at the national level (in systems financing pensions, health and long-term care), many remaining policy issues (e.g., public finances of local and regional authorities, real estate, infrastructure, schools, child care, health care or long term care facilities including qualified personnel, etc.) can only be tackled at the regional or local level. Also, population size is more relevant here than at the national level. Moreover, internal migration may have a strong impact on population size and age composition. For the future we expect increasing regional disparities in

Germany: some regions will still grow whereas the majority will shrink. Demographic aging will affect nearly all regions, but the degree of this process will differ (Sect. 4). What can be done? If controlling demographic development in short term is not possible, then reforms of political and social institutions are recommended (Sect. 5).

2 The Demographic Development in Germany

The aging of a population as a whole is a macro process and only partly similar to individual aging. But whereas the steadily increasing life expectancy ("individual aging") is proof for a remarkable and desirable progress of civilization, demographic aging leads to complex problems in several policy fields (see above). The process evolves when the number and share of elderly people rises. Aging is steered by biological, socio-economic, political and cultural factors on numerous levels.

In the face of the observed trends in developed countries demographic aging currently seems to be the last stage in human demographic development. However, intensity and consequences of this process may vary significantly between nations or regions and are therefore subject to public and political interest.

Demographers are eager to know which causes lead to the looming decrease and aging process of a population. Demographically, it is initiated when fertility and/or mortality decline. Migration and the current age composition can enforce or weaken this process. Thus, a population is affected in its size and structure by four components:

- The current, historically determined age composition;
- Fertility;
- Mortality;
- Migration (international and internal migration).

At the end of 2005 Germany had a population of 82.4 million inhabitants (40.3 million men and 42.1 million women), a decrease of 62,900 people since 2004. Around 65.7 million people were living in Western Germany, 16.7 million people in the Eastern part (including Berlin). There were around 7.3 million foreigners living in Germany at this time, 8.8% of the total population. 20.5 million persons were aged 60 years or older, almost 25% of the total population. The number of people aged 20 to 59 accounted for 45.4 million, almost 55% of the total population. The population aged less than 20 years was about 16.5 million in 2005, 20% of the total population (Statistisches Bundesamt 2006).

2.1 Trends in Fertility

A well known indicator measuring fertility trends is the total fertility rate (TFR). It can be interpreted as the average number of live births per woman in a certain period, normally a year.[1] In most developed countries the replacement of a generation requires a TFR of 2.1. Theoretically, this "ideal number" would provide a constant population size in the long run as well as a stable age composition with a sufficient number of people at employable age (not taking migration into account).

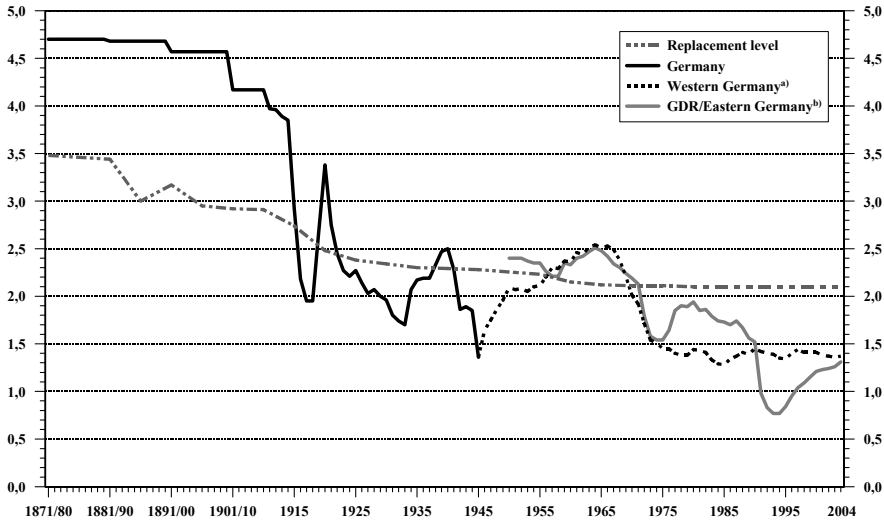
Today Germany is a low fertility country. This means that the TFR (at 1.3 in 2005) is remarkably below the replacement level. The replacement level is not a constant but depends on the mortality level. In the last third of the 19th century the replacement fertility level was at around 3.5 children per woman, mainly as a result of high infant mortality.[2]

Let us have a look at Figure 1. It depicts the long-term decline of fertility in Germany, starting with a first fertility decline from the end of the 19th century onward. A further observation is that there is considerable fluctuation in the number of live births per woman, mainly due to great crises (in particular, the two World Wars and the Great Depression in the 1920s/1930s): in bad times people decided to delay births, while there was a catch up later when these awkward situations had cleared. Demographers describe this phenomenon as a "timing effect". It can also be observed in other Western countries. After the Second World War the baby-boom from the mid-fifties to the mid-sixties was the last fertility peak; in 1964 the TFR accounted for 2.6 children. The main reasons for this baby-boom were: high economic growth that provided a boost in economic wealth, most men and women were married at this time ("golden age of marriage"), and the social roles of husbands and wives in households were more or less exactly defined ("male bread-winner model"). However, after this period a sharp decrease of live births started, driven by major societal changes (gender roles, individualization, variety of lifestyles, etc.), but also by effective contraceptives.

---

[1] The correct description of this indicator is "the average number of children each woman would have if the population's age-specific fertility rates remained constant" (Rowland 2003: 241). The reproductive life span of women is usually defined as age 15 to 49.

[2] In 1871/81 around one quarter of all new-born children did not survive the first year of life. In 1949/51 this proportion went down to a level between 5% and 6% (Statistisches Bundesamt 2004b: 10).



[a]From 2001 onward: without West Berlin.
[b]From 2001 onward: without East Berlin.

Sources: Federal Statistical Office; Federal Institute for Population Research.

Fig. 1. Fertility trends in Germany: total fertility rates, 1871–2004

As a consequence, from the mid-1970s up to now the fertility rate remained between 1.2 and 1.4 live births per woman. This fertility level means that in the long run a generation replaces the previous generation at about two thirds.

Several reasons can explain the continuing low fertility in (Western) Germany during the last 30 years (Dorbritz and Schwarz 1996: 246pp):

- Rising age at first marriage;
- Rising age of mothers at first birth;
- Increasing level of childlessness;
- Social factors, e.g. lack of partnership, divorce or separation;
- Economic pressure (unsatisfactory work-life-balance, especially for women).

Fertility trends in Western Germany and the former German Democratic Republic (GDR) are similar until the mid-1970s. In contrast to Western politicians the East German government reacted to the fertility decline with explicit pro-natalistic family policies, including gender-related measures and changes in labor-market conditions. They focused on monetary incentives for early marriages and early first births, but women were also

given a better chance of finding a balance between work and family life.[3] At first sight, these approaches appeared to be promising. The TFR in the former GDR went up to 1.9 in 1980, again followed by a slight decline. Dorbritz and Fleischhacker (1995) showed that shifts mainly reflect a timing effect rather than a lasting change in fertility. Furthermore, even though fertility in the GDR was temporarily higher than in the Western part, the pro-natalistic family policies applied there failed to reach at least the replacement level.

In the years after German reunification the TFR in the Eastern part of Germany went down to a historically unique low level of 0.8 children (1993–1995). This can be interpreted as a reaction to the radical changes involved in the overall reform process.[4] Although the Western and Eastern levels are converging in the recent past, the mean value of Eastern Germany's TFR is still slightly below that in the Western part (in 2004[5]: 1.31 in the East and 1.37 in the West, respectively).

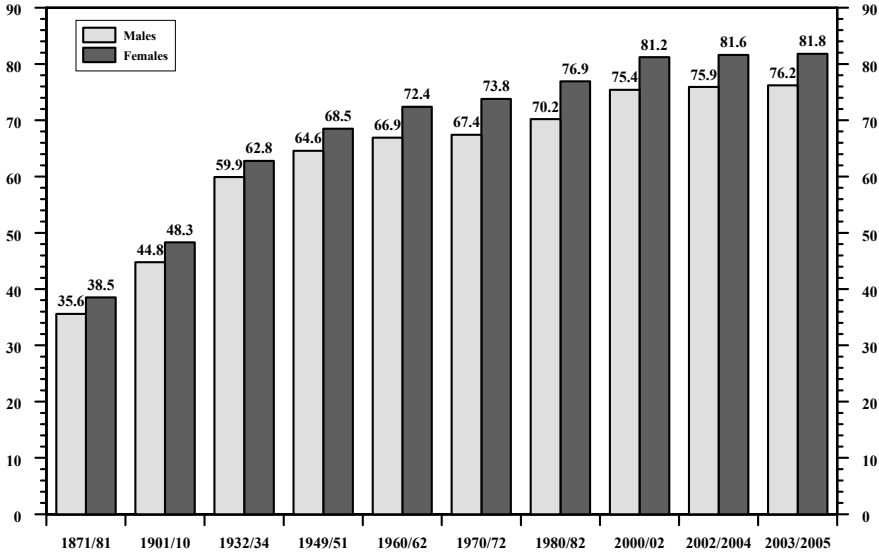
2.2 Trends in Mortality

Figure 2 shows the development of life expectancy at birth. In the period 1871/81 the average life expectancy at birth was 35.6 years for males and 38.5 years for females. Up to 1949/51 the gains in life expectancy at birth amounted around 29 years for men and 30 years for women. From 1949/51 to 2001/03 the gains in life expectancy at birth decelerated (11 years for men, and 12.9 years for women). The results of the recent life table 2003/05 show that life expectancy continued to increase (76.2/81.8 years for men/women at birth). The reasons for this overall increase of life expectancy are on-going improvements of "life quality" (environment, medical care, sanitation, nutrition, working conditions etc.) at all age stages (Statistisches Bundesamt 2004b: 10). Also a healthier life style promotes longevity.

[3] A detailed description of family policies in the GDR is provided by Dorbritz and Fleischhacker (1995).

[4] Future research should clarify whether this fertility decline was mainly a timing effect or not.

[5] Without Berlin.



Source: Federal Statistical Office.

Fig. 2. Life expectancy at birth: selected life tables, 1871–2005

2.3 Migration Dynamics

Throughout the period after World War II Western Germany had a large number of immigrants, but the reasons of immigration were different. In sum from 1950 to 1990 about 22.1 million people immigrated to Western Germany. In the same period 16.4 million cases of emigration were registered. The in- and outflows resulted in a net immigration of 5.7 million people (Statistisches Bundesamt 2005). All in all, migration did not exhibit stable patterns of development.

Which causes underlie these developments? The decision to leave one's native country is mostly associated with political, economic, or social changes (regarding both the countries of origin and destination). Natural disasters, famine, or wars also have a substantial impact on the decision to migrate.

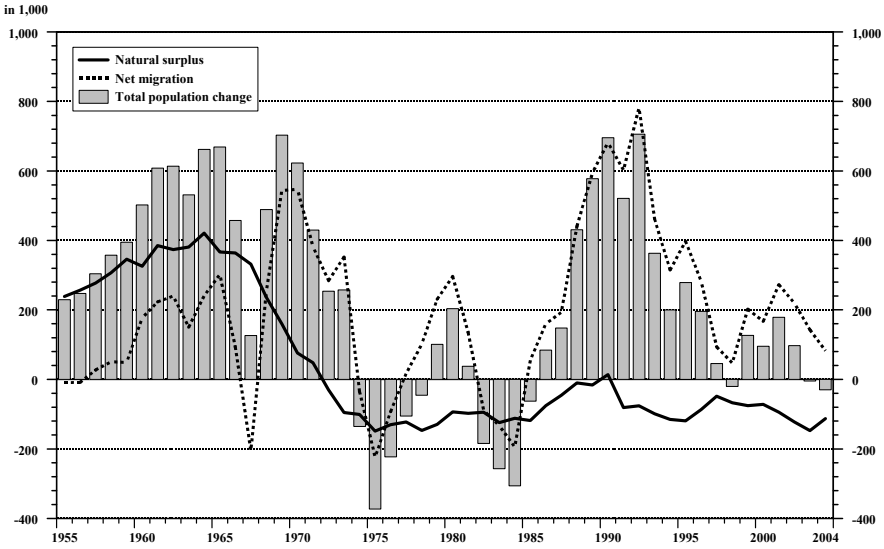
Immediately after World War II many German refugees and displaced persons came to Western Germany. In the 1950s Germans from GDR followed until 1961 when the Eastern German government started to close the border between the countries with the "wall". Later in the 1960s, due to increasing labor demand, an expansive recruitment of workers (so called "*Gastarbeiter*") from Southern European countries was started. The recruitment stop was launched in 1973. A temporary net emigration (around

206,000 people) was registered due to the first post-war economic recession in 1967/68. Partly as a result of the oil crises and the following economic downturns in the 1970s and the 1980s the number of out-migration exceeded the number of immigrants on several occasions (net losses in 1974–1976: 351,000 people; 1982–1984: 417,000 people). Since the late 1970s international migration to Germany diversified and increased at the end of the 1980s to a high level due to an influx of ethnic Germans from Eastern European countries and of asylum seekers, including refugees from former Yugoslavia. The peak of net immigration was registered in the year 1992 (782,000). The government limited the right of asylum seekers or political refugees to those who were not arriving from safe third countries (Höhn 2000: 6, Statistisches Bundesamt 2005). As a result the number of immigrants fell significantly during recent years, and in 2005 net migration gains accounted for only around 79,000 persons.

2.4 Demographic Balance

In every year since 1972, with the exception of 1990, natural growth (births minus deaths) was negative due to low fertility (see Figure 3). Fertility was insufficient to maintain a balance of life births and deaths. A decline of the total population, particularly in the 1990s, was compensated by net immigration solely. As a consequence international migration has more and more become an important factor in population change. On the other hand, net immigration went down significantly in the recent past. Figure 3 illustrates that net migration gains were not sufficient to compensate death surpluses in the last two years.

Often, demographic aging/juvenation and shrinking/increase are addressed as being synonymous. Without doubt these processes are closely linked, however one should thoroughly consider the differences. Comparing the trends of these processes in Eastern and Western Germany since 1950, one can notice their opposite courses. Western Germany is aging since several years, but still had an increasing population for many years (up to the year 2002). On the other hand, Eastern Germany (former GDR) had a shrinking population since the 1960s and yet a juvenation of the age composition. Looking back in time, one can find all four possibilities of combining these processes; the German demographic history reveals different phases. However, the succession of these reverse trends is not projected for the future any more, when population aging and shrinking will be the relevant long-term trends.



[a]Until 1990: Western Germany; from 1991 onward: Germany.

Sources: Federal Statistical Office; Federal Institute for Population Research.

Fig. 3. Components of demographic change in Germany[a], 1955–2004

To sum up, a bipolarity in demographic dynamics can be observed since 1991: on the one hand an aging but still growing population in Western Germany due to net immigration that exceeded death surpluses, on the other hand a shrinking and aging population in Eastern Germany due to out-migration and death surpluses, the latter even out-numbering the former. From 1991 until 2004, Eastern Germany's population[6] shrinked by 1.46 millions (death surplus: 987,000; out-migration: 470,000). Western Germany's population[7] increased by 4.1 millions (death surplus: 225,000; immigration: 4.3 millions). In 2004, the median age as an indicator for differences in the age-composition and related dynamics was 44.1 years in Eastern and 41.4 years in Western Germany. A remarkable fact is Eastern Germany's speed of aging: in 1991 the median age was 37.1 compared with 37.7 in the Western part. In just a few years Eastern Germany turned from a younger to a far older population. This can be traced back mainly to natural decrease, but out-migration also contributed to the rapid aging by almost 30%, as Mai and Scharein (2006) have shown.

6 Without Berlin.
7 Without Berlin.

3 Future Trends Until 2050

In 2006 the Federal Statistical Office published its 11th co-ordinated population prospects up to 2050 (Statistisches Bundesamt 2006). The projections are based on the population as of 31.12.2005. The researchers computed twelve variants; three additional scenarios, based on very stylized assumptions regarding fertility and international migration complete the set of calculations.

3.1 Assumptions of the 11th Co-ordinated Population Prospects

Fertility

Throughout the last 30 years fertility rates in (Western) Germany remained stable at a low level. Therefore the Federal Statistical Office assumes that fertility is constantly low in the baseline scenario, holding the TFR in Western Germany at a level of 1.4. The TFR in Eastern Germany is projected to converge to the Western level and then also kept constant. Alternative assumptions regarding fertility trends are also used, implying a further reduction of the TFR to 1.2 children per woman until 2050, or a gradual increase to 1.6 until 2025, a level that is held afterwards. In addition, the – as the researchers see it – unrealistic case of an increase to the replacement level of 2.1 children per woman is simulated.

Mortality

The 11th co-ordinated population projection assumes an increase in life expectancy from 75.9/81.6 years for men/women in 2005 to 83.5/88.0 years in Germany in 2050 (baseline scenario). More optimistic mortality assumptions (with higher life expectancy) are used to demonstrate the impact of life expectancy on the age composition of the population. In this case new born men/women are expected to live 89.8/85.4 years at average in 2050. However, the effects of mortality are rather small compared with variations of fertility, as Mai already showed for the results of the 10th co-ordinated population projection (Mai 2005).

International Migration

In section 2.3 we have highlighted the unstable migration pattern over the last fifty years. Thus the estimation of future trends in international migration seems to be the least predictable aspect of population projections. Usually population projections come in several variants to illustrate the

degree of uncertainty about the dimension of international migration. As a reasonable range of assumptions, the Federal Statistical Office expects annual net gains between 100,000 and 200,000 individuals.[8] Until the end of the projection period the net total number of migrants would then account for 4.4 to 8.6 million. In addition, two further scenarios are considered that appear to be more artificial. On the one hand, a scenario with "zero" migration[9] reflects the pure natural change of a population. On the other hand a higher flow of international migration with 300,000 net immigrants per year from 2012 onwards is looked at as a hypothetical upper limit.

3.2 Population Decline

In the following we refer to the lower limit of the baseline scenario (with medium assumptions regarding fertility and mortality, and an annual net migration of +100,000, building on recent trends observed with respect to migration). Based on these assumptions the Federal Statistical Office calculates a population size of 69 million people in 2050. Thus, compared with 2005 (the starting point of the projections) the number would fall by about 14 millions (16.6%) due to a further increase of death surpluses which cannot be compensated by migration gains. The projection suggests that death surpluses by 2050 are four times higher than in 2005.

3.3 Population Aging

According to this reference variant, in the long run the elderly will outnumber their children and grandchildren. The population aged 60 or older would increase to 27.8 million in 2050. They would thus make up 40.4% of the total population. The number of the very old (80+) is expected to rise to 10.0 million; an increase of 150% compared with the year 2005. A "high-speed" increase of the proportion aged 80 and over of the total population is expected (from 4.6% in 2005 to 14.6% in 2050).

In contrast the population aged below 20 is expected to fall to 10.4 million in 2050. The proportion of this age group would go down to 15.1% of the total population. In 2005 there were 16.5 million aged below 20 (20.0% of the total population). The median age would rise from 42 years in 2005 to 50 years by 2050.

---

[8] Starting with net gains of 50,000 in 2006 and 75,000 people in 2007.

[9] The number of in-migration equals the number of out-migration.

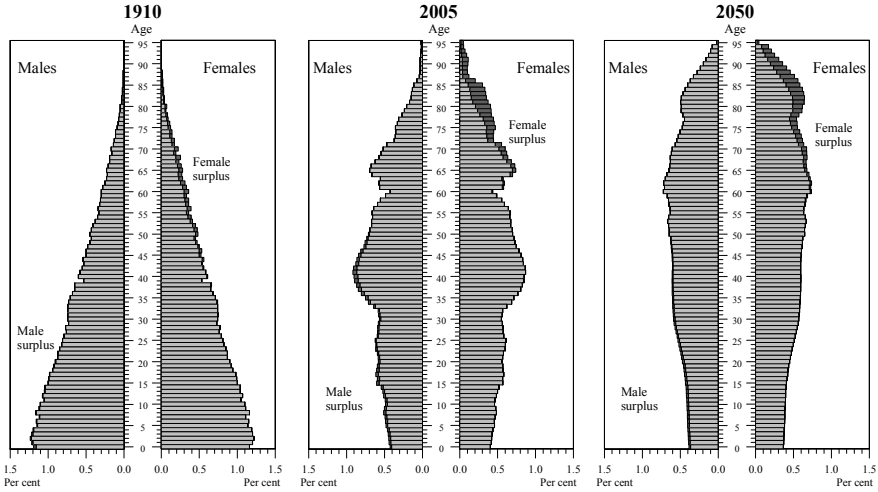
The old-age dependency ratio[10] is projected to go up due to a combination of constant low fertility rates and the aging of the baby boomers who are expected to reach the retirement age (60+ or 65+) during the 2020s and 2030s. In 2005 nearly 45 "dependants" aged 60 and over per 100 people aged 20–59 were observed. Between 2020 and 2030 this ratio would increase from 58 to 78. In 2050 nearly 91 older persons are "dependent" on 100 people of working age. The old-age dependency ratio "65+" is on a lower level. Between 2005 and 2050 this ratio will increase from 32 to 64. During the 2020s it is projected to rise from 39 (2020) to 52 (2030).

However, the old-age dependency ratio is not an accurate indicator for addressing questions of labor force participation. Instead, one should take into account the economic dependency ratio focusing on the relation between people who do not belong to the labor force to persons who are in the labor force. Estimating future labor-force participation is obviously more difficult than making population projections (e.g. Deutscher Bundestag 1998, Fuchs and Söhnlein 2005).

Comparing the population in Germany by age and sex for three points in time in the past, present, and future, we see that in the year 1910 the age composition had the shape of a triangle (see Figure 4). Due to high fertility the young age cohorts were overrepresented, whereas elderly people held a low proportion as a result of high mortality. At this time the population was markedly young with its proverbial pyramid structure. The age composition in 2005 shows a far older population. The first and the second demographic transition along with declining fertility and mortality have their left marks upon the age composition. The structure also shows traces of historic events (e.g. World War II) as well as hints on future demographic trends. As mentioned in section 2.1 childbearing was postponed or hindered in the Second World War. As a consequence of high male mortality during war older women out-number the elderly men even more than is demographically normal. Obviously, the middle-aged groups (including the baby-boomers) hold the largest proportion, whereas people aged below 30 comprise a small proportion of the total population. Until 2050 the age composition will remarkably change: the picture shows an urn rather than a pyramid, with a relative high share of older people (60+) and a small proportion of their descendants. As a result of observed low fertility from the 1970s onward that is assumed to persist until 2050 the older people will be replaced by lesser and lesser numbers of young people. In the future women are still projected to out-number men at higher ages due to a

[10] The old aged dependency ratio is calculated as the sum of people aged 60+ (65+), divided by the number of people aged between 20 and 59 (64).

higher life expectancy, although the relation gets more even (Mai 2005: 54, Statistisches Bundesamt 2006).



Sources: Federal Statistical Office; Federal Institute for Population Research.

Fig. 4. Age composition of the population in Germany, 1910, 2005 and 2050

3.4 Can Population Aging Be Reversed by Demographic Instruments?

There are two demographic options to reverse this trend. Higher net immigration and a rise in fertility would both shift the age composition towards a younger population. Are these options realistic?

Birg et al. (1998) calculated a variant with replacement TFR of 2.1. Their results show that it would take many years to compensate the fertility drop between 1965 and 1975. The absence of potential mothers and fathers determines the decline of the population for the following decades. Under these conditions a population that is stable in size and composition is possible not before the second half of the 21st century. The results of the 11th co-ordinated population prospects of the Federal Statistical Office support these findings. For example, considering old-age dependency ratios defined by age 60 under alternative assumptions, one can see that in the long run higher fertility has a more substantial impact on the age structure of the population than higher migration gains (Table 1). In the variant with higher immigration the dependency ratio would increase to 85 until 2050 instead of 91 in our reference scenario. In the model with a TFR of 2.1 this ratio would "merely" rise to 73.

Table 1: Comparison of old-age dependency ratios under alternative assumptions

	Reference scenario[a] (1)	Alternative: Higher migration[b] (2)	Difference (2) – (1)	Alternative: Higher fertility[c] (3)	Difference (3) – (1)
2005	45.2	45.2	0.0	45.2	0.0
2010	47.4	47.3	–0.1	47.4	0.0
2020	58.2	57.0	–1.2	58.2	0.0
2030	78.4	75.2	–3.2	76.4	–2.0
2040	83.5	78.9	–4.6	73.7	–9.8
2050	90.8	85.1	–5.7	72.9	–17.9

[a]Life expectancy: baseline scenario; TFR: 1.4; net migration: 100,000 per year.
[b]Life expectancy: baseline scenario; TFR: 1.4; net migration: 200,000 per year.
[c]Life expectancy: baseline scenario; TFR: 2.1; net migration: 100,000 per year.

Source: Federal Statistical Office

What else can be observed? Our selected variants suggest that the aging process would not be stopped until 2050. The old-age dependency ratios in alternative models would not substantially differ from the reference model between 2020 and 2030, when the baby boomers are expected to reach retirement age. Higher fertility would thus make a difference regarding the aging process to be expected in Germany in the long run only. Yet it is a more promising way to change the demographic outlook than the alternative, viz. a rise in immigration to strive for a balance between young and old people.

A well-known example, "Replacement Migration", was provided by the Population Division of the United Nations in 2000, where net migration flows required for the following scenarios were projected (United Nations 2000: 37pp):

- Constant total population. At the starting point of this projection (1995) Germany had a population of 81.7 million. The UN calculates that a net inflow of 324,000 people per annum is needed until 2050 to keep the population constant. In total 17.8 million immigrants would be required.
- Constant population at employable age (15–64 years). Between 1995 and 2050 a total net number of 25.2 million immigrants were needed; this corresponds to an average number of 458,000 per year. The population size would increase to 92 million in 2050, of which 36% would be immigrants and their descendants.
- Constant ratio between older people (65+) and people at employable age (15–64 years). Between 1995 and 2050 around 3.4 million immigrants per year were needed to hold this ratio constant. These migration flows

resulted in a total number of 188.5 million. The population size would increase to 299 million. The share of post-1995 migrants and their descendants of the total population would rise to 80%.

These impressive numbers, in particular the results of the last scenario, show that the option "replacement migration" is not a realistic demographic solution. A further important result is that the migration flows of the first and the second scenario would not stop the aging process.

Our main message is that the current age composition and past trends will determine the mid-term future population irrespective of a hypothetical increase of fertility up to 2.1 life births per woman (and realistic amounts of migration). The German society will face an aging process, in particular during the 2020s.

4 Regional Aspects of Population Dynamics

In virtually every country, demographic trends show distinct regional patterns which are sometimes stable over time. Yet such regional demographic disparities have to be analyzed in their specific context of time and space. The demographic situation has consequences for various aspects of a region's development (see Sect. 5). It would go too far to explain all the causes and structures that lie behind regional demographic patterns in Germany. Attempting to identify the determinants of such regional patterns is difficult, as demographic processes are generally steered by both basic structural conditions on the macro-level and individual behavior on the micro-level. Considering the variety of possible determinants in any of these areas, which are located at different levels and at the same time interact with each other (often in opposite directions), a demographic analysis that differentiates between several regional units can become enormously complex. Another limiting factor is the regional level itself, as the degree of data differentiation and availability diminishes with the degree of regional differentiation. Finally, one has to consider not only the interactions between the determinants of regional population trends, but also within the demographic processes themselves. Especially internal migration becomes all the more relevant for population dynamics, the smaller the regional level is.[11]

[11] In the following we analyse regional demographic disparities primarily on the level of counties (*Kreise*), further also states (*Länder*).

4.1 Fertility and Mortality

Both fertility and mortality differences show interesting regional patterns. Although regional disparities in Germany have diminished they are still present. Therefore it might be assumed that the possible discriminating factors are rather stable and not easy to change. The dominating regional pattern for the last decades is the East-West-divide. It is therefore advisable to differentiate between these two parts of the country when looking back in time.

The development of fertility is determined by several factors on various levels. Especially the behavioral side, i.e., the individual decision to have a child or not, is difficult to analyze. None of the standard theoretical approaches taken in sociology, economics or socio-psychology offers a universal, comprehensive and consistent explanation. This is even more true with respect to analyses addressing the regional level. Even if many determinants are the same everywhere, region-specific structures (economic structure, settlement structure, housing market, family structures, socio-cultural values and way of living, etc.) obscure the analysis of the observed pattern. In any case, one cannot expect a mono-causal approach to fully explain regional differences.

For many years, the regional pattern of fertility in Germany was dominated by the East-West divide in fertility (Bucher 1998, see also Fig. 1). Yet, on the regional level of counties[12] one can find both the lowest and the highest fertility rates in Western Germany. In 2002, the highest county-level TFR observed in Western Germany was 1.91, the lowest 0.87 (Eastern Germany: 1.39 resp. 1.07). In Western Germany there is also a stronger contrast between rural and urban regions (with higher figures for rural ones), although this discrepancy has diminished recently (Gans 2001). Regions with above-average fertility in Eastern Germany are located mainly in the Northern and Southern part. In Western Germany the highest rates are found in the rural North-West, in rural/sub-urban regions in the South-West and the South-East. Large cities (especially those with a university) show the lowest fertility levels.

Regional differences in mortality have been subjected to research in various studies (e.g., Kemper and Thieme 1991; van der Veen 1994; Mai 2004; Luy 2004)[13]. In the early times of industrialization regional differ-

[12] We used data from the regional database of the Federal Office for Building and Planning (Bundesamt für Bauwesen und Raumordnung 2004) at the level of counties (*Kreise*/*kreisfreie Städte*).

[13] It should be noted that analysing mortality data at a regional level soon reaches statistical limits, when the number of statistical cases in a region gets too small

ences were predominantly consequences of different nurture and breast-feeding habits, further of diseases and plagues. Today, scholars believe that factors like the economic situation and cultural attitudes, social class, educational level, selective migration, environment, and the (medical) infrastructure are the most prominent determinants. However, as with fertility the causes of regional mortality differences are hard to identify and assess. Again, individual factors (e.g. life style and health behavior) also play a major role. Together, these factors build a mix of region-specific determinants. However, knowledge about possible structural determinants can be an important prerequisite of regional policy which aims at balancing regional circumstances that are also indicated by mortality differences.

In Germany we can observe two broad trends that comprise more differentiated patterns. On the one hand there is an East-West divide, on the other a gradient from the North towards the South. At the time of German reunification, the gap in life expectancy at birth between Eastern and Western Germany was rather big: in 1990 it was 2.8 years for females resp. 3.5 years for males (Luy 2004). Since then, the gap has closed. Today, the difference in life expectancy at birth has almost vanished for females, whereas it is still visible for males[14]. As a consequence the gender-difference in life expectancy is larger in the Eastern part. Since the gap closed remarkably fast, the determining factors should belong to areas which are possible to be altered in a short time. Luy (2004) emphasizes the improvements of supply of long-term care facilities as important determinant for life gains. However, looking at the trend of the recent years, it seems that the process of adaptation has slowed down. It is thus uncertain whether the remaining gap between East and West will be closed soon for the males.

At a higher level of regional differentiation there are also remarkable differences within Eastern Germany, namely a North-South gradient. The Southern part shows the highest levels and increases in life expectancy, primarily Saxony and the region around Dresden, which in 2002 had higher figures (76.9 resp. 82.8 years) than some Western German regions[15]. The Northern parts of Eastern Germany, especially rural and low-densed regions are the ones with the lowest life expectancy (71.5 resp. 79.8 years; see, e.g., Uecker-Randow). Obviously, life expectancy is linked to the set-

to compute mortality measures. Therefore, computing regional (mortality) data is always a compromise between statistical validity and regional differentiation.

[14] Females: 81.9 vs. 81.6 years; males: 76.5 vs. 75.1 years (Western/Eastern Germany), according to life table 2003/05 (Federal Statistical Office).

[15] The data source for the figures is the Bundesamt für Bauwesen und Raumordnung (2004).

tlement structure: agglomerations have a lower mortality than rural regions, a pattern that was rather stable for the last years. However, as regions with a lower life expectancy gained the most a convergence could be observed and regional disparities in Eastern Germany have reduced slightly (Mai 2004). In Western Germany the regional dispersion of life expectancy was less distinctive, though still visible. Old-industrialized regions at the Ruhr or Saar show lower figures for life expectancy than prospering ones in the South. In 2002, the highest life expectancy – in the West and the entire Germany – was found in the very Southern regions, around the Lake of Constance and near the Alps. German-wide the highest (in brackets: the lowest) regional life expectancy was 79.0 (71.2) years for males, 81.5 (76.4) years for females. The overall regional pattern of gender-specific life expectancy is largely the same everywhere.

The regional pattern highlights the importance of infrastructural supply especially regarding medical care and emergency aids (with a notable East-West gap). On the other hand, the persistence of regional differences indicates that there are determinants which are not easily influenced by politics. These comprise life style aspects, health behavior, social status, and income. Moreover, there is legitimate reason for assuming that regional differences such as those in Germany are to a considerable extent a result of selective migration (Cischinsky 2005; Luy 2004a). Migration is selective in many ways, including physical condition.

4.2 Internal Migration

Internal migration occurs within a country's borders. The smaller the geographical scale, the more internal migration influences the demographic and socioeconomic development of a region. Therefore the knowledge of its structure and trends is essential for regional policy. Internal migration evolves as a reaction to prevalent objective living conditions in a region, but also to individual perceptions of these. It differs by direction, strength and selectivity, suggesting that the causes vary by regions. Above all, age-selectivity plays an important role for the regional development.

The main trends of German large-distance internal migration during the last decades were the following.

- *Western Germany*: since the 1960s, there has been a demographic relocation towards the South, out-migration in this direction being even larger from the Northern than from the mid-Western states; between the 1960s and 1990s, there was also some out-migration from the Northern towards the Western states; before and after, there were reverse flows.

- *Eastern Germany*: there has been large out-migration towards Western Germany in recent years, increasingly directed towards the Southern states; between 1991 and 2004, Eastern Germany[16] has lost 887 thousand inhabitants through net out-migration.

Since 1950 the Southern states gained some 1.66 million people via internal net migration, the Western states 856 thousand, the North and East suffered a corresponding loss through out-migration. The overall mobility in Germany was the highest in the 1950s and declined until the 1970s. Afterwards it rose but did not reach the level of the 1950s.[17] It is remarkable that, of the 1.66 million persons who moved to the South in total since 1950, 718 thousand did so in the years 1991–2004. Since 1991 almost two thirds of all Eastern out-migrants went to the South. The mid-Western states gained migrants mainly in the years following World War II. The Northern states lost inhabitants mainly to the West (1.1 of 1.6 million). To sum up, there have been notable exchange processes over long distances and even more intense ones over short distances.

Large distance moves like the East-West-migration are often characterized by long-term changes in life course. The main reasons for migrating over longer distances are connected to regional disparities regarding the labor market or educational opportunities. But the distance from the region of origin also matters for the choice of destination. Especially when analyzed by age and gender, the out-migration from Eastern Germany is clearly driven by such economic considerations (Mai 2004a). The main part of the East-West moves is made up by young persons between 18 and 30 years, with a clear dominance of females. Net female out-migration is almost twice as large as that of males, and this trend implies future demographic imbalances especially for rural regions. In total, out-migration from Eastern Germany is a severe problem for regional and economic development.

During the last decades the West was dominated by the trend of *suburbanization* (Bähr 2003; Kemper 2003). This trend emerged during the times of the economic boom in the 1950s and 1960s ("*Wirtschaftswunder*") when, along with economic growth and prosperity, large parts of the population were able to afford cars. Thus mobility was rapidly eased, and as a consequence families could fulfill their dream of an own house in the countryside and moved outside the cities. This trend has not come to an end yet, although recent evidence suggests a slight waning. Whether the so

[16] Including Berlin.

[17] Large-distance migration shows a particularly clear correlation with the business cycle.

called counter-urbanization during the 1970s and 1980s lead to a migration towards smaller, dense peripheral regions, is discussed controversially. In contrast, since the 1990s, bigger cities experienced yet few in-migration again by improving inner-city neighborhoods for well-off people ("gentrification"). Whether there is now a trend of re-urbanization followed by broader parts of the population is unsure yet. Anyway, during the last five decades Western Germany was characterized by a large scale deconcentration of the population.

In contrast, Eastern Germany before 1990 experienced an opposite trend, as internal migration was restricted and, to the extent that it occurred at all, was mainly directed towards larger cities, especially East-Berlin. After reunification internal migration increased, altered its trend, and became more differentiated. In particular, suburbanization emerged and soon became the dominant trend. The process was partly different from the trends observed in the West and gave rise to the formation of more dense suburban regions around bigger cities. Most recently, big cities were able to gain inhabitants by in-migration at the cost of surrounding areas, which may just be a cohort effect. In any case, migration did not result in deconcentration like in the Western part so far because there was, and still is, outmigration of young people at the same time, mainly from rural regions to the West and to the centers in Eastern Germany.

4.3 Regional Patterns of Demographic Change

The demographic processes reviewed here resulted in specific spatial patterns of population dynamics (Bucher, Schlömer, Lackmann 2004; Kemper 2003). Over the period from 1991 to 2004, a fundamental bipolarity could be observed. Western Germany had mostly growing regions, primarily because of net immigration which outnumbered a natural decrease. Without immigration, these regions would already experience a decreasing population. Some suburban regions (e.g., Southern Bavaria) showed a slight natural increase, but this was mainly due to age structural effects. Nevertheless, population growth was wide spread in Western Germany, especially in a broad band of regions southward along the Rhine and eastward to Munich. Mainly old-industrialized regions at the Ruhr or Saar were shrinking, also at the former inner-German borderline. Since the second half of the 1990s a broader decrease in population was observed due to economic reasons, for example in cities such as Bremerhaven.

Eastern Germany mainly comprised shrinking regions, but the decrease was rather due to death surpluses than to migration. A unique phenomenon was the combination of a shrinking population with an on-going sub-

urbanization. Especially middle cities suffered from population decline (up to one third), with strong out-migration and very low fertility. Few regions with increasing population could be observed, mainly suburban ones or cities with specific locational advantages. But even these regions could only gain population by net in-migration from other parts. All in all, there has been a quite unbalanced situation of German demographic dynamics on a regional level.

Another remarkable trend is the increasing diversity among cities. Because of differences in age composition, selective migration, or the economic situation, they divide in subgroups with diverse paths of development since reunification: There are shrinking cities such as those in the Ruhr region; shrinking cities with net immigration (Bremen, Dortmund); increasing cities with a natural decrease (Hamburg, Düsseldorf, and Dresden); and increasing cities which also had birth surpluses (Stuttgart, Munich, Cologne, and Frankfurt). In contrast, most of the middle cities in Eastern Germany show a uniform pattern of decrease and death surpluses, although a growing diversity seems to emerge.

To sum up, Germany's regions experienced simultaneous demographic increase and decrease since 1990. Until 2004, the population was growing in 278 counties and shrinking in 162. The population in the Western part deconcentrated on a large scale: rural regions increased and suburbanization advanced. Eastern Germany mainly showed a concentration of the population: agglomerations gained the most and suburbanization began, but yet mostly over short distances.

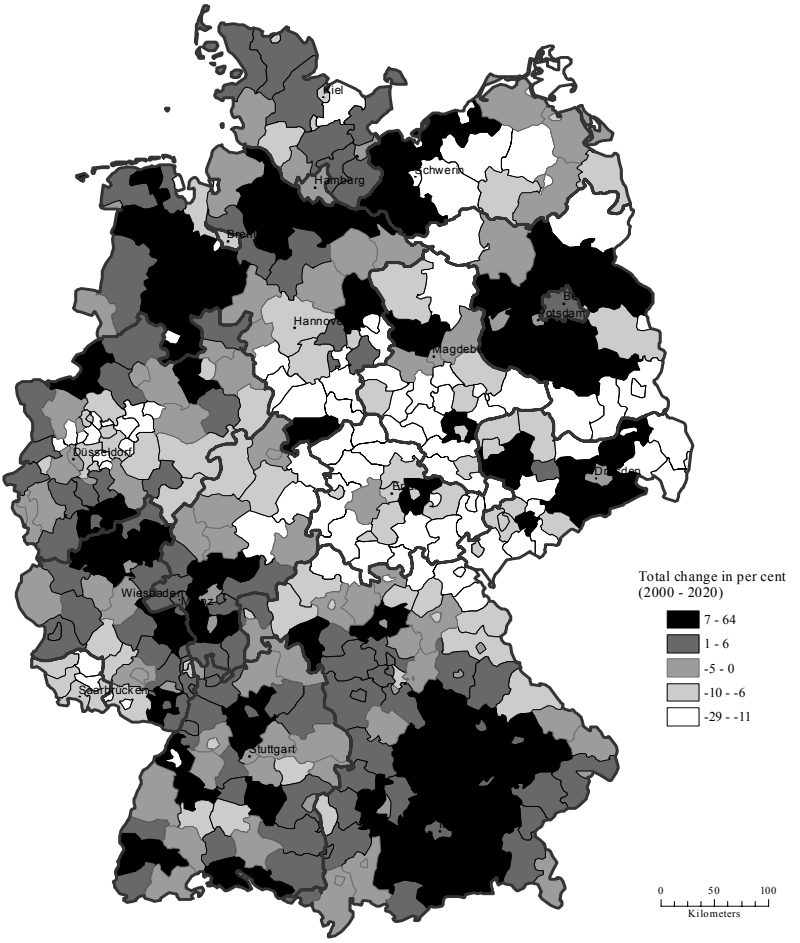
Apart from changes in population size, another consequence of demographic processes is a shift in the age composition. Nearly all counties experienced demographic aging during this period of time. However, the causes were different: Generally speaking, in the East aging was mainly enforced by the shrinking proportion of younger persons (fertility decline), whereas in the West it was driven by the growing proportion of elderly. Regions with a higher median age are primarily found in the East (where the South-East is still "older" than the North-East), in old-structured cities in the West, and along the coast and the Alps. Suburban and high fertility regions can profit from a younger age composition.

4.4 Outlook: Growing or Diminishing Regional Disparities?

The "*Raumordnungsprognose*", a regional forecasting model with a time horizon until 2020 run by the Federal Office for Building and Planning, projects a continuation of simultaneous increase and decrease of the population on a regional level (Bucher, Schlömer, Lackmann 2004). However,

the number of shrinking regions will rise and almost double (compared with the 1990s), and spatial disparities will increase. Thus, the future regional demographic development would be dominated by declining populations. The current distinct East-West divide may become fuzzier as a corridor of shrinking regions from the East into the Ruhr region in the West could emerge (see Figure 5). These are the first regions in Germany with age-structural dynamics that are too weak to compensate for the population decline. Growing regions in the East can only be found in a few suburban areas, receiving in-migration from the cities. In the West there are also less growing regions due to more wide-spread death surpluses. Agglomerations and, in particular, their suburban areas, such as Munich, Stuttgart, Frankfurt or Hamburg will continue to grow. It should be noted that immigration (international or internal) is more or less solely responsible for projected growth in these regions. However, this depends of course on the assumptions of the projection as well as on unforeseen circumstances in the future.

Like population decline, demographic aging will spread around and become faster over time. Especially rural regions are expected to show rapid aging and increasing proportions of elderly. The same applies, to a smaller extent, to suburban regions, where the suburbanites of the 1950s and 1960s then enter old age. However, the most dramatic relative and absolute increase will occur in the highest age groups, the oldest old (aged 80+). In conjunction with their potential need for assistance, this increase can create severe problems in rural regions. In some of them, the rate of increase is projected to be almost 75% until 2020. A decline in the numbers of younger people will primarily be a problem for Eastern German regions. Peripheral and old-industrialized regions will have the most dramatic development, with a fast shrinking young population and also a fast growing proportion of elderly, while total population will be shrinking. It will be a crucial question whether such an unbalanced demographic development can be compensated by regional politics.



Source: Federal Office for Building and Planning (mapping: Ralf Mai).

Fig. 5. Regional population dynamics in the German counties, 2000–2020

5 Implications for Society, Economy, and Policy Makers: Challenge or Catastrophe?

Past demographic changes led to strong shifts in the age composition, a process that will continue in the future. Shrinking age cohorts on the one hand and the above-average number of baby-boomers on the other will destabilize the age composition. These structural imbalances, implying an

enormously increasing number of old-aged people, represent the actual risk involved in demographic aging. The declining population is alarming as well. However, it matters rather on a regional than on a national level.

Large-scale demographic aging cannot be reversed within a short time span through higher immigration or fertility, but it can be reduced using these demographic instruments.[18] There are thus direct counter-measures. First of all, family policies are required that encourage young couples to have more children and invest in their education. Constraints for women and for men to find a balance between work and family life have to be reduced. However, even more important than these direct policies will be indirect reactions, adjusting public policies and society to the aging process in several ways.

Perhaps the most evident and the most imminent problems of aging will show up on the labor market and in the social security system. A marked decrease of people at employable age (20–64) will start around 2015. In the following years an ever smaller number of people will enter the labor market. Against this background, reforms in social security system are required that lengthen the active life span through an earlier entry into the labor market as well as a reduction of incentives for early retirement. Also, with a shrinking quantity of labor supply, human capital with higher quality is needed instead, a major goal being employability at all ages. The post-Second World War baby boomers will start entering retirement age in the 2020s, and they will move into the age group 80+ between fifteen and twenty years later. The aging process of those 80+ is thus the most dynamic in the future. In particular, one must expect a sharp increase of cases of long term care after 2030.

Demographic change certainly matters on a national level where it can be dealt with through social security reform or higher immigration and, in the long run, through higher fertility. However, aging has an impact that is no less important at a regional level where many other issues have to be addressed. An important example is given by infrastructure. Due to low fertility rates, more and more schools may have to be closed, as already happens in Eastern Germany. Another issue is the housing market where demand may fall in many regions and may also shift towards new forms of housing, especially for the elderly. A crucial question will be whether a region is able to adapt its policies towards demographic sustainability, with more emphasis on family policies and a family-friendly life in the city or a suburban or rural area in order to give the inhabitants stronger incentives to stay. Of course, successful policies for developing businesses and creat-

[18] Recent calculations can be found in Bomsdorf (2005).

ing distinct locational factors suited to attract potential firms and potential immigrants are important as well.

References

Bähr J (2003) Binnenwanderungen. Geographische Rundschau 55(6):4–9

Birg H, Flöthmann JE, Frein T, Ströker K (1998) Simulationsrechnungen zur Bevölkerungsentwicklung in den alten und neuen Bundesländern im 21. Jahrhundert. Institut für Bevölkerungsforschung und Sozialpolitik (IBS) der Universität Bielefeld, Bielefeld

Bomsdorf E (2005) Höhere Fertilität, steigendes Rentenzugangsalter und Migration – Wie die zukünftige Belastung der Gesellschaft in Deutschland erträglich gestaltet werden kann. Deutsche Rentenversicherung 60:439–459

Bucher H (1998) Geburtenentwicklung in West- und Ostdeutschland nach der Wende. In: Deutsche Gesellschaft für Bevölkerungswissenschaft (ed): Geburtententwicklung nach der Wende. Johann-Peter-Süßmilch-Gesellschaft für Demographie. TrafoVerlag, Berlin, pp 8–20

Bucher H, Schlömer C, Lackmann G (2004) Die Bevölkerungsentwicklung in den Kreisen der BRD zwischen 1990 und 2020. Informationen zur Raumentwicklung No 3-4/2004:107–126

Bundesamt für Bauwesen und Raumordnung (2004) Indikatoren, Karten und Grafiken zur Raumentwicklung (INKAR), 2004. Bundesamt für Bauwesen und Raumordnung, Bonn

Cischinsky H (2005) Determinanten regionaler Mortalitätsunterschiede am Beispiel Baden-Württembergs. Jahrbuch für Regionalwissenschaft 25:175–205

Deutscher Bundestag (1998) Zweiter Zwischenbericht der Enquête-Kommission „Demographischer Wandel – Herausforderungen unserer älter werdenden Gesellschaft an den einzelnen und die Politik“. Bundestagsdrucksache 13/11460

Dorbritz J, Fleischhacker J (1995) Der Übergang von der Bevölkerungs- zur Familienpolitik in den neuen Bundesländern – ein Beitrag zum familienpolitischen Diskurs in Deutschland. Zeitschrift für Bevölkerungswissenschaft 20:159–185

Dorbritz J, Schwarz K (1996) Kinderlosigkeit in Deutschland – ein Massenphänomen? Analysen zu Erscheinungsformen und Ursachen. Zeitschrift für Bevölkerungswissenschaft 21:231–261

Fuchs J, Söhnlein D (2005) Vorausschätzung der Erwerbsbevölkerung bis 2050, IAB-Forschungsbericht No 16/2005, Institut für Arbeitsmarkt- und Berufsforschung, Nürnberg

Gans P (2001) Regionale Unterschiede der Geburtenhäufigkeit. In: Institut für Länderkunde (ed): Nationalatlas Bundesrepublik Deutschland: Bevölkerung. Spektrum, Heidelberg, vol 4, pp 94–95

Höhn C (2000) Policy response to population ageing and population decline in Germany. Expert group meeting on policy responses to population ageing and population decline, New York, 16-18 October 2000

Kemper FJ, Thieme G (1991) Regional disparities of mortality in the Federal Republic of Germany. Espace, Populations, Societés 1:93–100

Kemper J (2003) Binnenwanderungen in Deutschland: Rückkehr alter Muster? Geographische Rundschau 55(6):10–15

Luy M (2004) Mortality differences between Western and Eastern Germany before and after Reunification. GENUS No 3-4/2004:99–141

Luy M, Caselli G (2004) The impact of a migration-caused selection effect on regional mortality differences in Italy and Germany. Paper presented at the PAA 2004 Annual Meeting, Boston 2004

Mai R (2005) Demographische Alterung in Deutschland. Die Entwicklung von 1871 bis 2050 und der Einfluss von Sterblichkeit und Zuwanderung auf die Alterung. Zeitschrift für Bevölkerungswissenschaft 30:43–80

Mai R (2004) Abwanderung aus Ostdeutschland. Strukturen und Milieus der Altersselektivität und ihre regionalpolitische Bedeutung. Peter Lang, Frankfurt am Main

Mai R (2004) Regionale Sterblichkeitsunterschiede in Ostdeutschland. In: Scholz R, Flöthmann JE (eds) Lebenserwartung und Mortalität. Materialien zur Bevölkerungswissenschaft, vol 111. Bundesinstitut für Bevölkerungsforschung, Wiesbaden, pp 51–68

Mai R, Scharein M (2006) Abwanderung und Alterung in den Bundesländern. Zeitschrift für Bevölkerungswissenschaft 31 (forthcoming)

Rowland DT (2003) Demographic methods and concepts. Oxford University Press, New York

Statistisches Bundesamt (2004a) Bevölkerung und Erwerbstätigkeit: Natürliche Bevölkerungsbewegung 2003, Fachserie 1, Reihe 1.1. Statistisches Bundesamt, Wiesbaden

Statistisches Bundesamt (2004b) Periodensterbetafeln für Deutschland. Allgemeine und abgekürzte Sterbetafeln von 1871/1881 bis 2001/2003. Statistisches Bundesamt, Wiesbaden

Statistisches Bundesamt (2005) Wanderungsstatistik 2004, Fachserie 1, Reihe 1.2. Statistisches Bundesamt, Wiesbaden

Statistisches Bundesamt (2006) Bevölkerung Deutschlands bis 2050. Ergebnisse der 11. koordinierten Bevölkerungsvorausberechnung. Statistisches Bundesamt, Wiesbaden

United Nations Population Division (2000) Replacement migration: is it a solution to declining and ageing populations? United Nations, New York

Van der Veen W (1994) Does it matter where I live in Western Europe? An analysis of regional mortality differentials in Belgium, Germany and the Netherlands. European Journal of Population 10:319–348

The Effects of Aging on Labor Markets and Economic Growth

Willi Leibfritz, Werner Roeger

1 Introduction

In the late 19th century when population growth in Europe was still high Thomas Malthus projected a miserable future with populations outgrowing food supply. Such fears are now gone, at least in developed countries but are replaced by other fears that population growth could be too small to sustain living standards. People fear that with aging populations there may be not enough workers to feed the growing number of pensioners. Almost everyone seems to be worried about an "aging time bomb" leading to breakdowns of pension systems and there is talk of a future warfare between young and old generations. Young generations expect their living standards to be cut as they have to support the growing number of elderly people, and those middle-aged and close to retirement fear that their pension benefits will be cut and they may perhaps even end up in poverty. Different demographics between countries and world regions are also expected to shift economic and political power to younger fast growing countries and away from aging countries with weaker economic growth.

In spite of widespread fears, what exactly should be done is less clear. While some call for fundamental changes in pension and health care systems, others argue that changes around the edge of social systems are sufficient. Some say that we simply need more babies and this could be achieved by improving conditions for young families. Others think that opening borders and letting more immigrants in would do the trick as this would bring in both more young workers and more babies helping financing pensions. Such ideas sound appealing and it is clear that something has to be done. But economists and politicians are in uncharted waters as never in human history there has been a similar episode of population aging as it is envisaged for the next decades in many countries including Germany.

But before we speak of “time bomb” and “crisis” one has to get a clearer view about the magnitude of the problem. As aging affects not only the welfare state but also the whole economy which provides the means for financing it, a broader view is needed. This chapter looks at the potential effects of aging on labor supply and economic growth and also discusses how Germany’s growth performance may change relative to that in other European and non-European countries. The first section looks at the main supply factors which determine long-term economic growth and compares Germany’s past economic growth with that in other industrial countries, also taking into account Germany’s relative income level at the beginning of this phase of pronounced aging. The second section discusses the possible demographic effects on the various determinants of growth. The third section illustrates the possible quantitative impact of aging on growth be referring to long-term growth scenarios which have been carried out by the OECD Secretariat and the EU. These scenarios not only attempt to capture the effect of aging on growth but also the repercussions of possible policy measures which governments may take in response to the challenge of aging populations. The chapter concludes with some policy considerations.

2 Main Determinants of Economic Growth

2.1 Some Methodological Observations

By definition, real output (Y), labor supply in terms of total hours worked (L), employment (E), labor force (NLF), population at working age (N_{WA}) and total population (N) are related by:

$$Y \equiv \frac{Y}{L} \cdot \frac{L}{E} \cdot \frac{E}{N_{LF}} \cdot \frac{N_{LF}}{N_{WA}} \cdot \frac{N_{WA}}{N} \cdot N \tag{1}$$

$$\frac{Y}{N} \equiv \frac{Y}{L} \cdot \frac{L}{E} \cdot \frac{E}{N_{LF}} \cdot \frac{N_{LF}}{N_{WA}} \cdot \frac{N_{WA}}{N} \tag{2}$$

where: Y/L = Labor productivity per hour (p)
L/E = Hours worked per worker (h)
E/N_{WA} = Employment rate (e)
N_{LF}/N_{WA} = Labor force participation rate (ℓfp)
N_{WA}/N = Share of working age population in total population (n_{WA})

Taking logs, growth of GDP and of GDP per capita can be proxied as follows:

$$\Delta y = \Delta p + \Delta h + \Delta e + \Delta \ell fp + \Delta n_{WA} + \Delta n \quad (3)$$

$$\Delta \frac{y}{n} = \Delta p + \Delta h + \Delta e + \Delta \ell fp + \Delta n_{WA} \quad (4)$$

Thus, growth of GDP per capita can be proxied by the sum of percentage changes of labor productivity per hours worked, the number of hours worked per worker, the employment rate, the labor force participation rate and the share of the working age population in total population; growth of GDP can be derived by adding the percentage change of population. By applying a standard production function, under perfect competition and constant returns to scale, the contributions of factor inputs and the technical progress to output can be formalized as

$$Y = A \cdot F(L,K), \quad (5)$$

where A is a term for the level of Hicks-neutral technical progress, F is the production function, L is labor and K is physical capital. Assuming a Cobb-Douglas production function and taking logs yields

$$y = a + \alpha \ell + (1-\alpha)\, k, \quad (6)$$

and multi-factor productivity (MFP) growth (technical progress) can be proxied by the so-called Solow residual as

$$\Delta MFP = \Delta y - \alpha \Delta \ell - (1-\alpha)\Delta k. \quad (7)$$

Labor productivity growth can then be expressed as the sum of MFP growth and the capital deepening effect,

$$\Delta y - \Delta \ell = \Delta MFP + (1-\alpha)(\Delta k - \Delta \ell). \quad (8)$$

Furthermore, growth of output can be expressed as the sum of MFP growth, capital deepening and labor input growth,

$$\Delta y = \Delta MFP + (1-\alpha)(\Delta k - \Delta \ell) + \Delta \ell, \quad (9)$$

or as the sum of MFP growth and the weighted average of labor input growth and capital stock growth, with wage and profit shares as weights,

$$\Delta y = \Delta MFP + + \alpha \Delta \ell + (1-\alpha)\, \Delta k. \quad (9a)$$

Growth of output per capita can be expressed as the sum of MFP growth, capital deepening and labor input growth minus population growth,

$$\Delta y - \Delta n = \Delta MFP + (1-\alpha)(\Delta k - \Delta \ell) + \Delta \ell - \Delta n \quad (10)$$

or

$$\Delta y - \Delta n = \Delta MFP + \alpha \Delta \ell + (1-\alpha)\, \Delta k - \Delta n. \qquad (10a)$$

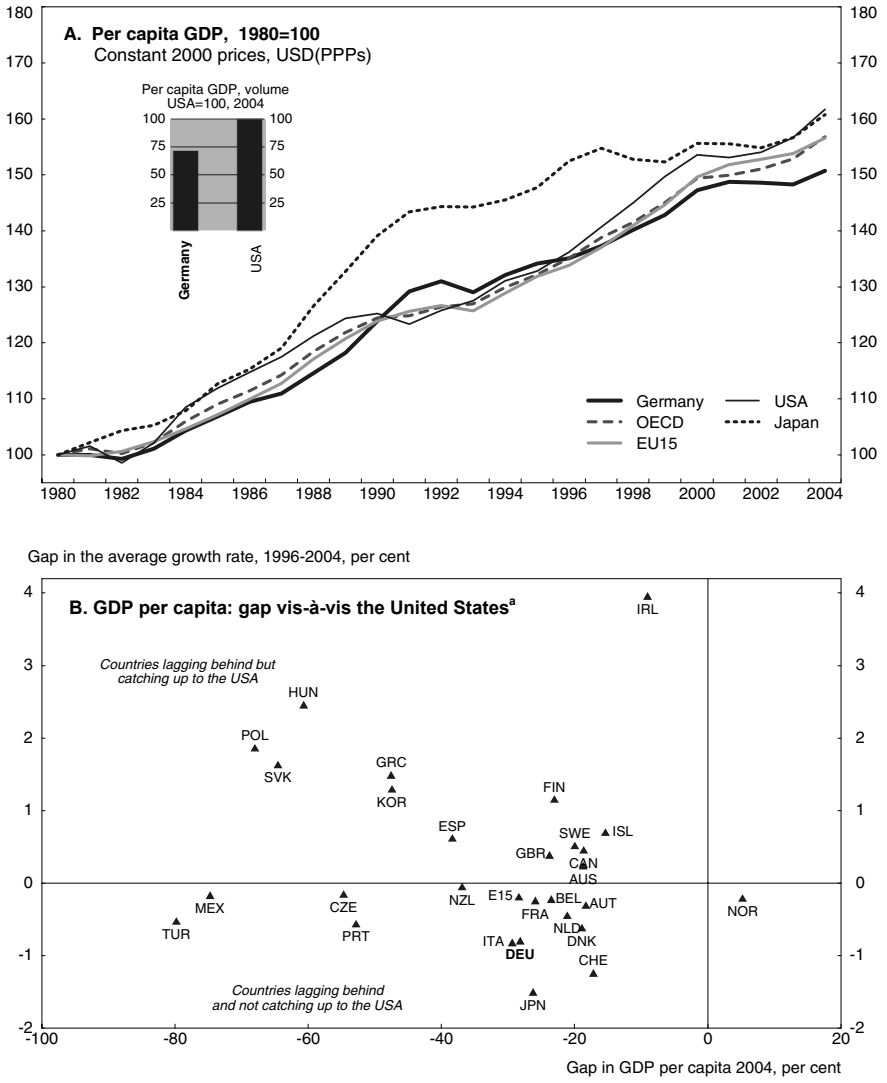
As aging leads to a deceleration in labor input growth (or an absolute decline), output growth declines if labor productivity growth (i.e., the sum of MFP growth and capital deepening) does not accelerate at the same time. But if aging would also reduce labor productivity growth, the reduction of output growth would be bigger than its effect through labor supply. GDP per capita growth is also affected by aging but less than output growth as population growth also declines (or becomes negative).

2.2 Past Growth Trends

Over the past ten years (1996–2005) Germany's average annual economic growth was only 1½ per cent, down from around 2¼ per cent both in the first half of the 1990s (which was, however, affected by the unification boom) and in the 1980s, after 2¾ per cent in the 1970s. While it is natural, that after a long period of catching up (as in particular during the 1950s and the 1960s) growth decelerates in a highly developed country, the recent weakening of Germany's growth was more pronounced than in many other industrial countries. At the same time (and counter to textbook growth theory) the US economy remained on its steep growth path despite its high income level. As a result, Germany's income gap vis-à-vis the United States which had narrowed until the early 1980s and then remained broadly constant until the early 1990s widened to 28% (in purchasing power parities) in 2004 (Figure 1 A). The deceleration of German output (and output per capita) growth was caused by both lower productivity growth (including lower MFP growth) and – to a lesser extent – lower growth in labor input. Demographic factors played only a minor role in the recent weakening of growth, and with a better utilization of the potential labor force, or labor potential, Germany's growth would have been significantly higher.[1] Germany thus belonged to the group of countries with income levels lagging behind the United States and achieving lower growth, while other OECD countries continued catching-up (Figure 1 B). Lower utilization of the labor potential remains to be the reason for Germany's income gap relative to the United States but there exists also a productivity gap, which – at first sight – appears to be relatively small (Figure 2).[2]

[1] For an analysis of past growth in Germany and other OECD countries see OECD (2003).

[2] As discussed below, labor productivity and labor utilization are, however, to some extent interrelated as with the drop-out of lower-skilled workers average productivity of the remaining workforce increases. Germany's structural pro-

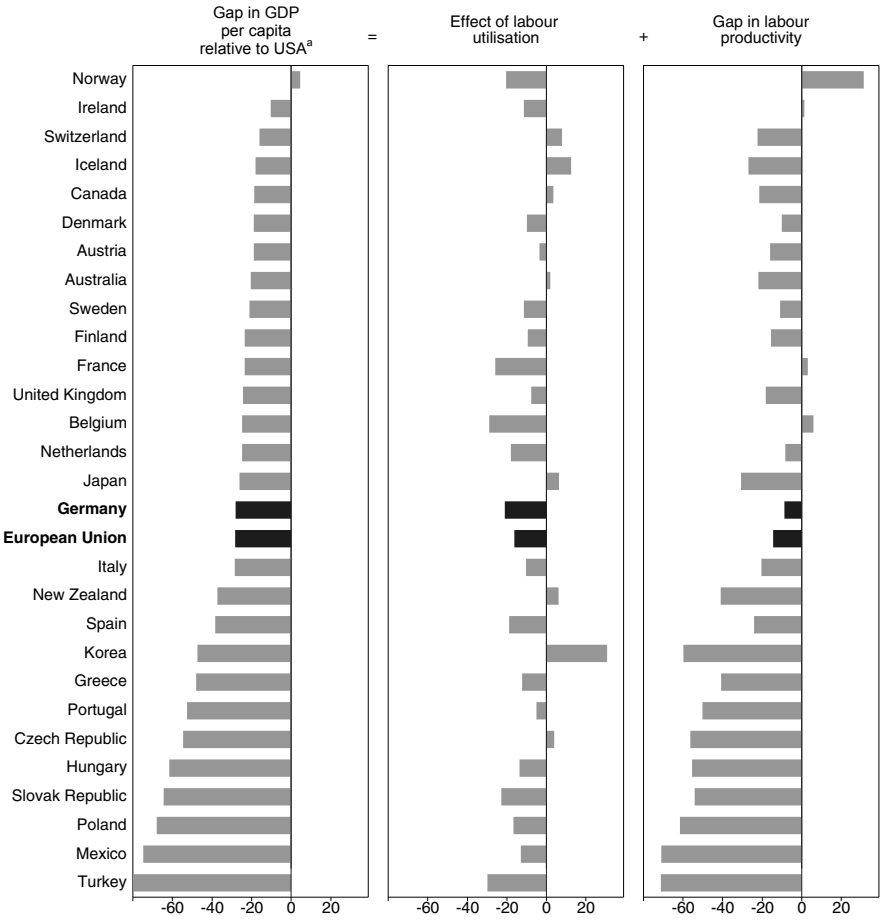


[a]The average growth rate of GDP per capita is calculated in constant 2000 prices, USD (PPPs), over the period 1996–2004. The level of GDP per capita is for 2004.

Source: OECD, Main Economic Indicators database; OECD, National Accounts database.

Fig. 1. Germany's growth performance in comparison

ductivity gap vis-à-vis the United States is therefore bigger than the statistically measured gap.



[a]The income gap is measured as percentage point differences in GDP per capita in USD (PPPs) relative to the United States, 2004. It is equal to the sum of the three components shown. The effect of labor utilization is based on total hours worked per capita. Productivity is measured on a per-hour basis.

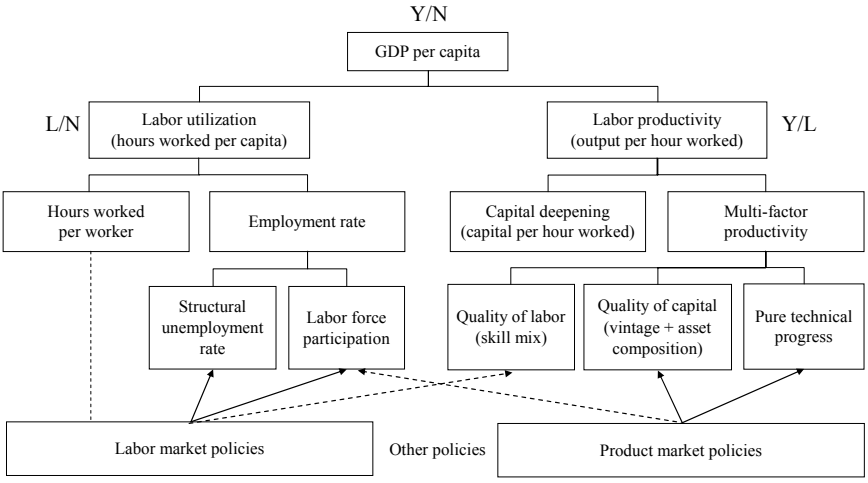
Source: OECD, Economic Policy Reforms: Going for Growth, 2006.

Fig. 2. Breaking down the income gap

3 Future Demographics and Growth

By changing the number and the shape of the workforce aging tends to reduce labor supply which tends to reduce economic growth. But how growth of output and output per capita will finally change is not easy to

tell and – as is often the case with complex issues – there are different views about such effects. The issue can be separated into a more easy and a more difficult part. The first is making the simplistic assumption that growth of labor productivity is not affected by aging so that its effect on growth can be derived from its effect on the population at working age and – with additional assumptions about the utilization of labor potential – on effective labor supply. The more difficult part is finding out how labor productivity is affected by aging. This involves assessing the demographic effects on all factors which determine productivity, such as the capital labor ratio (capital deepening), the skill level of the workforce (human capital) and technical progress (multifactor productivity). Figure 3 provides an overview about the various factors which affect long-term growth of GDP per capita. In the following these issues are discussed in turn.



Source: OECD.

Fig. 3. Determinants of GDP per capita

3.1 Impact Through Labor Supply

In an aging society labor supply tends to fall which reduces economic growth. This can be seen from the above-mentioned identities. Thus, if growth of labor supply (as defined by the total number of hours worked) declines or becomes negative, growth of GDP is reduced unless growth of labor productivity is not increased accordingly. Growth of GDP per capita is also reduced as the share of labor supply per capita of the population falls. A closer look reveals, however, that the analysis of aging on growth

is more complex. If growth of labor productivity is also adversely affected by aging, the negative effect on economic growth would be bigger. By contrast, if an aging society manages to raise its utilization of labor potential, the negative effect of the demographic change on labor supply will (at least partly) be compensated during the period of transition to the higher labor utilization.

As explained above, there are basically three channels to raise the utilization of labor potential: (1) by increasing the share of the labor force in the total population at working age (participation rate), for example if women or older workers participate more in the labor market; (2) by reducing unemployment (employment rate); (3) by increasing the average number of hours worked per worker, for example by reducing part-time work or increasing the number of full-time working hours. Given that in Germany (as in some other European countries) the utilization of labor potential is currently low, there is room to compensate (at least partly) the negative effect of demographics on labor supply. As labor participation and working time are affected both by people's preferences and by economic policies much depends on how these will change in the future. Increased life expectancy and concern about the level of pensions could encourage people to work longer. Furthermore, if labor becomes scarce, wages should increase which may attract people to increase labor supply.[3] Last not least, policies may become more "employment-friendly" as it is now widely understood that any measures which tend to reduce labor utilization, such as early retirement schemes or obstacles to female labor participation are aggravating the adverse effects of aging on the economy.

In Germany, according to national demographic projections, the population at working age is projected to decline by almost 9.5 million or by about one fifth until 2050 although most of the decline will be after 2020. The average annual decline of the working-age population will be around ¼ per cent until 2020 and around ¾ per cent from 2020-2030 (Table 1). Thus, if the employment rate and the labor participation rate would remain unchanged, the growth of the number of workers would decline by the same rate If growth of labor productivity (per worker) would continue its

[3] However, the effect of higher wages on labor supply is in theory ambiguous due to opposing "substitution" and "income" effects: a rise in the wage increases the price of leisure relative to work and thus encourages working (substitution effect); at the same time if consumers have a targeted flow of consumption, higher wages increase disposable income of workers so that less labor supply is needed to achieve this level of consumption (income effect). Thus higher wages increase labor supply only if the substitution effect is bigger than the income effect.

recent trend of 1¼ per cent, the demographic change would limit annual growth of GDP and of GDP per capita to around 1% until 2020 and around ½ per cent in 2020-2030.While such changes are significant, average income levels would by the mid-2020s still be more than one fifth higher than today.

Table 1. Demographic projections for Germany

	2004	2010	2020	2030	2040	2050
Total population (million)	82.5	83.1	83.5	82.7	80.7	77.7
Population at working age (15-64, million)	55.5	54.9	54.0	50.0	46.9	45.0
Share of population at working age in total population	67.3	66.1	64.7	60.5	58.1	57.9
	Average annual % change					
		2004-2010	2010-2020	2020-2030	2030-2040	2040-2050
Total population (million)		0.1	0.1	-0.1	-0.2	-0.4
Population at working age (15-64, million)		-0.2	-0.2	-0.8	-0.6	-0.4
Share of population at working age in total population		-0.3	-0.2	-0.7	-0.4	0

Source: OECD.

Illustrating the mechanical demographic effects on labor supply and growth provides only a starting point for the analysis of the effects of aging on the economies. Two other questions are also important: first, how many people at working age will actually look for a job and also find one, and second, how will productivity growth be affected by aging? The second question is highly complex and depends on a number of factors, in particular on how savings, investment, labor efficiency and innovation are affected by aging.

3.2 Impact Through Labor Productivity

Sustaining a relatively high level of productivity growth is of key importance for an aging society in order to maintain growth of living standards. Over the past decades productivity growth has been the main driver for the rise in living standards and this will be even more the case in the future when labor supply is depressed by aging.

In theory, countries with a currently relatively low level of productivity should be able achieve above-average productivity growth in the future.

The reason is that these countries could adopt technologies and organizations which exist already in the countries with higher productivity, while the countries that are at the technological frontier have to shift it further up in order to raise productivity which should be more difficult. As shown above Germany's average level of productivity is currently somewhat lower than that of the leading US, but the difference is not very big which suggests little catching-up potential. However, Cette (2005) finds that if one adjusts Germany's level of productivity per hour for the lower working time and the lower employment rate as compared with the United States the level of productivity per hour would be around 12% lower than statistically measured so that Germany's productivity gap vis-à-vis the United States would be around 20% rather than less than 10% implying a larger catching-up potential.[4] Nevertheless, as shown above, in the past ten years or so Germany was not able to catch up to the higher US level of productivity and the productivity gap continued widening. Current trends do not point to a major change.

Productivity can be increased through various channels, in particular by raising workers' level of skills (increasing human capital), by equipping workers with more fixed capital (increasing capital intensity or capital deepening) and by higher growth of multifactor productivity (MFP). The latter is the sum of all efficiency gains which raise output growth above the rate which can be attributed to the change of factor inputs (labor and capital). It is therefore important how these sources of productivity growth will be affected by the aging of the population.

[4] In Germany productivity growth per worker was over the past decades on average by around ½ percentage point lower than productivity growth per hours worked. The reason was that labor input per worker declined as a result of shorter collectively-agreed working weeks and longer holidays and more part-time work which reduces productivity per worker and raises productivity per hour. Furthermore the rising unemployment tended to raise average productivity (both per worker and per hour) as low productivity workers were more affected by unemployment. This means that if Germany would increase its annual working time and its rate of employment to the US level its average productivity per hours worked would decline. Output and output per capita would still increase, however, as the previously unemployed would now also contribute to production so that the increase in labor utilization would be larger than the decline in average productivity. The same is true for some other European countries. For France, Cette (2005) finds that the lower labor utilization vis-à-vis the United States increases the statistically measured labor productivity by more than 13% which explains why in France the statistically-measured productivity is higher than in the US.

Level of Skills

Upgrading the level of skills of the workforce (human capital) is an important source of productivity growth both for catching-up economies and for those which have already achieved a high level of skills (as expressed by the term "knowledge society"). Germany as well as other aging countries may increase its efforts to equip its declining labor force with more skills so that part of the lower labor supply is compensated by additional productivity. Germany's relatively low scoring in the PISA exercise and its relatively low tertiary graduation rates and long study durations indicate that improvements in the education system are needed.

Aging can affect human capital in different ways. As the level of education tends to be higher for younger than for older age groups, the average level of skills of the labor force tends to increase with aging as more of the older cohorts go into retirement. This would boost labor productivity. However, the share of older workers in the workforce increases with aging and if productivity declines at older age this would lower average productivity of the workforce. Thus, much depends on the productivity profile of workers over their lifetime. An optimistic view is that productivity of an average worker increases until it reaches a peak during the forties and remains constant thereafter while a pessimistic view assumes that it falls moderately or – more pessimistic – falls sharply after this peak; in the latter case aggregate productivity growth could fall significantly with aging.

The lifetime profile of productivity of workers depends on the quality of education at the beginning of the career and also on the training during working life (life-long learning). Life-long learning can be affected by providing incentives including wage systems; performance-based wage systems provide more incentives for training than seigniority-based systems where older workers receive higher wages even if their productivity falls. The incentives for life-long-learning are also lower if workers retire early as the rate of return on training is lower for workers (and their firms) if the newly acquired skills can be applied only over a shorter remaining working life. All this means that if the fewer future workers are getting better schooling and engage more in life-long training as their working life becoming longer with increased life expectancy and elimination of early retirement schemes, and also remain in good health, they may be able to sustain their productivity at a relatively high level. By contrast if workers are less able or willing to acquire the skills needed or if their health conditions deteriorate when they are getting older, the aging of the workforce could restrain future productivity growth.

Capital Intensity (Capital Deepening)

Another main channel for gains in labor productivity besides the quality of labor is the accumulation of physical capital. By equipping fewer workers with more capital (capital deepening) aging societies can increase labor productivity and (at least partly) offset the adverse effect of deteriorating demographics on living standards. For example, in manufacturing robots have more and more replaced workers and there exist already factories with robots producing robots. The trend of substituting labor by capital is also visible in the service sector such as banking services and other services and could further accelerate also in health care services. If on the other hand saving and investment would decline because of aging, the capital deepening effect would be smaller which would reduce productivity growth.

The *life-cycle hypothesis of savings* suggests that people are saving during their working life and are running down their assets during retirement; such saving/dis-saving behavior is rational as it smoothes consumption over the entire lifetime. As in an aging society the number of workers who are savers declines relative to the number of pensioners who are dis-savers, total net savings of households fall after a peak. This could lead to a fall in growth of the fixed capital stock (if the gap is not filled by more foreign direct investment inflows). In the extreme case with gross investment falling below depreciation of the existing capital stock so that net investment becomes negative, the capital stock would shrink and workers would be equipped with a smaller capital stock which would reduce their productivity.

Thus, all depends on how big the effects of aging on saving and investment are. With a declining workforce there may still be a boosting of productivity through capital deepening (if the capital stock declines less) despite a weakening of saving and investment. As in an aging society labor becomes scarce relative to capital real wages should increase relative to capital costs which favors capital deepening and boosts labor productivity.[5] However, when assessing the effect of aging on saving and investment and relative factor prices one also has to consider that economies have become more open. In an open economy with fully integrated capital markets capitals interest rates are determined by global investment-saving balances.

[5] For example, in a model simulation (a so-called overlapping-generation general equilibrium model), Miles (1997) found that in Europe aging leads to a significant fall in saving and investment but as labor supply also falls the capital-labor ratio increases. Nevertheless, according to this model the level of GDP par capita will by 2050 be just under 25% lower than it would be with an unchanged demographic structure.

This could mitigate the change in relative factor prices and thus the additional capital deepening effect in rapidly aging countries as compared to a situation with closed capital markets.

The effect of aging on saving also depends on how policies respond to the challenge of aging. For example, if governments raise taxes to finance higher pension expenditure, income is redistributed from the high-saving working-age population to low saving or dis-saving pensioners so that the negative effect of aging on household saving is exacerbated. If instead pension reforms reduce the generosity of public pensions, people have to save more for their old age which could boost savings of younger generations.

Aging may, however, have less influence on savings than the pure life-cycle hypothesis suggests. Older people often continue to save rather than dis-save. So rather than running down their assets during retirement they continue building-up assets and transfer big amounts of wealth to their children and grand children and it is unclear how this bequest motive will change in the future. Furthermore, as people live longer they may increase their precautionary saving at all ages. This effect could, however, be reduced again if at the same time the effective retirement age increases more than life-expectancy so that the (expected) time in retirement declines.

While some empirical studies find evidence that aging reduces private saving (i.e., that life-cycle saving dominates), other empirical studies find only small or no effects. But this latter result could also reflect mismeasurement,[6] or the fact that in the past demographic changes were very small so that their effects on savings are difficult to identify; with demographic changes becoming larger in the coming decades, the life-cycle theory of saving may reflect saving behavior better than in the past. Furthermore, the existence of generous public pension systems may have reduced the importance of retirement savings so that current saving patterns are dominated by other saving motives.[7] But with the generosity of public pensions declining, younger generations will have to increase their retirement savings so that their saving patterns may become more in line with the life-

[6] For example pension receipts from funded pension systems are generally counted as income in the private household account although a good part of it stems from running down assets and represents dis-saving.

[7] Saving for retirement is only one among many determinants for household savings. Others are hedging against various risks, saving for the purchase of residences or durable consumer goods (cars etc.) or, as mentioned above, saving for bequests. Saving tends to increase with higher income (or income growth) and with higher real interest rates and it is also affected by government policies as social security and the tax system.

cycle theory of savings. The transition period towards a higher level of savings could then be used to increase productivity through increased capital deepening.

Given all these uncertainties there are very different views about how important the demographic effects on savings are in reality. For example, at one extreme it was estimated that an increase of 1 percentage point in the old-age dependency ratio (i.e. the ratio between pensioners and workers) causes an almost commensurate fall in the savings ratio; such high savings sensitivity to demographics is consistent with the results typically found in calibrated overlapping-generations models. At the other extreme, evidence from household surveys suggests that an increase of 1 percentage point in the dependency ratio reduces the private savings ratio by only 0,14 percentage points (Masson et al. 1995).

When looking at the effect of aging on domestic saving, the effects on government saving should also be considered. For example, if governments are slow to adopt reforms in their welfare systems, their saving could be significantly reduced by aging (through increasing government deficits) so that the fall in domestic saving would be more pronounced. The associated rise in government deficits and debt could raise interest rates and "crowd out" private investment and reduce productivity growth.[8] More recently real long-term interest rates have remained low, however, despite the increase in government deficits in particular in the larger OECD countries, but this should not be taken as evidence that this situation will prevail over the longer term.

Governments may prevent a fall in their savings by following prudent fiscal policies and by implementing appropriate pension reforms. In Germany the prolonged economic weakness and insufficient structural reform have increased the deficit of the general government to above the Maastricht ceiling of 3%, and with almost 68% in 2005 the debt-to-GDP ratio is now also well above the Maastricht ceiling of 60% and continues to rise. Such trends are in contrast to the needs of preparing for the aging of the population. The new German government has taken measures to restore fiscal sustainability and it has to be seen if it will be successful.

---

[8] It has been estimated (for the US) that a 1-percentage point rise in the government deficit raises interest rates by 0.25 percentage point (Laubach 2003). For Germany it has been estimated that a 1-percentage point increase in the expected budget deficit ratio increases the government risk premium (as measured by government financing costs relative to high-quality private debtor's funding costs) by 8 basis points. The authors argue, however, that the overall effect is likely to be higher as a potential rise in real interest rates must be added to the changes in the swap spread (Heppke-Falk and Hüfner 2004).

Technological Innovation (Multi-factor Productivity)

As growth in inputs of labor and capital tends to slow down in aging economies, economic growth will increasingly depend on growth of multi-factor productivity (MFP). This in turn is mainly driven by innovation. Germany belongs to the countries with strong innovation activity even though its position relative to other industrial countries has somewhat weakened recently. In particular, Germany has benefited less than some high-performing countries from new technologies, such as ITC. This has resulted in a deceleration in Germany's MFP growth in the 1990s in contrast to some other OECD countries, such as Ireland, the Nordic countries, the United States, Canada, Australia and New Zealand, where MFP growth accelerated (see OECD 2003). In the past, Germany's innovation activities have focussed more on medium-tech sectors, such as machinery and automobiles where it has preserved a strong export performance. With rapid globalization, competition in medium-tech sectors will further increase and Germany has to strengthen its high-tech sectors and move closer to the world technology frontier in these sectors in order to sustain its high living standards. It has been noted that Germany's potential to innovate could be increased by removing obstacles in product, capital and labor markets which would help increasing risk capital, developing innovative firms and reallocating labor to more productive sectors (see Fuentes et al. 2004).

There are different views about the effects of aging on MFP growth. If an aging society reduces economic dynamism by becoming more protectionist and more redistribution-focused and spends less on R&D, MFP growth declines. Furthermore, if markets for capital goods shrink, innovation becomes less profitable and certain technologies may become inefficient and inapplicable. Some have also argued that with less people there may be less chances for clever inventors to be born. On the other hand, as labor is becoming the scarce factor of production there could be pressure for more labor-saving innovation which would tend to raise technical progress and MFP. An aging society may also benefit from the global environment by importing innovation from abroad through foreign direct investment and international R&D linkages, by importing new products and by attracting high-skilled workers and researchers. This requires, however, that the economy is open and flexible enough to adjust. Maintaining a high level of human capital and enough saving and investment also helps to sustain MFP growth as qualified labor and a modern capital stock are important sources for the creation and diffusion of innovation.

Aging is also expected to affect productivity through its impact on the pattern of demand. When people are young they are spending more on education and entertainment and when they are getting older they spend

more on housing and health care. Older people also spend less on motor vehicles as they drive less. If the net result of aging is a shift towards labor intensive services, average productivity growth would be reduced. Work by the OECD suggests, however, that the size of age-induced changes in consumption patterns is relatively small and does not lead to major structural changes in the economy (Martins et al. 2005).

Given these complex relationships between aging and the various sources of productivity it is unclear how in the end productivity growth will be affected by aging. If the possible negative effects as mentioned above come together, productivity growth could be significantly reduced. But it is also possible that the net effect on productivity growth will be rather small or that productivity growth even increases as labor becomes scarce and is equipped with more skills and more capital. Last but not least, the net effect on productivity growth will also depend on how policies respond to these challenges. It is of particular importance for an aging country like Germany to pursue "growth-friendly" policies. As discussed above, economic growth can be enhanced by appropriate macro policies, in particular sound public finances, and by appropriate structural policies increasing labor market flexibility, which improves job creation and facilitates the reallocation of labor to its most productive use, enhancing competition by eliminating barriers to trade and capital flows, improving conditions for human capital formation and research and development, and removing barriers for the formation of new enterprises and other regulations which hamper competition in markets for goods and services. Such policies do not only increase the level of productivity and GDP per capita (static gains) but may also lead to permanent higher growth of productivity and GDP per capita (dynamic gains). It has been estimated that combined reform measures along these lines could raise growth in living standards by as much as 0.7, 0.6 and 0.3% per annum for the European Union, Japan and the United States respectively relative to the "business-as-usual" case (see, again, Martins et al. 2005).

4 Long-Term Growth Scenarios

The discussion in the previous section suggests that aging tends to reduce economic growth. The main channel is the lower growth of labor supply. However, the adverse demographic effects on growth can be mitigated or perhaps temporarily outweighed by increasing labor utilization. Furthermore, there is some risk that aging will reduce productivity growth although there is much uncertainty about how much. Nonetheless, the non-

age related sources of growth, in particular technology and human-capital driven productivity gains, could still offset at least part of the adverse effects from the demographic change so that the level of living standards could still increase, although by less than without aging. The OECD Secretariat and the EU Commission have attempted to shed some light at the possible quantitative effects of aging on growth and on the impact of different policies.

4.1 Growth Scenarios by the OECD

Baseline Scenario

According to a long-term scenario by the OECD, Germany's annual growth of potential GDP will decline after 2010. In 2020-2030 it will be only 0.6 per cent p.a.. which is less than half of what it is in 2000-2010. Annual growth of potential GDP per capita is projected to decline a bit less (to 0.8 per cent; Table 2). The decline in growth is caused by the lower labor supply as the fall in the working-age population after 2010 is not compensated by a further increase in labor force participation or a fall in structural unemployment. It should be mentioned, however, that this baseline scenario does not consider any additional policy measures which might be taken to further raise the participation rate and reduce structural unemployment. At the same time, potential productivity growth is assumed to increase somewhat from its currently depressed level. With these assumptions Germany's level of GDP per capita is projected to be by one third higher in 2030 than in 2005, despite the negative effect of demographics.

The aging of populations will also reduce growth in other European and non-European countries. In the Euro area growth of potential GDP is projected to remain somewhat higher than in Germany as in most other Euro countries the negative effect from demographics is smaller. It is interesting to note, however, that according to this scenario the difference in future growth of GDP per capita between Germany and the Euro area is very small. The reason is that Germany's productivity growth – which is the main determinant of GDP per capita growth - is assumed to be similar as in the Euro area. In the United States growth is also projected to decline as a result of demographics but will remain significantly higher than in Europe. Growth of potential GDP is projected to fall to 2.6 per cent p.a. after 2010 (from slightly above 3 percent in 2000–2010) and growth of GDP per capita to 1¾ per cent (from above 2%). The reason for the higher US growth is that growth of labor supply will decelerate less and remain positive and that productivity growth is assumed to remain higher than in Europe. According to these scenarios the gap in GDP per capita levels be-

tween Germany and the United States will continue to widen from 28% in 2004 (in purchasing power parity) to 40% in 2030. Thus, although the average German citizen is projected to become richer in absolute terms, the income gap to the average American will continue to widen. The same is true for the average European citizen. While more pronounced aging in Germany and Europe contributes to the widening income gap, the lower productivity growth plays a much bigger role.

Model Simulations

By applying a general equilibrium model with overlapping generations, the OECD Secretariat has also made an attempt to illustrate, in a stylized way, how reforms in the labor market and in pension systems could compensate the effects of aging on growth (Martins et al. 2005). Table 3 shows the results for Germany. The first scenario in the table may be considered as a "no-reform" scenario as it assumes that higher pension payments are financed over time by raising the contribution rate, while leaving the replacement rate and the retirement age unchanged. The second "pension saving" scenario keeps the contribution rate constant after 2005 and the higher pension payments are financed by gradually reducing replacement rates for new retirees. As a result, households increase their savings (in the form of pension fund assets or other financial assets) in order to sustain their consumption after retirement. In the third scenario the statutory age at which individuals receive a full pension is raised by 1¼ years per decade. This is roughly in line with the projected increase in longevity. If the minimum amount of working years needed to receive a full pension is not met the replacement rate is reduced by 6% per year and the remaining imbalances in the pension system are covered by changes in the contribution rate. The fourth scenario combines the "pension saving" scenario with an optimistic policy scenario to raise utilization of labor potential. In this scenario older workers' labor market participation is increased by removing early retirement schemes, introducing actuarial neutrality of pension schemes with respect to retirement decisions, raising the statutory retirement to 67, raising female labor participation rate to that of men and modifying incentives for working full-time instead of part-time.[9]

As expected, economic growth is lowest in the "rising contribution" scenario. In the "pension saving scenario" growth is higher as the adverse demographic effect on labor supply is partly compensated by higher productivity growth resulting from the higher growth of the capital stock (capital deepening). In the third scenario growth is similar to the second

[9] For more details see Martins et al. a.a.O. and Burniaux et al. (2003).

Table 2. Medium and long-term projections

	Annual average rates of change				
	1995-2000	2000-2005	2005-2010	2010-2020	2020-2030
Germany					
A. Potential employment	0.2	0.3	0.1	-0.3	-0.9
Contribution from:					
A1. Working-age population	0.0	-0.2	-0.2	-0.2	-0.8
A2. Trend labor force participation	0.5	0.5	0.3	-0.1	-0.1
A3. Structural unemployment	-0.3	0.0	0.0	0.0	0.0
B. Potential labor productivity	1.0	1.2	1.5	1.6	1.6
C. Potential GDP	1.3	1.4	1.6	1.2	0.6
D. Population	0.1	0.1	0.1	0.0	-0.2
E. Potential GDP per capita	1.1	1.3	1.6	1.3	0.8
Euro area[a]					
A. Potential employment	0.8	0.8	0.3	-0.3	-0.7
Contribution from:					
A1. Working-age population	0.2	0.2	0.1	-0.2	-0.6
A2. Trend labor force participation	0.6	0.6	0.3	-0.1	-0.1
A3. Structural unemployment	-0.1	0.0	0.0	0.0	0.0
B. Potential labor productivity	1.2	1.2	1.6	1.6	1.6
C. Potential GDP	2.0	2.0	1.9	1.3	0.9
D. Population	0.3	0.3	0.2	0.1	0.0
E. Potential GDP per capita	1.8	1.6	1.7	1.2	0.9
United States					
A. Potential employment	1.4	0.8	0.9	0.3	0.4
Contribution from:					
A1. Working-age population	1.4	1.2	1.1	0.3	0.3
A2. Trend labor force participation	-0.2	-0.2	-0.1	0.0	0.0
A3. Structural unemployment	0.2	-0.2	-0.1	0.0	0.0
B. Potential labor productivity	2.0	2.1	2.3	2.3	2.3
C. Potential GDP	3.5	3.0	3.2	2.6	2.6
D. Population	1.2	1.0	0.9	0.8	0.8
E. Potential GDP per capita	2.3	2.0	2.3	1.7	1.8

[a]Excluding Luxembourg.

Source: OECD, Economic Outlook 77 and Secretariat calculations based on Medium-Term Baseline database and demographic projections.

Table 3. German GDP per capita growth under different policy scenarios

	Annual percentage changes					
	2001-2010	2011-2020	2021-2030	2031-2040	2041-2050	2001-2050
	'Rising contribution rate' scenario					
GDP per capita[a]	1.2	1.1	0.9	1.2	1.2	1.1
Labor apparent productivity	1.6	1.6	1.6	1.4	1.5	1.5
Capital per unit of labor	0.5	0.5	0.5	0.4	0.4	0.5
TFP	1.1	1.1	1.1	1.1	1.1	1.1
Labor force growth[b]	0.1	-0.4	-0.8	-0.5	-0.6	-0.5
Total population growth	-0.4	-0.1	0.1	0.3	0.4	0.1
	'Pension saving' scenario					
GDP per capita[a]	1.3	1.3	1.1	1.4	1.4	1.3
Labor apparent productivity	1.7	1.7	1.7	1.6	1.6	1.7
Capital per unit of labor	0.6	0.7	0.6	0.5	0.6	0.6
TFP	1.1	1.1	1.1	1.1	1.1	1.1
Labor force growth[b]	0.1	-0.4	-0.8	-0.5	-0.6	-0.5
Total population growth	-0.4	-0.1	0.1	0.3	0.4	0.1
	'Gradually increasing age of retirement' scenario					
GDP per capita[a]	1.3	1.4	1.0	1.6	1.3	1.3
Labor apparent productivity	1.5	1.5	1.5	1.4	1.6	1.5
Capital per unit of labor	0.5	0.5	0.5	0.3	0.6	0.6
TFP	1.1	1.1	1.1	1.1	1.1	1.1
Labor force growth[b]	0.3	0.0	-0.6	0.0	-0.6	-0.2
Total population growth	-0.4	-0.1	0.1	0.3	0.4	0.1
	'Pension saving' scenario, incl. potential changes in participation rates and retirement age[c]					
GDP per capita[a]	1.9	1.7	1.4	1.4	1.4	1.6
Labor apparent productivity	1.3	1.6	1.8	1.7	1.6	1.6
Capital per unit of labor	0.3	0.6	0.7	0.6	0.6	0.5
TFP	1.0	1.0	1.1	1.1	1.1	1.1
Labor force growth[b]	1.0	0.3	-0.5	-0.6	-0.6	-0.1
Total population growth	-0.4	-0.1	0.1	0.3	0.4	0.1

[a]GDP per capita growth is decomposed here into three contributions. The contribution of labor productivity is the sum of the contributions of growth of capital per unit of labor and TFP. TFP growth is 1.5 per cent and is assumed to be labor-augmenting; since the labor share in output is 0.7, the TFP contribution amounts to 0.7*1.5 per cent. The contribution of labor force growth equals the contribution of the employed population since unemployment rates are frozen after 2000. The contribution of total population is negative when total population grows.
[b]Participation rates are frozen at their 2000 levels except in the 'gradually increasing age of retirement' scenario.
[c]Following Burniaux et al. (2003).

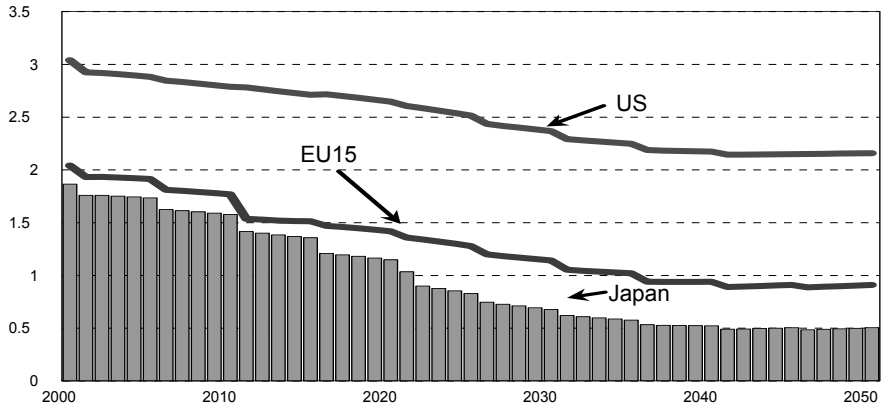
Source: OECD calculations.

scenario as in the third scenario, but here the higher growth compared to the first scenario is achieved by higher labor supply as older workers continue working longer. In the fourth scenario, which provides the highest growth, this is achieved by even higher labor supply, in particular until 2020 as the participation rate increases more. Furthermore productivity growth is also being boosted although less so than in the "pension saving" scenario as the rising capital stock meets with more labor supply so that capital intensity increases less. These simulations suggest that future growth is not just "given" but also depends on how the society responds to the challenge of aging.

4.2 Growth Scenarios by the EU Commission

The EU Commission, or more precisely, the Aging Working Group (AWG) attached to the Economic Policy Committee (EPC) and the Directorate General for Economic and Financial Affairs (DG ECFIN), has also carried out studies to examine the effects of aging on the EU economies. Similar to the work by the OECD these projections also consider the effects of aging on labor supply and on saving and investment but (also) not on innovation (multifactor productivity). According to these simulations, German growth will decline, especially in the period after 2020; the annual average rate of growth of GDP per capita will decline from a growth rate of 1.6 per cent p.a. projected for the next 15 years to an average of 1.3 per cent for the period 2020 to 2050. Growth will decelerate somewhat less than in the OECD baseline projection as labor input falls less and productivity growth is assumed to be a bit higher. Other EU member states are confronted with similar demographic trends. Therefore, per capita growth for EU25 will decline from an average rate of around 2.1 per cent projected until 2020 to about 1.5 per cent on average for the period 2021 to 2050. Growth of potential output in EU-15 is projected to decline from currently almost 2% to less than 1% by the mid 2030s. It will remain significantly lower than potential growth in the United States but higher than in Japan where the process of aging is even more pronounced (Figure 4).

Of course one must be aware that the decline of GDP per-capita growth will be smaller than the projected decline in GDP growth. While in the case of Germany GDP growth is projected to decline from 1.8% over the period 2005-2020 to about 1.1% after 2030, GDP per capita will only decline from 1.8% to 1.3%. Table 4 provides detailed information on the relevant demographic and technological trends underlying this scenario for Germany.



Annual percentage changes

Source: EU Commission

Fig. 4. Impact of aging on potential growth rates in the EU-15, the U.S. and Japan

The demographic trends, which are based on EUROSTAT projections, show a continuous decline in the population of working age from 2005 to 2050. This decline will accelerate after 2020 and will reach negative growth rates of around –0.7% per annum around 2030. The projections assume that the decline will slow down in later years. This is primarily due to an assumed increase in the fertility rate from 1.4 until 2030 to 1.5 afterwards. Consequently employment growth will eventually turn negative as well. In the projections of the AWG there are two factors which postpone this process, an increase in labor force participation and a decline in structural unemployment. Indeed, in Germany there has been a trend increase in the participation rate since the early 80s from around 66% to 67% in the early 90s and a visible acceleration in the 90s to 73% in 2005. The projections are based on a so called 'cohort method' which takes into account the age profile of the population in projecting the participation rate forward. As can be seen from the table, the crucial assumption underlying a continued increase in labor force participation is a strong increase in the participation of the age cohort 55-64. Thus the projection assumes an increase in the effective retirement age.

Concerning the unemployment rate, the projection assumes a decline from 9.4 per cent in 2005 to 7% in the longer term, i.e. it is assumed that the structural unemployment rate will reach a level of 7% in the medium term. Unlike other EU countries, Germany so far has not achieved a trend reversal in the structural unemployment rate. For example, in the Euro area as a whole structural unemployment peaked in 1996 with 9.3 per cent and

has declined to 8.2 per cent in 2005, while Germany's structural unemployment rate has increased from 7.4 to 8.6 per cent over the same period. However, based on the experience of other countries and the labor market reforms which have recently been undertaken, the projected decline to 7% does not seem out of reach. At the same time, we have to take into account that the increase in pension contribution rates due to aging is putting upward pressure on non-wage labor costs. Without any reform in the generosity of the pension system the contribution rate which is currently close to 20% could approach nearly 40% in 2050. Various reform efforts have been undertaken in recent years, with the goal of stabilizing the contribution rate below 23% in 2030 (see, for example, Börsch-Supan and Wilke 2004). While most labor market theories suggest a positive causal relationship between labor taxes and unemployment, no general consensus about the actual tax elasticity of unemployment has yet been reached. For the European Union, the empirical evidence ranges from a total absence of an effect (see Blanchard and Wolfers 2000) to an unemployment tax elasticity of up to 0.59 (see Daveri and Tabellini 2000). Notice, however, that the effects found in empirical studies tend to be stronger for continental European countries. These countries tend to have a stronger focus on wage income as a base for social security taxes. It can be argued that raising social security contributions while leaving social benefits unaltered has been a major reason why structural unemployment increased.

Not included in the employment projections are trends in hours worked. It is true that in 2002 the trend decline in hours worked has come to an end. It is, however, not clear whether a further increase in the participation rate will not be associated with an increasing share of part time workers and thus a further decline in average hours worked.

In the scenario it has been assumed that MFP growth in the EU will return to a growth rate that prevailed on average over the period 1970-2004, namely 1.1 per cent. Against the background of a secular decline in MFP growth this assumption appears to be optimistic. On the other hand, it can be argued that several OECD countries have actually managed a turnaround in MFP growth, most importantly the US, but also some EU countries such as Ireland, Finland and Sweden. In fact, the long-term MFP growth trend comes close to the MFP growth rate in the US (1.2 per cent). A trend reversal for the other EU countries, including Germany, does not seem impossible. In light of the post war experience of continued technological catching up of Europe with the US it seems not unreasonable to assume that the EU will not permanently diverge technologically from the US. Undoubtedly, MFP growth acceleration in the US, Ireland and the Scandinavian countries in the last 10 years has benefited from a high IT

Table 4. Baseline scenario of the EU for Germany

	2004	2005-2010	2010-2020	2020-2030	2030-2040	2040-2050
	Demographic assumptions					
Fertility rate	1.4	1.4	1.4	1.4	1.5	1.5
Life expectancy at birth:						
Males	76.1	76.7	78.0	79.6	80.7	81.6
Females	81.7	82.3	83.5	84.8	85.8	86.5
Life expectancy at age 65:						
Males	16.1	16.5	17.4	18.4	19.2	19.8
Females	19.5	19.9	20.9	21.9	22.6	23.1
Net migration (thousand)	270.0	240.0	229.0	214.0	205.0	200.0
Net migration (% of population)	0.3	0.3	0.3	0.3	0.3	0.3
Population (million)	82.5	82.9	83.4	83.2	81.7	79.3
Population aged 0-14 (% of total)	14.7	14.0	13.3	13.1	12.6	12.2
Prime-age pop. (25-54; % of total)	43.6	43.2	41.7	37.8	36.5	35.6
Work. age pop. (15-64; % of total)	67.3	66.4	65.8	62.8	58.8	58.1
Pop. aged 65+ (% of total)	18.0	19.6	20.9	24.1	28.6	29.7
Pop. aged 80+ (% of total)	4.2	4.6	5.8	7.5	8.6	11.4
Pop. aged 55+ (% of pop. 15-64)	54.9	56.3	60.4	69.8	74.9	75.0
Dependency ratios:						
Share of older workers[a]	11.2	12.4	17.5	21.4	18.6	19.8
Old-age dependency ratio[b]	26.8	29.5	31.9	38.5	48.8	51.2
Total dependency ratio[c]	48.7	50.5	52.1	59.4	70.2	72.1
Total economic dep. ratio[d]	125.1	119.6	109.0	117.8	131.3	133.7
Econ. old-age dep. ratio (15-64)[e]	39.5	41.8	42.6	50.9	64.3	67.8
Econ. old-age dep. ratio (15-71)[f]	39.0	41.3	42.1	50.0	63.1	66.7

[a]Population aged 55-64 as a percentage of the population aged 15-64
[b]Population aged 65 and over as a percentage of the population aged 15-64
[c]Population aged less than 15 and 65 and over as a percentage of the population aged 15-64
[d]Inactive population (total population less those employed) as a percentage of the employed population aged 15-64
[e]Inactive population aged 65 and over as a percentage of the employed population aged 15-64
[f]Inactive population aged 65 and over as a percentage of the employed population aged 15-71

production share. While it will be difficult to replicate the same pattern of specialization in all EU countries, it has also been argued (see Inklaar et al.

Table 4. Baseline scenario of the EU for Germany (continued)

	2004	2005-2010	2010-2020	2020-2030	2030-2040	2040-2050
	Macroeconomic assumptions					
Real GDP (growth rate)	1.1	1.8	1.8	1.0	1.1	1.3
Labor input (growth rate)	0.4	0.9	0.3	-0.7	-0.6	-0.4
Labor productivity (growth rate)	0.7	0.9	1.5	1.7	1.7	1.7
Contrib. of capital deepening	0.1	0.1	0.4	0.6	0.6	0.6
Contrib. of MFP growth	0.5	0.8	1.1	1.1	1.1	1.1
GDP per capita (growth rate)	1.1	1.7	1.8	1.1	1.3	1.6
GDP (2004 prices; mill. Euros)	2 177	2 299	2 669	3 044	3 355	3 804
GDP per worker	20.3	21.4	24.6	28.2	31.6	36.9
Real interest rate	3.0	3.0	3.0	3.0	3.0	3.0
	Labor force assumptions					
Pop. growth (work. age: 15-64)		-0.2	-0.2	-0.7	-0.7	-0.4
Labor force (million)	40.5	41.5	43.1	41.1	38.0	36.5
Participation rate (15-64)	73.0	75.3	78.6	78.7	79.1	79.2
young (15-24)	50.5	51.3	52.3	51.8	51.5	52.0
prime-age (25-54)	86.5	87.6	88.9	89.7	90.0	89.8
older (55-64)	45.9	53.6	67.0	68.7	68.9	70.1
oldest (65-71)	6.2	6.4	7.7	8.7	8.3	8.5
Employment rate (15-64)	66.0	68.6	72.7	73.2	73.6	73.7
Employment rate (15-71)	59.9	61.5	66.1	65.1	63.9	65.6
Employment growth (15-64)		1.0	0.3	-0.8	-0.6	-0.5
Unemployment rate (15-64)	9.5	9.0	7.4	7.0	7.0	7.0

2004) that the use of IT has productivity spillovers to service industries and here in particular to wholesale and retail trade that could be mimicked in a similar way as in the EU's post-war adoption of US industrial practices.[10] But this will certainly depend on how innovation-friendly the populations in Germany and the EU will be in the coming decades.

Capital deepening is another important source for additional productivity growth in the projections presented above. The question is: will capital formation in aging economies be sufficiently strong? Using neoclassical investment theory we know that capital productivity will be equated in the

[10] There is a discussion to what extent there is a genuine productivity increase in wholesale and retail trade in the US or whether the reported productivity growth in these sectors is a measurement problem associated with a strong decline in IT prices (see, for example, EU Economy Review 2004).

longer-term term with capital costs. Therefore it is important to have a view on the evolution of the real interest rate. Whether it will rise or fall depends, as mentioned above, essentially on the investment and savings developments on a global scale. There are arguments for a change in interest rates in both directions. In case of the AWG scenarios a neutral position was adopted and a constant real interest rate path was assumed. Under this assumption, the marginal productivity condition for capital leads to further capital deepening.[11]

Table 5. Germany's GDP per capita under alternative pension scenarios[a]

	No policy change	Reducing the generosity of the pension system	Increasing the effective retirement age
2030	-12.0%	-9.8%	-3.3%
2050	-19.0%	-14.8%	-5.9%

[a]The figures reported in this table show % deviations from a hypothetical no-aging baseline.

The EU Commission has also considered a number of alternative scenarios in order to see which policies would be most effective in keeping the projected slowdown of GDP per-capita growth at a minimum. Table 5 reports results from three alternative scenarios for Germany. The first scenario simply shows the decline in per capita income – relative to a hypothetical no-aging scenario – under the assumption that the current generosity of the PAYG system is retained and the contribution rates are successively increased in order to balance the system. The second scenario analyses the possible impact of a gradual and partial move towards a funded system, were the first PAYG pillar only guarantees a continuation of current real pension income but no further growth in line with real wages so that the replacement rate falls. The third scenario present results from an increase of the effective retirement age to 65 years. The analysis was conducted with the QUEST aging model.[12]

The simulated reduction of the generosity of the PAYG system is of the same order of magnitude as the proposals of the Rürup Commission for

[11] Simulation studies that have been conducted with the Commission's QUEST-Aging model, which has an explicit life-cycle household sector suggest that real interest rates will actually decline. An important reason for this result is that younger age cohorts increase their savings rate because they face lower income growth in the future, and they also know that because of an increase in life expectancy they will spend more time in retirement.

[12] See Mc Morrow et al. (2004) for more details concerning the model and the simulations.

Germany. This reform will, however, not prevent an increase in the contribution rate which still increases by about 10 per cent until 2030. Compared to the baseline scenario there are positive effects on growth, although these are limited. There are gains from increased employment and there are additional savings, however, with high capital mobility as assumed in this simulation, a significant fraction of additional savings would not be invested domestically but flows to regions with less demographic pressure. While this does not raise German output it would increase Germany's Gross National Income (GNP) through future capital returns from abroad.

In the third simulation the effective retirement age, which is currently close to 60, is gradually increased to the average statutory retirement age of 65 over the next 10 years. Under the assumption that this increase could be accomplished without a significant loss in the average efficiency of the labor force, this scenario goes a long way in offsetting the decline in per capita income. However, the simulation also shows that by itself it will not be able to completely offset the GDP loss. But a combination of the two reforms which is keeping the real pension levels unchanged (and thus continuously reducing the replacement rate) and raising the average retirement age to 65 would achieve this goal. The German government has recently increased the statutory retirement age from 65 to 67 (or after 45 years of work) which goes in the right direction as it helps to raise the effective retirement age.

5 Conclusions

Over the past ten years economic growth in Germany has been relatively weak due to a deceleration of productivity growth and a decline in labor input (hours worked) with demographics playing only a minor role. From 1995 to 2005 real GDP increased on average by 1.4 per cent p.a. and with population almost stagnating (average increase of 0.1 per cent) real GDP per capita increased by a similar rate (1.3 per cent). In the coming decades Germany will be faced with a significant aging of the population which could further dampen growth. According to current demographic projections – which are, however, uncertain due to various simplified assumptions, in particular concerning future migration and birth rates – the labor force will shrink by around ¼ per cent per year until 2020 and by ¾ per cent per year between 2020 and 2035. Productivity growth could also be adversely affected by aging but views differ about such an effect and its size. There are various channels through which productivity growth could be reduced, such as lower saving and investment and lower innovation.

Thus aging could have a significant adverse effect on future growth. However, the overall growth pattern will also depend on how policies respond to the challenge of aging. For an aging country like Germany it is of particular importance to increase the utilization of the labor potential which is currently low and also to sustain and possibly increase productivity growth. Restoring fiscal sustainability and reforming pension and health care systems, which will come under considerable strain with the aging of the population, should therefore be carried out in ways which limit the adverse effects on the economy, implying that tax increases should be limited. Increasing labor market flexibility would help job creation and at the same time improve productivity through reallocation of labor to its most productive use. Furthermore, improving human capital formation, including life-long learning, sustaining R&D and fostering product market competition are very important to enhance productivity.

As illustrated by alternative scenarios considered by the OECD Secretariat and the EU Commission economic policies can make a big difference to future growth. According to these scenarios Germany's annual average growth of GDP per capita varies over the next decades between around 1% and around 1½ per cent, depending on which policies are pursued. The EU also estimates that the effect of aging on the long-term level of German GDP per capita could be fully compensated if real pension benefits were frozen at the current level – which would, however, lead to a continuous fall in the replacement rate as real wages continue to increase – and if, in addition, the effective retirement age were increased from currently around 60 to 65. These measures would not only raise utilization of labor potential but also improve productivity as saving and investment would increase.

Recent reforms in Germany are going in the right direction and help to contain the adverse effects of aging on growth. They aim at limiting tax increases and at increasing the effective age of retirement. The main measures are eliminating early retirement schemes, increasing the statutory retirement age from 65 to 67 years and reducing replacement rates. However even if pension reforms will not fully outweigh the adverse effect of aging on growth, the level of GDP per capita will continue to improve at a moderate pace, provided productivity growth can be sustained. Nonetheless Germany's (and Europe's) income gap vis-à-vis the United States will continue to widen as productivity growth is projected to remain lower and the degree of aging is higher than in the United States.

References

Blanchard O, Wolfers J (2000) The Role of Shocks and Institutions in the Rise of European Unemployment: The Aggregate Evidence. Harry Johnson Lecture. Economic Journal 110:1–33

Boersch-Supan A, Wilke CB (2004) The German Public Pension System: How it was, how it will be. NBER Working Paper No 10525

Burniaux JM, Duval R, Jaumotte F (2003) Coping with Aging: A Dynamic Approach to Quantify the Impact of Alternative Policy Options on Future Labor Supply in OECD Countries. OECD Economics Department Working Papers No 371

Cette G (2005) Are productivity levels higher in some European countries than in the United States? International Productivity Monitor 10:59–68

Daveri F, Tabellini G (2000) Unemployment, Growth and Taxation in Industrial Countries. Economic Policy 15:49–104

European Commission (2004) The Lisbon Strategy and the EU's Structural Productivity Problem. In: EU Economy Review 2004. European Commission, Brussels

Fuentes A, Wurzel E, Morgan M (2004) Improving the Capacity to Innovate in Germany, OECD Economics Department Working Papers No 407

Heppke-Falk K, Hüfner F (2004) Expected budget deficits and interest rate swap spreads: Evidence for France, Germany and Italy. Deutsche Bundesbank Discussion Paper Series 1: Studies of the Economic Research Centre No 40

Inklaar R, O'Mahony M, Timmer M (2004) ICT and Europe's Productivity Performance: Industry level Growth Account Comparisons with the United States. Groningen Growth and Development Center Research Memorandum No GD-68

Laubach T (2003) New Evidence on the Interest Rate Effects of Budget Deficits and Debt. Federal Reserve Board Finance and Economics Discussion Series No 2003–12

Martins JO, Gonand F, Antolin P, De la Mainonneuve C, Yoo KY (2005) The Impact of Aging on Demand, Factor Markets and Growth. OECD Economics Department Working Papers No 420

Masson P, Bayoumi T, Samiei H (1995) International Evidence on the Determinants of Private Saving. IMF Working Paper No 51

Mc Morrow K, Röger W (2004) The Economic and Financial Market Consequences of Global Aging. Springer, Berlin Heidelberg New York

Miles D (1997) Modelling the impact of demographic change upon the economy. CEPR Discussion Paper Series No 1762

OECD (2003) The Sources of Economic Growth. OECD, Paris

The Impact of Global Aging on Capital Markets and Housing

Axel Börsch-Supan*

1 Introduction

Aging has complex effects on the markets for real capital – capital used in the production of goods and services, and housing capital. If elderly people save less than younger people, an aging society saves less. This should increase interest rates since supply of funds gets tight. At the same time, the younger generation becomes ever smaller, so there is also less demand for new investment. The equilibrium effect is thus uncertain.

Pessimists believe in the so-called "asset meltdown" hypothesis: households' demand for financial assets will plummet between 2030 and 2040, when the baby boomers retire and die, asset values will melt down dramatically and the return on financial investments will fall sharply.

Optimists stress economic mechanisms which soften or even reverse the negative impacts of aging on capital markets. One such important countermechanism is an aging society's need for more capital since capital must increasingly substitute for labor. This rising demand for real capital increases the return to capital at exactly the same time as pessimists fear the prospect of an asset meltdown.

In order to be able to judge whether the pessimists or the optimists are right, we quantify the potential effects of aging on asset prices using a sophisticated overlapping generations (OLG) model with international diversification reflecting the global nature of the markets for productive

* I would like to thank Alexander Ludwig and Mathias Sommer who have done most of the hard work underlying this contribution. Financial support from the *Deutsche Forschungsgemeinschaft*, the Volkswagen Foundation, the *Gesamtverband der Deutschen Versicherungswirtschaft* and the state of Baden-Württemberg is gratefully acknowledged.

capital. The results from this model indicate that there will be some decline in the value of productive capital, but it is small in any case and even smaller when capital is globally diversified. So aging is not as damaging as the pessimists make believe, but markets for productive capital are not immune to demography, as some optimists claim.

Returns on real estate will be more affected by the demographic trend because there is much less room for diversification and because housing cannot substitute for scarce labor. The pessimism of Mankiw and Weil (1989), however, who made the asset meltdown hypothesis popular in the USA, appears to be misguided. Since household size lags population size by about 20 years, housing demand will only begin to fall from 2025 onwards even if populations start declining today. Thereafter housing demand will drop very gradually such that house prices will not fall dramatically over the next 30 years. Mankiw and Weil's (1989) estimate of a housing price drop between 1990 and 2010 to half of their original levels will certainly not materialize.

In order to rest these findings on a solid foundation, the chapter proceeds as follows. Section 2 collects the major findings of earlier studies on this topic. Section 3 analyses productive capital, while section 4 deals with the developments that can be expected on housing markets. Section 5 summarizes our results with a view on economic and social policy implications.

2 The Asset Meltdown Debate

A spectacular fall in the price of assets as a result of demographics was predicted for the first time by Mankiw and Weil (1989) for the real estate market in the United States. Mankiw and Weil used cross-sectional data on real estate assets from the 1970 US census to develop an age profile of the demand for property. Their demand forecast is based on the assumption that this age profile remains constant and it is only the size and age structure of the US population that will change. Based on the historical correlation for the growth in demand with the price index for investments in residential buildings, Mankiw and Weil conclude that the demand for residential property must increase by approximately 1.5% per year to keep prices constant. However, the demographically controlled demand variable shows consistently lower growth rates for the period 1990–2010. This forecast discrepancy exercises enormous price pressure on the residential property market. The point estimate by Mankiw and Weil implies a 47% price fall within 20 years.

The study provoked a large number of very critical comments, which ultimately cast considerable doubt on whether the forecasts by Mankiw and Weil (1989, 1992) are sustainable. Woodward (1991) grouped together the main points of criticism in the first series of responses refuting the study. For instance, both Hamilton (1991) and Hendershott (1991) criticized the fact that the estimates of Mankiw and Weil imply that, even if demand remains at a constant level, the prices would fall by 8%. This implausible linear time trend has a much greater influence on the forecast than the decline in the growth for demand from 1.6% at the start of the 1980s to around 0.6% in approximately 2000. Swan (1995) criticized that not only were the effects of a long-term rise in real income completely ignored but the supply side of the residential property market was also not taken into account.

Engelhardt and Poterba (1991) also cast doubt on the findings of Mankiw and Weil. They made an equivalent analysis for Canada, a country with demographic trends that very largely mirror those in the USA. The age profile for real estate assets in Canada also broadly corresponds to the equivalent figures in the USA. In spite of this, Engelhardt and Poterba could not find that demography had any similar influence along the lines identified by Mankiw and Weil.

More recent research has shown how important cohort effects are. When Mankiw and Weil used cross-sectional data to analyse the demand for residential property over the life cycle they ignored the effects of income and the cohort group, which have proved to be very important in quantitative terms. In cross-sectional data, i.e., in data from many people at a single point in time of observation, it is not possible to decide whether persons save “too much” because they are old (age effect) or because they were born a long time ago at a time when, for instance, thrift was considered to be particularly virtuous (cohort effect).

If one applies this approach to demand for residential property, it cannot be ascertained whether persons use a small amount of living space because they do not need a large apartment when they are old or whether they do not need a large apartment in old age because at the time when they purchased their apartment they did not have enough real income to afford a large apartment. In their analysis, Mankiw and Weil present the cross-sectional profile of real estate assets in 1980 by way of comparison. However, the asset values recorded in the 1980 census were on average more than 50% above the 1970 sample group for each age group. When it comes to using demand profiles for fairly long-term forecasts, the order of magnitude of 50% shows the quantitative significance of income-related effects, in particular, but also other cohort effects. The increase in the asset

profiles of all age groups between 1970 and 1980 illustrates the dimension in which the demand for real estate could also change in the future.

Studies made in the United States of America that adopt a more careful approach than Mankiw and Weil verify that, for just these reasons, the estimates of age-specific demand for residential accommodation are distorted and a possible "asset meltdown" effect is greatly exaggerated – for example, see Venti and Wise (1990), McFadden (1994), and Skinner (1996). Section 4 will apply a similar approach to Germany.

The ultimate judge, of course, is time. Hence it is worth noting that the forecasted "asset meltdown" which should have occurred between 1990 and 2010 in the US has simply not occurred until 2006, neither during the boom in equity markets (which is easy to explain), nor since the bubble burst (which is more significant).

Turning to productive capital, the most familiar study based on empirical data of saving behavior over the life cycle is the analysis by Poterba (2001). It derives a demand variable from the shift in the aging structure of the population, which is produced from an estimated life cycle savings profile. In contrast to Mankiw and Weil, Poterba estimates the demand from the various age classes in a model which permits explicit cohort effects. The estimated asset profile in old age is very largely flat – a result that has already been documented by other authors. Poterba uses a series of further demographic variables which can explain the accumulation of savings in a society. For long time series he finds hardly any indications that demography influences returns on equity investments and only minimal indications of such influences on the market for secure interest-bearing securities. It was only for the price-earnings ratio of equities that Poterba found demography had historical influences but these were not stable. The estimated parameters led Poterba to the conclusion that a demographically induced fall in prices on capital markets, as had been predicted by Mankiw and Weil for the real estate market, is extremely unlikely.

Abel (2001) criticized Poterba's analysis. He sets up a theoretical model in which the households are interested in the well-being of their heirs and thus possess an inheritance motive. He shows that it is entirely possible for an asset meltdown to be consistent with a flat asset profile in old age. Although the demand of the old generation for capital is not falling, a demographically induced fall in prices could be brought about through lower savings by the younger generation. However, there is no evidence that the amounts to be inherited will fall with the number of children. Abel's theoretical countermechanism to Poterba's analysis thus seems to be of little empirical relevance.

3 Aging and the Markets for Productive Capital

Initial theory-based models to estimate the effects of demographic changes on the development of returns on productive capital can be found in Cutler et al. (1990), Börsch-Supan (1996), and Reisen (2000). More recent work is based on models of overlapping generations ("OLG models"), which were used for applied policy analysis for the first time by Auerbach and Kotlikoff (1987). Since then, such models have undergone considerable progress, enabling them to mirror reality more closely. The models have increasingly developed from semi-theoretical analytical tools to genuine forecasting and simulation models (INGENUE 2002). In the sequel of this section, we employ the next generation of OLG models characterized by the implementation of realistic demographic data (Börsch-Supan et al. 2002, 2003a; Börsch-Supan et al. 2003c).

3.1 A Model of Overlapping Generations: The MEA-OLGA Model

Savings, capital returns and international capital flows are the outcome of complex interactions between supply and demand on German and international capital markets, influenced by demography and the capital and goods markets. Our simulation model calculates this equilibrium by drawing on model households which mirror the various generations living together during the phase of demographic transformation ("overlapping generations", abbreviated OLG). Such models have a long tradition. They were developed as theoretical models by Samuelson (1958) and Diamond (1964) and extended by Auerbach and Kotlikoff (1987) to be used for the first time in a near-reality computer simulation model.

The MEA-OLGA simulation model on which the results of this section are based is the first such model that is not restricted to one country but also covers international trade and capital movements. Details, including a mathematical description, of the MEA-OLGA model can be found in Börsch-Supan, Ludwig and Winter (2003). Here we are limiting ourselves to the essential equations and mechanisms effective in this model. Note that the model takes a long-term perspective and thus abstains from all short-term Keynesian considerations. This also justifies the assumption that exchange rates have no role to play in our real economic model.

How Households Behave

The model households in the MEA-OLGA model offer a fixed amount of work. They divide their income into consumption and savings but here we only map the long-term savings, i.e. the savings that are required to compensate for the drop in income upon retirement. The accumulation of savings is therefore mapped according to the life cycle hypothesis by which the household does not apportion a distribution of income into consumption and saving each year but over a time scale that is only limited by the households' discount rate. Consumption C_t is smoothed by this long-term life-cycle planning so that it greatly depends on consumption in the preceding period C_{t-1}. Impatient consumers (their discount rate ρ exceeds the market interest rate r_t) initially consume a large amount but, in contrast, patient households initially save and their discount rate of ρ is lower than the market rate r_t. The development over time of consumption C_t is therefore produced from the following simple equation in which the ratio between the discount rate and the market interest rate is weighted by the parameter σ, which states the extent to which households react to deviations between the discount rate and the market interest rate:

$$C_t = C_{t-1} \cdot \left(\frac{1 + r_t}{1 + \rho} \right)^{1/\sigma} \tag{1}$$

This consumption equation implicitly also describes the savings decision because current income minus consumption expenditure gives the figure for savings. This is added, with interest, to asset A_{t+1} of the next period:

$$A_{t+1} = A_t (1 + r_t) + Y_t^n - C_t \tag{2}$$

The pension scheme has a crucial influence on savings decisions because it is the main source of income during retirement, albeit supplemented by cashing in household savings, for instance in the form of "Riester pensions".[1] Our model only maps long-term savings in the form of provision for old age. If the pay-as-you-go pension scheme is so generous that the level of pensions is 100%, no long-term savings at all occur in our model. If, at the other extreme, the level of pension falls to zero, all the income in old age must be provided from savings. Consumption is correspondingly lower in younger years.

[1] „Riester pensions", named after a former German minister who was responsible for the introduction of this program, are a special type of subsidized savings plans that are meant to make up for the long-term reduction in public pension benefits following recent reforms.

Savings are invested in productive capital. These investments can either be in Germany or abroad. The international portfolio shows that capital moves to where the returns, after adjustment for risk and tax, are the highest and this remains so until the balance between risk- and tax-adjusted returns is the same in all countries.

Production Side, Capital Market and Overall Economic Balance

On the production side, capital and labor are used as a substitute so that the wages correspond to work productivity and the capital return corresponds to capital productivity. We are modelling this using a so-called Cobb-Douglas production function, which converts GNP $Y_{i,t}$, labor $L_{i,t}$ and capital $K_{i,t}$ in units of goods and services produced. Here, the indices stand for year t and country i.

$$Y_{t,i} = F\left(K_{t,i}, \Theta_{t,i} L_{t,i}\right) = K_{t,i}^{\alpha} \left(\Theta_{t,i} \sum_{a=1}^{65} \varepsilon_a L_{t,a,i}\right)^{1-\alpha} \tag{3}$$

All countries have the same production technology F, but labor productivity varies by $\Theta_{i,t}$. Also, the entire workforce $L_{i,t}$ is composed of the various age groups $L_{i,a,t}$, whose age-specific productivities ε_a correspond to the average wage profile.[2]

The different productivity levels $\Theta_{i,t}$ correspond to the different per-worker gross domestic products. The available quantity of labor $L_{i,a,t}$ is derived from the demographic assumptions.[3]

Wages and interest rates are determined in such a way that they correspond to labor productivity and capital productivity, respectively. In particular, the interest is produced from the marginal productivity of the capital deployed minus the rate of depreciation δ,[4]

$$r_{t,i} = f'\left(k_{t,i}\right) - \delta, \tag{4}$$

and the investments made in the domestic economy from the net change of the domestic capital stock,

$$I_{t,i} = K_{t+1,i} - (1-\delta) K_{t,i}. \tag{5}$$

---

[2] Rising until the age of 55 and then constant.

[3] See Börsch-Supan et al. (2003b) for a description of the demographic assumptions.

[4] To be more precise: From the marginal productivity of capital deployed per efficiency unit of labor, therefore $k = K/\Theta L$. The depreciation rate δ is assumed to be constant and uniform.

Capital $K_{i,t}$, which is used in a country for production does not have to correspond to the assets that the inhabitants of this country have accumulated and which we have described as A_t. The difference

$$V_{i,t} = A_{i,t} - K_{i,t} \tag{6}$$

is represented by the assets abroad. If more is saved than invested, the capital flows abroad – for instance, in the form of direct investments – as described above, i.e., until the returns, adjusted for risk and tax, have converged in all countries. The current account surplus is therefore

$$CA_{t,i} = V_{t+1,i} - (1-\delta)V_{t,i} = S_{t,i} - I_{t,i}\,. \tag{7}$$

If one takes all the regions of the world together, both the international capital flows and the net external positions of the various countries must cancel each other out overall, because the regions of the world form a closed economy. This is one of the key conditions for the equilibrium of international trade and our model:

$$\sum_{i=1}^{R} V_{t,i} = 0 \tag{8}$$

The MEA-OLGA model is matched to the overall economic pattern in Germany from 1970 to 1995, i.e. the model parameter is selected in such a way that the historical development is mapped as successfully as possible ("calibration"). The relevant parameters are listed and explained in the appendix.

How International Capital Movements Are Modelled

We first apply the MEA-OLGA model to three scenarios for capital mobility: firstly, to Germany as a closed economy; secondly, to Germany as an open economy with perfect capital mobility within the other countries of the EU; thirdly, with perfect capital mobility within the other countries of the whole OECD. Perfect mobility of capital within the OECD may be an exaggerated assumption but not so within the EU, because by far most of the flows of capital are within the eurozone where there is free movement of capital. This also justifies the assumption that exchange rates have no role to play in the MEA-OLGA model. In addition, the model describes the very long-term trends in capital movements. Whereas the short-term exchange rate induces flows of capital movements which, although considerable, are of short duration and of less interest to us, the long-term exchange rate and the long-term capital flows are determined jointly by the fundamental variables of demography and overall economic development.

How Further Capital Is Accumulated as a Result of Old-Age Provision

We map the scope of potential developments of pension insurance with two scenarios: the curve to be expected after the Riester reform is between the two. The first scenario ("Retain the PAYG system in place prior to the Riester reform") keeps the net replacement rate (of approximately 70%) provided by the pay-as-you-go pension system. In this scenario the contribution rate is raised from 19.5% to 25.7% in the year 2030 to finance aging-related additional costs. We call the second scenario the "freezing model". This systematic reform model stabilizes the contribution rate at 19.5%, so that the pay-as-you-go pension level falls to just under 51%; at the same time, the overall pension level remains constant with a resultant gradual transition to a pension system based on a substantially higher funded component. These are obviously two extreme scenarios. The present reform process will not permit a situation where the contribution rate rises to almost 26%; however, it is also unlikely that the contribution can be frozen so the most probable social policy development will be a figure between these two extremes.

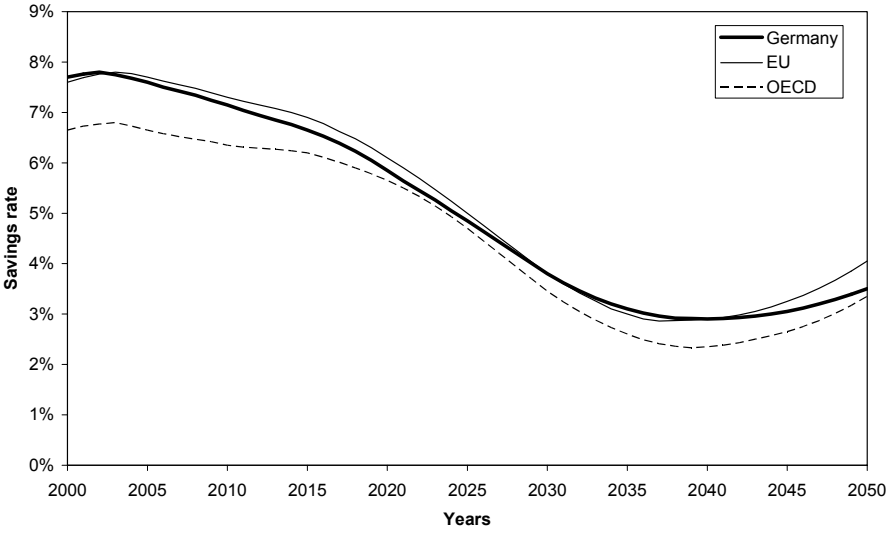
If the gaps in the pay-as-you-go pension insurance are fully plugged by individual capital formation, this increase in individual private provision will have displacement effects on other forms of household savings. The calibration of the model to the development of household savings between 1970 and 1995 indirectly produces displacement of around one third. In other words, two thirds of the individual private provision induced by the reduction in the replacement rate represents genuine savings which enhance the capital stock in the economy.

3.2 The Development of Household Savings

Figures 1 and 2 show the development of the long-term savings rate for the two pension reform scenarios (no reform, systematic reform) and these, again, in relation to the three different assumptions on capital mobility (Germany as a closed market, free movement of capital in the EU, free movement of capital throughout the entire OECD). The savings rate, which the simulation model calculates, is the proportion of long-term savings of private households in relation to the available income of the household. This percentage is lower than the savings rate usually measured, which is approximately five percentage points higher in Germany and includes short-term savings (for holidays, purchases of consumer durables, etc.), which are not at all sensitive to demographic factors and are thus of secondary importance for our simulation calculations.

The Pure Demographic Effect

Figure 1 begins with the scenario in which today's pension insurance system is not changed, i.e. under the fallacious assumption that the benefits of the current pay-as-you-go system will be continued at the present level and financed by increases in contributions, without employment being influenced by it. Figure 1 therefore shows the pure effect that an aging population has on the resultant savings rate, without the additional effect of a pension reform.



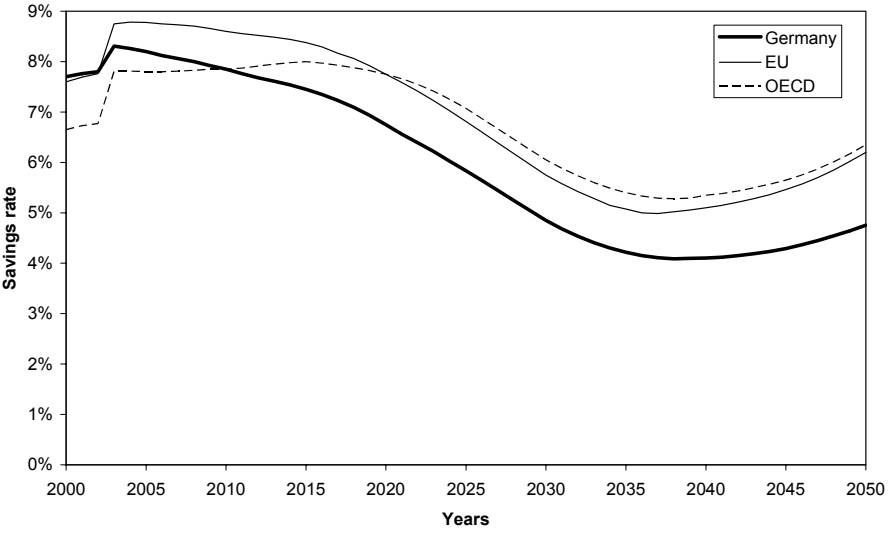
Notes: The savings rate is defined as long-term savings of private households divided by available income of private households; the pension level of the pay-as-you-go system stays at 70%. On the expression "long-term saving": see the explanations in the text.
"Germany" scenario: all German savings are invested in Germany; "EU" scenario: all German savings are invested within the EU; "OECD" scenario: all German savings are invested in OECD countries.

Source: MEA-OLGA model (Börsch-Supan et al. 2003a).

Fig. 1. Savings rate of private households, continuing with the current pay-as-you-go pension system

The savings rate follows the demographics very closely. After a phase of very slow decline, during the years in which "baby-boomers" are receiving the highest income and thus also saving the most, a rapid, demographically induced decline will follow from 2020 onwards, when the first "baby-boomers" start to retire. Overall, the savings rate will fall in

the long term by approx. 4 percentage points. This decline is not particularly affected by international diversification options.



Notes: The savings rate is defined as long-term savings of private households divided by available income of private households; the contribution to the pay-as-you-go pension system is limited to 20%. On the expression "long-term saving": see the expanations in the text.
"Germany" scenario: all German savings are invested in Germany; "EU" scenario: all German savings are invested within the EU; "OECD" scenario: all German savings are invested in OECD countries.
The "leap" represents the increase in savings as a consequence of introducing the multi-pillar model because in our model the households make the payments for old-age provision that are necessary to maintain the level of pensions at the accustomed level.

Source: MEA-OLGA model (Börsch-Supan et al. 2003a).

Fig. 2. Savings rate of private households with a partially capitalized pension reform

The Effect of a Funded Pension Reform

Figure 2 shows the effect of a systematic pension reform, i.e. if the contribution rate is stabilized at 19.5% and the income in old age is secured by a corresponding amount of private pension provision. Pension reform of this kind will increase the savings rate considerably. Figure 2 also clearly highlights the importance of international diversification options. If all the funds for old-age provision have to be invested in Ger-

many, the return on capital will fall much more sharply than would be the case with international diversification – see Figure 3. This will reduce savings. In contrast, with systematic pension reform and international diversification, household savings increase by approximately three percentage points as compared with the initial situation in Figure 1, thus compensating for a major part of the decline in the savings rate due to demographics.

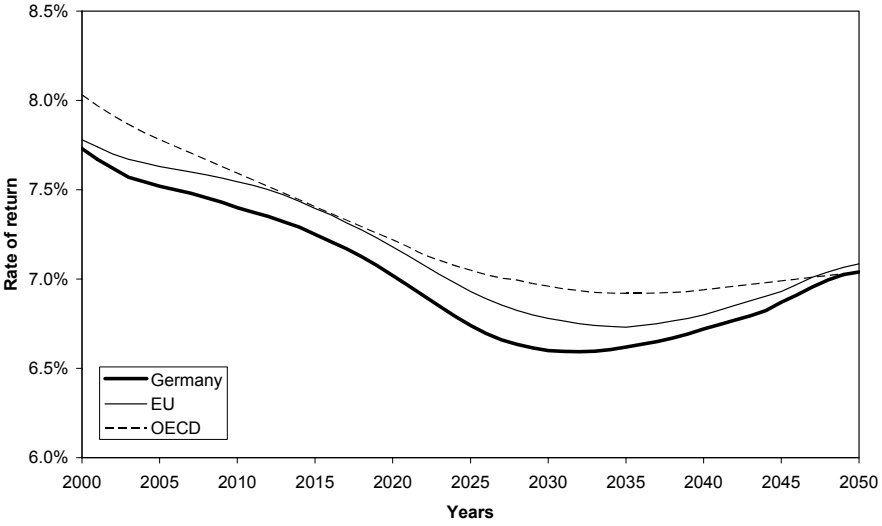
3.3 Trends in Returns on Capital

We now come to the central point of this section and that is the development in overall economic returns on productive capital, i.e., all machines ("equipment") and buildings ("plants") of the corporate sector. This return on capital falls when work is scarce and capital is relatively plentiful. Thus returns on capital tend to fall in countries that are aging. This effect is intensified by a pension reform because then the supply of available capital increases.

Our model shows these effects, but not to a dramatic extent. Firstly, we have seen that household saving remains relatively stable and is even likely to fall. Thus the supply of capital becomes scarce and with it the rate of return on capital offered by the corporate sector rises. The boost is particularly due to the fact that an aging economy needs capital to take the place of labor and increase productivity. Also, the reduction in aggregate households savings – as can be seen in Figures 1 and 2 – will take place over a long period and is anticipated by capital markets because the demographic data is already well known.

These aspects become clear in Figures 3 and 4. Once again, the first figure shows the actual effect of the aging population and the following figure shows the effect of a systematic pension reform. The most important finding is that, although capital returns do actually fall with the demographics, the quantitative effects are relatively minor.

The two figures present the long-term capital returns on total productive capital. This yield includes fixed-interest securities (industrial securities and bonds) as well as shares and direct investments. The basic rate of capital return is calculated in the model and corresponds closely with the empirical values in Börsch-Supan (1999) for the period 1970–1994. The level of return varies slightly, depending on the extent of international diversification in the portfolio. If one looks at productive capital in Germany and the EU, the returns in 2000 – the initial year – are approx. 7.7% but if the other OECD countries and particularly the USA are added, it edges up slightly to approximately 8%.



Notes: The figure shows the long-term return on productive capital; the pension level of the pay-as-you-go system stays at 70%.
"Germany" scenario: all German savings are invested in Germany; "EU" scenario: all German savings are invested within the EU; "OECD" scenario: all German savings are invested in OECD countries.

Source: MEA-OLGA model (Börsch-Supan et al. 2003a).

Fig. 3. Capital return if the present pay-as-you-go system is continued

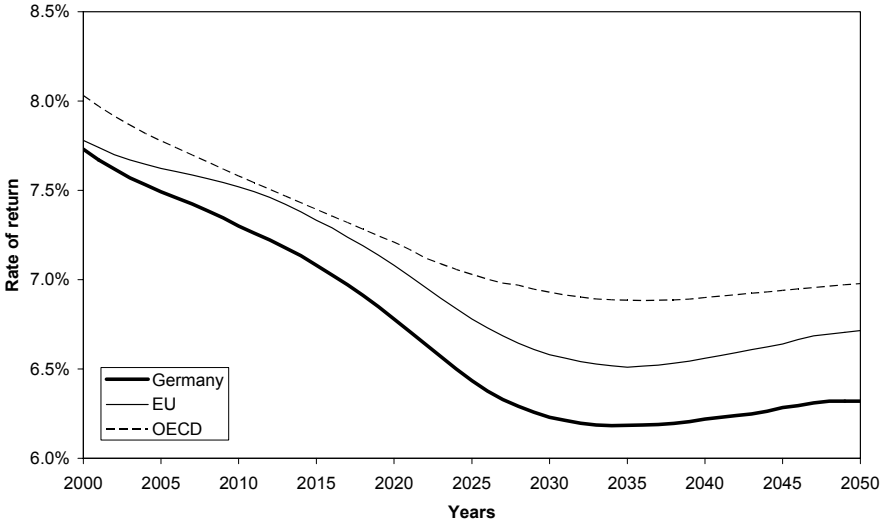
The Pure Demographic Effect

Figure 3 starts with the scenario in which no pension reform takes place, in other words only the demographic effects are mapped. Overall, the maximum decline as a result of demographics until 2035 will be around 120 basis points and then this will only be in the fallacious situation whereby there will be no capital movements with foreign countries. In this case, capital returns will fall from 7.7% (2000) to 6.5% (2035). Where diversification is applied, the decline is reduced by 10 to 20 basis points; for diversification within the EU, the demography-related decline in capital return is from 7.7% to 6.7% and, within the OECD as a whole, from around 8% to 7%.

The Effect of a Funded Pension Reform

The comparison with Figure 4 shows the additional effect of a pension reform that focuses systematically on stable contribution rates. It reduces

returns on capital because it creates an additional supply of capital. However, this effect is only significant in quantitative terms if international diversification options are excluded. In this case, capital returns fall by a further 40 base points in 2035. Where diversification takes place within the EU, this effect is reduced to approximately 20 basis points and, if the USA – which dominates capital markets in the other OECD countries – is included, the decrease in the rate of returns disappears almost completely as a result of the funded pension reform.



Notes: The figure shows the long-term return on productive capital; the contribution to the pay-as-you-go pension system is limited to 20%.
"Germany" scenario: all German savings are invested in Germany; "EU" scenario: all German savings are invested within the EU; "OECD" scenario: all German savings are invested in OECD countries.

Source: MEA-OLGA model (Börsch-Supan et al. 2003a).

Fig. 4. Return on capital in the case of a partially capitalized pension reform

3.4 Diversification Effects of Global Capital Markets

International capital markets play an important role in balancing out the remaining fluctuations in returns. Globalisation cushions the macroeconomic effects of aging. It is not difficult to understand the intuition behind this result. Different developments always provide the opportunity to balance these out through trade. In this case, different demographic trends

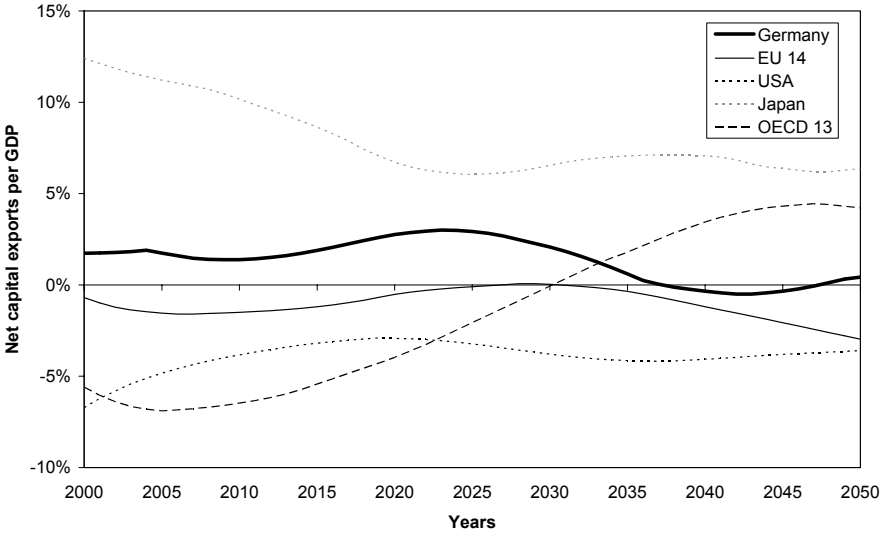
in the OECD countries provide the opportunity and international capital movements the mechanism to allow national differences in population and gainful employment to be balanced out to the benefit of all countries. In fact, populations of different countries are not aging uniformly – not across the industrial countries and not even within the European Union.

In many respects, these findings turn the maxim on its head that globalisation is especially dangerous in times of population aging. Increasing non-wage labor costs (here the rise in pay-as-you-go pension contributions in the first pension scheme scenario) in aging economies do indeed make life difficult because in younger economies companies can pay the same net wage yet the gross wages are lower. Conversely, a comparison of Figure 3 with Figure 4 shows that it is precisely because of this that a partial changeover to a funded pension system delivers advantages. It is only by using the international capital market that the demographic risk can be diversified.

The cushioning role of the international capital market is based on the capital flows prompted by the aging process. The effects on savings and returns related to demography, which were described in the two previous sections, have a different impact in the various countries. With free mobility of capital, therefore, flows of capital will come from the aging countries with low rates of returns and move into the young economies where returns tend to be high and this causes the returns to balance out.

Figure 5 shows capital exports for five regions in the OECD (Germany, the rest of the EU, the USA, Japan and the rest of the OECD), measured as a percentage of the gross domestic product in each case. The model first reproduces the well-known initial levels of capital flows: Japan as a particularly large exporter of capital and the USA as the largest importer of capital. As is the case for Japan, Germany saves more than it invests in its own country but to nowhere near the same extent.

These very different initial values now have to accommodate the demographic change. Falling support ratios mean lower savings, thus tending to reduce capital exports. This is particularly clear in Japan where capital exports are declining sharply. If Japan had not started with such a high export rate, Japan would have to become an importer of capital. Because aging in Germany is more pronounced than in the other EU states, the change in the capital export rate is also greater than it is in the other EU states. In the USA and the remaining OECD countries, where the support ratio is initially rising again, they are reducing their capital imports. From 2030 onwards the other OECD countries will even become exporters of capital, primarily to the USA, where the high gross domestic product makes the capital import rate plotted in Figure 5 particularly important.



Source: MEA-OLGA model (Börsch-Supan et al. 2003a).

Fig. 5. Capital flows within the OECD

4 Aging and Housing Markets

Residential property accounts for a major part of privately held assets and accordingly provides an important motive for saving. The movement in the value of owner-occupied homes or properties that are rented out is an important factor in determining the situation of a household with regard to assets and/or income. At the same time and in contrast to other financial investments, property is a halfway house: for owner-occupiers of apartments and houses the home is not just an asset that is "parked" – it is also a consumer good that can be actively enjoyed by living in it. Hence, housing cannot be classified as "productive capital", which was the focus of the preceding section, and for which the substitution effect – machines and computers replace the work of people – was so important in view of the scarcity of labor in an aging society. This substitution effect does not apply to residential property. Ultimately, the residential property market is influenced by the demographic shift both directly and indirectly. Basically, a population that is shrinking in the long term will need fewer homes than a society where the population remains stable or is growing. No less importantly, an aging society needs different housing from a young society. Furthermore, in contrast to financial assets, involvement in capital

markets does not provide any relief for real estate assets in the face of dwindling demand.

Our procedure for assessing the plausibility of an asset meltdown of this kind of capital is fundamentally different from that for the forms of investment discussed previously, as the scope for "dividing" residential property is limited (most households generally only buy one house and it is very unusual to buy a fraction of one or several houses, unless it is in the form of a property fund) and the dual role as both a capital investment and consumer good transcends the bounds of existing portfolio models. We therefore adopt an empirical approach: We first analyse the pattern of residential property consumption over the life cycle and the trends over the last two decades. We then determine a typical residential property consumption curve over the life cycle, taking into account the cohort effects of residential property consumption, which also include the expected trends in income, and project this into the future taking the demographic changes into account.

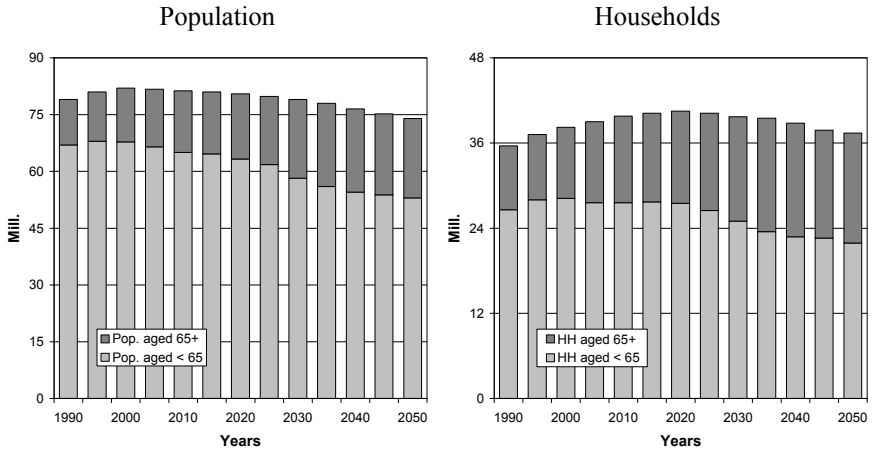
Börsch-Supan (1993) explains in detail which demographic mechanisms play a role. First, falling demand results from the declining population – see the left-hand part of Figure 6. At the same time, the average size of households in an aging society becomes smaller so the number of households falls much more slowly than the population – see the right-hand part of Figure 6. This effect cannot be stressed enough: Whereas according to UN forecasts the population of Germany will fall from approximately 2005 onwards, the number of households will not start to decline until 2020, in other words with a time delay of 15 years. The number of households will not drop below today's figures before 2043 and the figure will be just under 3% lower than today in the year 2050.

Scale effects of the area required for a household also need to be taken into account. Smaller households characteristically have a higher floor area per person. Demand for residential space will therefore fall much less substantially than might be feared on the basis of the population developments.

What is more, rising life expectancy will also induce higher demand for living space. Medical progress is improving the health of people of pensionable age and will enable more pensioners to live independently within their own four walls for longer. Börsch-Supan (1993) quantifies the effect of increasing life expectancy at approx. 20% of new building units.[5]

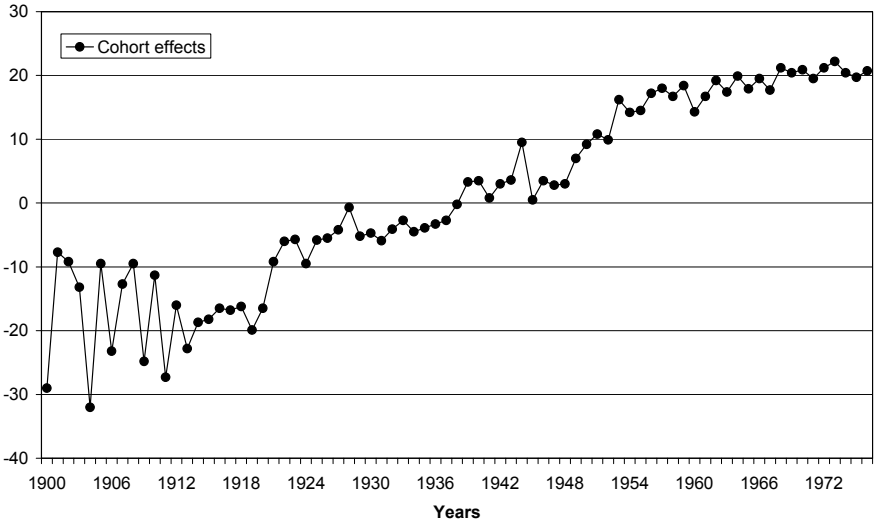
Demographic factors – shrinking birth cohorts and a changing age structure – are accompanied by economic changes. Young birth cohorts entering the housing market are typically more prosperous than the current

[5] Average of new building units from 1975 to 1990.



Sources: population projection in accordance with UN (2000); household projection according to age of reference persons; own calculations based on age-specific household ratios in the 2001 micro census.

Fig. 6. Trends in population and households



Source: Börsch-Supan et al. (2003b), based on SOEP, 1984–2001.

Fig. 7. Cohort effects in demand for housing

generation of pensioners. Income and asset effects involving higher housing consumption, despite unchanged household size, have been observed in the past and are likely to continue in the future. Even if incomes and assets are likely to grow more slowly in the future than in previous decades, housing demand will increase simply because those from the richer post-war generations make up a larger proportion of the overall population, see Figure 7.

Finally, a third trend which increases demand is the move away from multi-generation homes to households occupied by single people, linked to the desire of pensioners to remain independent for as long as possible.

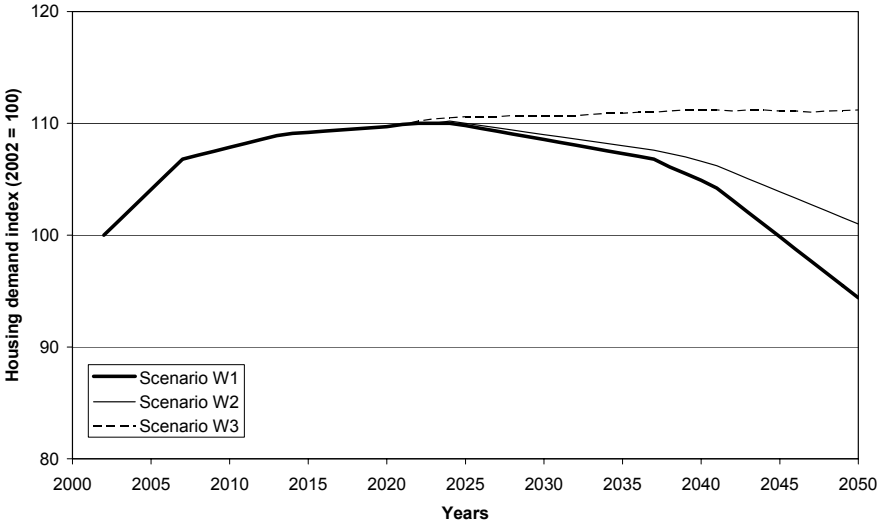
In the sequel of this section, we employ three scenarios for forecasting housing demand. In the pessimistic scenario (called W1), we assume that the demand for residential accommodation among future generations will only be at the same level as today's youngest generation. The demand for housing is therefore developing in accordance with the age-specific demand for housing and the decline in the population. In other words, there will either be absolutely no increases in income or these will not be reflected in the demand for more residential space. Also, the demand in the federal states in the Eastern part of Germany is maintained at today's level: there is no further convergence with the situation in the former West Germany. We therefore consider this scenario to be unrealistic. We will, however, show that even using these pessimistic assumptions, a dramatic fall in residential property prices will not occur.

For the middle scenario (W2) we assume that the demand for housing of future Eastern German birth cohorts will converge with the Western German level by 2050. However, at the same time we assumed that the demand for housing was saturated at the 1990 level in the Western part of Germany. The future cohort-related growth in demand is therefore purely derived from the need for the lower demand that currently exists in the East to catch up with the level in the West. When it comes to the future development of assets in the residential property sector, our middle scenario definitely errs on the side of caution.

The optimistic scenario (W3) projects the growth in the years prior to German re-unification. Equally, we also assume that East German demand will latch onto this growth trend. We consider this third scenario to be the "best case".

Our expectations lie between scenarios W2 and W3. We are expecting both further convergence in the living standards between the West and the East and thus a convergence in demand for housing. At the same time, however, historical growth rates are likely to slow down, in the same way as the growth rates of per capita income have already weakened over the last few decades.

By their definition the three scenarios exhibit a largely uniform trend until 2025, see Figure 8. Until 2025 demand for residential space will increase by around 10% in comparison to 2002. This gives an annual mean rate of growth of approximately 0.45%, although the rate of increase will begin to slow down even before 2010.



Source: Börsch-Supan et al. (2003b), based on SOEP, 1984–2001, and the UN's population forecast (2000).

Fig. 8. Development of demand for housing, indexed (2002=100)

The forecasts begin to diverge sharply from 2025 onwards, because this is when the different assumptions on the future development of the cohort effects begin to have an impact. Whereas for the W1 scenario in which we assumed no further increase in demand for future birth cohorts, we calculated that by 2050 there would be a downturn in the demand for residential accommodation of approximately 15% as compared to 2025, for the W3 scenario we are forecasting a further, albeit minimal, increase in demand for housing in the second quarter of our century.

Both forecasts are extreme – the one because it assumes no further growth for the next 50 years and is even ruling out any effects as a result of Eastern Germany catching up and the other because it assumes unbridled growth in demand for housing, even though growth in income over recent years has already slowed down. From today's perspective, the actual trends will probably lie between scenarios W2 and W3. Hence, whereas the demand for residential space between 2025 and 2050 will fall

slightly between 2025 and 2050 for demographic reasons, a sharp fall to below today's level is rather unlikely. If one assumes that demand between 2025 and 2050 will fall by 5%, the decline each year will be around 0.2%.

The development of demand for housing forecast in Figure 8 therefore implies a much more stable development of property values on average than would be associated with an "asset meltdown" situation. In view of the declining population, substantial increases in value after 2025 cannot be expected but in no way will values fall by 47% until 2020, as feared by Mankiw and Weil.

5 Summary and Outlook

Aging is affecting markets for productive capital and housing in a complex way. Only a general equilibrium analysis can separate the various diverging trends. The results of our analysis are thus subtle: neither the pessimists with their catastrophic "asset meltdown" hypothesis are right, nor the optimists who claim that capital markets are immune against demographic change.

The key reason behind this is that aging societies need more productive capital to take the place of labor, which is scarce, so the demand for capital is increasing. Moreover, the internationalization of capital markets allows finance to be provided for those production facilities abroad in "younger" countries (notably the United States, to some extent also the United Kingdom and France) from which, in the future, consumer goods will be imported to the "older" countries (the most prominent being Germany, Italy and Japan). Internationalization of capital markets almost completely prevents a decline in capital returns prompted by pension reform.

Housing markets are different from markets for productive capital. Aging of the population is less of a threat than the fact that population numbers are declining. However, there will be a time lag of 15 to 20 years before the number of households starts to fall, while the figure will continue to increase until around 2025, although the population is already in decline. Factors relating to income and assets will also play a role. Hence, a dramatic slump in demand for housing is unlikely, and in any case will not occur before 2040.

In spite of this, economic policymakers cannot afford to relax. Even if capital markets are not threatened by an "asset meltdown", the development of employment looks much less rosy. The effect of demographic change is that the number of gainfully employed persons will fall sharply from 2010 onwards, whereas the number of consumers will

largely remain constant until around 2040. This will put pressure on production capability and thus also on the overall growth of our economy: labor – at least in the highly skilled sector – will become increasingly scarce because it is not possible to compensate for this decline in employment per head of population by intensifying the capital deployed. For this, the change is too rapid and too extensive. Labor productivity will in fact need to increase in order to compensate for the effects of the shift in the age structure on domestic production. Owing to the effects of population aging in particular, education and training will assume an increasingly important role to keep returns of productive capital high.

This chapter shows that the capital market plays a particularly important role in an aging society. The logic of this is obvious because labor is becoming scarce. There are however two further reasons. Firstly, capital investments are the only way of freely distributing resources over time and between generations. More specifically, in the case of the demographic shift, capital investments are the vehicle that allows part of the earning power of baby-boomers to be used to finance their own pensions instead of imposing the entire burden of financing for their pensions on the next generation, who will be completely overwhelmed because of their greatly reduced numbers. We therefore need the capital market so that the earning power of the younger generation is not subdued by the excessive demands of the older generation.

The second reason lies in the international mobility of capital. As we know, mobility of the factor labor is not particularly good and the old countries cannot expect that younger countries will help to finance their pay-as-you-go systems, nor is it likely that a surge of migrants will pay their pension contributions. Capital, in contrast, can move around the global economy and bring in earnings from countries abroad where labor is more plentiful than it is here. For "old countries" such as Germany, Italy and Japan in particular, an open and globalised world can be of assistance during the aging process. Rich in consumers, poor in labor, these countries must have an intrinsic interest in boosting their imports. Free trading relations are therefore a substitute for inward migration. However, capital is required to extend production abroad. Not only that, it will also certainly be in the old countries' interest to retain a certain degree of control over companies which will be producing our consumer goods in the future by means of the mechanism offered by their foreign direct investments.

This exchange is not a one-way process. It offers scope for improvement that allows both benefits for the aging countries, which are relatively short of labor, as well as for the economies with younger populations that are relatively short of capital. The advantages for the old countries lie in a restored balance between employment and the demand for goods. The

younger countries obtain both capital and sales markets. The demographically younger countries will thus be able to grow faster than they would do without direct investments from and exports to the old countries.

References

Abel AB (2001) Will Bequests Attenuate the Predicted Meltdown in Stock Prices when Baby Boomers Retire? NBER Working Paper No 8131

Auerbach AJ, Kotlikoff LJ (1987) Dynamic Fiscal Policy. Cambridge University Press, Cambridge, MA

Börsch-Supan A (1993) Langfristige Perspektiven im Wohnungsmarkt – Folgen für eine Reform der Wohnungsförderung. In: Bachmann U (ed.) Innovation und Tradition in der Wohnungs- und Immobilienwirtschaft. GAGFAH, Essen, pp 341–364

Börsch-Supan A (1996) The impact of population aging on savings, investment and growth in the OECD area. In: OECD (ed), Future Global Capital Shortages: Real Threat or Pure Fiction? OECD, Paris, pp 103–141

Börsch-Supan A (1999) Capital productivity and the nature of competition. Brookings Institution (ed), Brookings Papers on Economic Activity: Micro-economics 1998, pp 205–248

Börsch-Supan A, Ludwig A, Winter J (2002) Aging and international capital flows. In: Auerbach A, Hermann H (eds.) Aging, Financial Markets and Monetary Policy. Springer, Heidelberg, pp 55–83

Börsch-Supan A, Ludwig A, Winter J (2003a) Aging, Pension Reform, and Capital Flows: A Multi-Country Simulation Model. Mimeo, University of Mannheim, MEA

Börsch-Supan A, Ludwig A, Sommer M (2003b) Demographie und Kapitalmärkte – Die Auswirkungen der Bevölkerungsalterung auf Aktien-, Renten- und Immobilienvermögen. Deutsches Institut für Altersvorsorge, Köln

Börsch-Supan A, Heiss F, Ludwig A, Winter J (2003c) Pension reform, capital markets, and the rate of return. German Economic Review 4:151–181

Cutler DM, Poterba JM, Sheiner LM, Summers LH (1990) An aging society: Opportunity or challenge? Brookings Papers on Economic Activity 1:1–73

Diamond PA (1965) National debt in a neoclassical growth model. American Economic Review 55:1126–1150

Engelhardt GV, Poterba J (1991) House Prices and Demographic Change – Canadian Evidence, Regional Science and Urban Economics 21:539–546

Hamilton BW (1991) The Baby Boom, the Baby Bust, and the Housing Market – A Second Look, Regional Science and Urban Economics 21:547–552

Hendershott PH (1991) Are Real House Prices Likely to Decline by 47 Percent? Regional Science and Urban Economics 21:553–563

INGENUE (2001) Macroeconomic consequences of pension reforms in Europe: An investigation with the INGENUE world model. Working Paper No. 2001-16, CEPREMAP, Paris

Mankiw GN, Weil DN (1989) The Baby-Boom, the Baby-Bust and the Housing Market, Regional Science and Urban Economics 19:235–258

Mankiw GN, Weil DN (1992) The Baby-Boom, the Baby-Bust and the Housing Market – a Reply to our Critics, Regional Science and Urban Economics 21:573–579

McFadden D (1994) Demographics, the Housing Market, and the Welfare of the Elderly. In: Wise D (ed.) Studies in the Economics of Aging. University of Chicago Press, Chicago, pp 225–290

OECD (2002) Labor force statistics. OECD, Paris

Poterba JM (2001) Demographic structure and assets returns. Review of Economics and Statistics 83:565–584

Reisen H (2000) Pensions, Savings and Capital Flows: From Aging to Emerging Markets. Edward Elgar, Cheltenham, UK

Samuelson PA (1969) Lifetime Portfolio Selection by Dynamic Stochastic Programming, Review of Economics and Statistics 51:239–246

Skinner J (1996) Is Housing Wealth a Sideshow? In: Wise D (ed.) Advances in the Economics of Aging. University of Chicago Press: Chicago, pp 214–274

Swan C (1995) Demography and the Demand for Housing – a Reinterpretation of the Mankiw-Weil Demand Variable, Regional Science and Urban Economics 25:41–58

United Nations Population Division (2000) World Population Prospects: The 1998 Revision. UN, New York

Venti SF, Wise DA (1990) But They Don't Want to Reduce Housing Equity. In: Wise D (ed.) Issues in the Economics of Aging, University of Chicago Press: Chicago, pp. 13–29

Woodward SE (1991) Economists' Prejudices: Why the Mankiw-Weil Story is Not Credible, Regional Science and Urban Economics 21:531–537

Social Insurance: How to Pay for Pensions and Health Care?

Martin Werding

1 Introduction

It is easy to see that broad-based social protection schemes which are financed on a pure pay-as-you-go basis and, at a given point in time, mainly redistribute resources from the young and middle-aged to the old will be put under substantial financial pressure as the process of demographic aging unfolds. Compared to the consequences of aging in other areas, such as labor markets, capital markets, economic development in general and other areas of public finance, its impact on pay-as-you-go social protection schemes is probably best understood. In any case, it has been subject to extensive research and, in many of the countries affected, has already led to policy changes. These may have been more or less fundamental in their nature. Also, they were sometimes enacted at an early stage, sometimes more recently, as it may have taken time to convince politicians and the greater public of the necessity to make some adjustments.

In the case of Germany, demographic aging is likely to affect the entire national system of social insurance, viz.

- the statutory pension scheme (*gesetzliche Rentenversicherung*),
- public health insurance (*gesetzliche Krankenversicherung*),
- public long-term care insurance (*soziale Pflegeversicherung*)
- and, albeit to a lesser extent and probably also in a different way, unemployment insurance (*Arbeitslosenversicherung*).

The main question we will address in the present paper is how strong the resulting pressure is going to be in Germany over the period until 2050, respectively, what form it will assume under the current legal framework governing the German social insurance system. We will do so combining current population projections (see Höhn et al. 2007, this volume), long-

term scenarios for the development of labor markets and economic growth (see also Leibfritz and Roeger 2007, this volume), and a simulation model that represents the relevant set of legal rules in rich detail to form what we think is a meaningful "baseline" scenario for the consequences of demographic aging in all branches of the German social insurance system.

Certainly, public pensions are the social insurance branch where the adverse impact of demographic change is most obvious. If the old-age dependency ratio roughly doubles in the period between 2005 and 2035, as is projected to happen in Germany, this is a matter of simple arithmetic. The periodic pay-as-you-go constraint that the system is subjected to requires that revenues collected in a given year – ear-marked contributions plus a regular injection financed from general taxation – must meet benefits expended in the same year. Taking as given the shift in demographic fundamentals, adjustments are needed in one or more of the policy variables that remain (contribution rates, benefit levels, etc.) which, overall, must be equally large. Following numerous changes that were enacted during the past 15 years, the room for maneuver is now limited. Yet, the statutory pension scheme still creates a major challenge for the long-term sustainability of German public finances.

For reasons that will become fully clear as we go along, the German system of public health insurance is also likely to be affected by a substantial increase in expenditure over the next few decades. On top of the consequences of demographic aging, a distinct type of technical progress observed in this sector may contribute to this up-ward pressure. Even though there are considerable uncertainties involved in projecting future health costs, public health insurance could effectively create no less of a challenge in terms of fiscal sustainability in Germany than the public pension system does. In spite of a long series of incremental changes, this challenge has so far not really been addressed by German politicians.

What we have just said about aging and health insurance is equally true for the German system of public long-term care insurance, apart from the fact that the latter is considerably smaller in size. Therefore, the increase in expenditure that must be expected in this area may not be as worrying. The only social insurance branch where expenditure may actually remain constant or even decrease when measured, say, as a percentage of current GDP is unemployment insurance – depending, of course, on the precise assumptions made regarding the future performance of German labor markets and the potential impact of demographic change on how they evolve over time.

Taken together, our attempt at projecting the consequences of demographic aging on the separately operated budgets of the German social insurance system will add up to a considerable increase in expenditure ratios (per GDP) and contribution rates (per taxable gross earnings) which will

mainly take place in the period between 2015 and 2035. It does not take very sophisticated measures to demonstrate that this situation will, in all likelihood, turn out to be financially unsustainable. Nonetheless, we will discuss this issue with some more care in what follows.

The remainder of this paper is organized as follows. Sect. 2 contains some remarks on the methodology adopted for our long-term projections. Sect. 3 summarizes the main assumptions regarding demography and economic development, plus a number of intermediate results that relate to the macroeconomic background scenario for our further simulations. In Sect. 4, we will describe in some detail how the different branches of the German social insurance system are organized under the current legal framework and how they are projected to fare during the up-coming period of overt demographic aging, i.e., until 2050. Building on the results obtained for the individual branches of social insurance, Sect. 5 highlights the overall consequences of demographic change for the fiscal sustainability of the current system. Sect. 6 concludes, discussing the main policy options that remain to stabilize the German social insurance system in the face of the challenges that we will identify in this paper.

2 Methodology

The projections that this paper is mostly based on were prepared with the "CESifo Pension Model" which was first set up for an official report of the Scientific Advisory Board of the German Federal Ministry of Economics (1998). Since then, the model has been regularly up-dated and used for a number of applied studies by the Center for Economic Studies (CES) at the University of Munich and the Ifo Institute for Economic Research. Also, it has been given a lot more structure and was heavily extended, now covering the entire German social insurance system.

The CESifo Pension Model builds on a pure "accounting" approach to analyzing social insurance budgets which looks simple, but is complex in its own way. It reflects numerous institutional details – such as differentiated membership rules for the different social insurance branches, or benefit entitlements that are contingent on quite a number of individual characteristics – that could not be dealt with in a general-equilibrium setting. Yet, the model does not capture any endogenous adjustments and behavioral responses, for instance, changes in savings rates and domestic investment as society is aging or a reduction in labor supply as contribution rates go up. The results are thus mainly driven by a large set of assumptions regarding single parameters and their future time paths, where neither the probability

of each assumption nor the consistency of the entire set of assumptions can be assessed in a rigorous fashion. All this could be seen as a major drawback. On the other hand, general-equilibrium models have their shortcomings as well. They are less capable of incorporating rich institutional detail. Also, their results often cannot be compared internationally as they are fitted, through widely differing calibrations, to time series of actual data observed in each country. Accounting models are therefore the current standard for comparative work meant to monitor the future viability of social insurance systems in different countries. In fact, the CESifo Pension Model has been used to prepare projections on Germany which were channeled into international studies initiated by the OECD (2001, Chap. 4) and the EU Economic Policy Committee (2001).[1] It was also applied for running illustrative simulations that entered the first official "Sustainability Report" of the German government (Federal Ministry of Finance 2005).

Our projections largely conform to methods and procedures suggested for these large-scale international studies.[2] By the simple methodology adopted here, they ultimately rest on the rule of proportion. Current expenditure on specific items – disability benefits, old-age pensions, health care, unemployment benefits, etc. – are disaggregated to form per-capita figures differentiated by age and gender. The resulting life-cycle profiles are determined with a narrow focus on individuals who are actually eligible for the respective type of benefits. Where necessary, they are combined with a specific probability for the relevant contingency to arise. Building on these pieces of information, the projections then take into account (i) expected changes in the size and structure of the total population, the labor force, and other relevant sub-populations; (ii) expected changes in the economic environment, e.g., a rate of productivity growth that feeds through to wage increases and regular benefit up-ratings; (iii) implications of the current legal framework (or alternative rules) for eligibility, benefit assessment, benefit up-ratings and many other aspects; as well as (iv) a limited amount of behavioral changes, e.g., an increase in the effective retirement age that could result from on-going and potential future changes in the statutory retirement age. (Apart from these latter changes, labor-force participation is assumed to follow an exogenous time path based on long-term trends observed in the past.) Putting all these pieces together yields projected future levels of aggregate expenditure and contribution rates required to finance these in any of the German social insurance system's branches.

---

[1] A new release of projections for the EU-25 was mainly prepared at an EU-level (see EU Economic Policy Committee and the European Commission 2006).

[2] See, e.g., OECD (2002) or EU Economic Policy Committee (2003).

The model also contains a macroeconomic background scenario which is needed to calculate future expenditure ratios as a percentage of GDP as these are much easier to interpret than results expressed on absolute terms. Here, it is simply assumed that productivity, i.e., GDP per worker, follows an exogenous trend which is largely stable throughout the projection period. Aggregate GDP can then be easily determined taking into account the projected figures for total employment in each year. Note that the GDP figures resulting from this exercise are intermediate results, at best, and should never be taken as a genuine forecast regarding economic growth in Germany over a period of almost five decades into the future.

The results derived from our projections for the individual branches of the social insurance system can finally be consolidated and translated into a long-term scenario for German public finances as a whole. Using stylized assumptions regarding future revenues from contributions and general taxation, a first set of results obtained in this context are projected time paths of deficit ratios and accumulated debt ratios reflecting the consequences of aging for social spending (see Blanchard 1990; Blanchard et al. 1990). Based on a number of more specific measures that have been designed in recent years to assess the long-term sustainability of public finances more thoroughly, the same results can also be expressed in terms of a stock of "implicit" public debt involved in the current social insurance system (for a survey of relevant concepts, see Holzmann et al. 2001) or, as a corresponding flow measure, in terms of an annual "sustainability gap" (for a definition, see EU Economic Policy Committee 2003).

Clearly, none of our projections nor their summary results should be taken to be a serious "point estimate" of what is actually going to happen to the German social insurance system in the period until 2050 given current policies. Nobody would be able to predict the various shocks and instationarities which, in addition to the long-term trends sketched here, will inevitably materialize over time under real-world conditions. Due to space limitations, we are even unable to include a larger set of sensitivity analyses with respect to our main demographic and economic assumptions.[3] However, the interested reader should note that our projections are far from producing "white noise" in the sense that the financial situation of Germany's social insurance schemes could turn out to be either favorably or unfavorably affected by demographic change, just as one changes the precise assumptions used. Rather, as long as variations in major assump-

[3] Those interested in exercises of this kind are referred to earlier studies based on the same simulation tool and on baseline assumptions that largely parallel those adopted here, augmented with extensive sensitivity analyses with respect to all major assumptions (Werding and Blau 2002; Werding and Kaltschütz 2005).

tions are restricted to plausible ranges of parameter values, the fiscal strain indicated by our results can be stronger or less strong by a substantial margin, but maintaining current rules never really appears to be a viable policy option. It is only the implementation of major policy changes that could make a difference with respect to the final results obtained from calculations like ours – an aspect that offers the main rationale for running long-term projections such as those described here.

3 Assumptions and Intermediate Results

Setting all the assumptions needed for our simulations is of course not a matter of arbitrary choice. To the extent possible, all assumptions regarding single parameters are based on long-term trends derived from actual data and on economic wisdom regarding the potential effects of on-going changes, including the aging process itself. (In this latter area, however, hard conclusions regarding many important aspects have not been established so far.) Table 1 summarizes all our major assumptions and some intermediate results in the areas of population, labor markets, and aggregate economic performance that enter our financial projections. It should be mentioned that, all in all, our assumptions as well as the resulting macro-level scenario for Germany are much in line with the parallel assumptions and scenarios developed by the OECD and the EU Commission (see Leibfritz and Roeger 2007, this volume, Tables 1–4).

The demographic projection that our calculations are based on is the "upper medium" variant of the latest official projections prepared by the Federal Statistical Office (2006).[4] For the population aged 15–74, we apply participation rates that are differentiated by gender and 5-year age groups to obtain an estimate for the size of the total labor force. The main long-term trends by which labor-force participation is expected to change over time (until 2040, all changes then leveling out) are an increase of female participation rates (closing about half of the existing gap vis-á-vis participation rates of males of the same age), an increase in participation rates of older individuals aged 55+ (mainly reflecting changes in early-retirement rules phased in since the late 1990s), and a slight decrease in participation

[4] See Höhn et al. (2007, this volume, Sect. 3.1) for all the details. Essentially, this variant of the official population projection is based on the assumptions that fertility will remain at its current low level; that there will be a further increase in contingent life-expectancies at all ages; and that there will be a continuous flow of net immigration in line with corresponding long-term averages.

Table 1. Assumptions for the simulations (CESifo Pension Model, 2007 version)

	2005	2010	2020	2030	2040	2050
	Population					
Total fertility rate	1.36	1.38	1.4	1.4	1.4	1.4
Life-expectancy at birth (years)						
– females	81.8	82.3	84.0	85.6	86.8	88.0
– males	76.2	77.1	79.0	80.7	82.0	83.5
Net immigration (thsds)	79	200	200	200	200	200
Total population (mill.)	82.4	82.0	81.3	79.8	77.3	74.0
Old-age dependency ratio[a] (%)	28.9	31.0	35.3	46.6	53.5	55.7
	Labor market and employment					
Participation rate (%)						
– females (15–64)	68.2	70.3	71.3	72.3	73.6	73.2
– males (15–64)	82.0	83.1	82.2	82.3	83.3	83.0
Total labor force (mill.)	42.6	42.3	41.0	37.6	35.5	33.5
Total employment (mill.)	38.8	39.2	38.2	35.2	33.4	31.6
– covered by soc. ins. (mill.)	26.2	26.8	26.0	23.8	22.6	21.4
Registered unemployment[b] (mill.)	4.9	4.1	3.8	3.2	2.9	2.6
Unemployment rate[c] (%)	9.1	7.2	7.0	6.4	6.1	5.7
	Macro-economic performance					
Labor productivity growth[d] (%)	1.0	1.5	1.5	1.5	1.5	1.5
GDP (€ bill., at 2005 prices)	2,241	2,438	2,752	2,946	3,243	3,564
– aggregate GDP growth[d] (%)	0.9	1.6	1.0	0.8	1.0	0.9
– per-capita GDP growth[d] (%)	1.0	1.6	1.1	1.0	1.4	1.4
Interest rate[d] (%)	1.2	3.5	3.5	3.5	3.5	3.5

[a]Population 65+ per population 15–64.
[b]National definition.
[c]Per total labor force; internationally standardized definition.
[d]On real terms p.a.

rates of younger individuals aged 15–24 (reflecting a continued trend towards higher educational attainments).[5] Overall participation rates for individuals aged 15–64 are also influenced by substantial variations in the age composition of the population within this large age bracket.

Combining our labor-force projection with assumptions regarding the future time path of the unemployment rate yields estimates regarding total employment as well as the number of unemployed. The unemployment

[5] See Fuchs and Thon (1998, 1999) who investigated these trends in terms of participation rates by gender and age using econometric techniques and projected them into the future. Here, we use an up-dated version of their projection, taking into account actual developments and data revisions that took place in the meantime (see also Fuchs and Söhnlein 2003).

rate is assumed to settle to its current "structural" level until 2010 (as estimated by the OECD 2006), thereby taking out any business-cycle fluctuations from our scenarios. Later on, it reflects a further reduction of excess supply as the labor force starts shrinking from 2012 onward. Of course, the precise assumptions do by no means imply that the projected decline in the labor force will reduce aggregate unemployment on a one-for-one basis, as there may still be a severe mismatch between those seeking jobs and the positions that become vacant. However, recent reforms imply that German labor markets will now become a bit more flexible, so that some more adjustments on the supply side may occur than in the past.

Social insurance in Germany does not cover the entire labor force. Therefore, we also need to identify employees who are subject to compulsory membership rules and do not make use of a special opt-out clause for health and long-term care insurance. As most of the legal exemptions appear to be linked to specific stages in individual life cycles (see Sects. 4.1 and 4.2 for further details), we determine current age-specific fractions of those employed who are actually covered by the different branches of the system and keep these basically constant over time.[6]

Using our employment figures and assumptions regarding the future trend in labor productivity, we also obtain a rough estimate regarding the development of aggregate GDP. Since the net impact of aging on productivity growth is subject to dispute (see Leibfritz and Roeger 2007, this volume, who survey all diverging effects that might be relevant in this area), we simply fix it at an annual real growth rate of 1.5%, about the average rate of productivity growth since German re-unification.[7] Due to a shrinking labor force and employment, this implies that the rate of aggregate GDP growth fluctuates around 1% p.a. after 2010. Per-capita GDP will be growing at slightly higher rates, between 1% and 1.5% p.a., as the total population is also shrinking, albeit not as fast as the labor force.

Basically, all our simulations are run on real terms. Only when assessing indicators of fiscal sustainability, where we need to include interest payments determined by nominal interest rates, we have to make an assumption regarding the inflation rate. It is simply set to 1.5% p.a. An assumption which really matters in the same context is that regarding the interest

[6] Only, we apportion most of those who exit from unemployment to employment that is subject to social insurance.

[7] It is important to note that the final results of our simulations are not too sensitive with respect to the precise assumptions made in this area, at least if they are expressed on relative terms (i.e., as contribution rates, per-GDP ratios, etc.). The reason is that benefit entitlements are basically indexed to wages, hence productivity growth, in most cases.

rate, mainly because most of the indicators applied there are highly sensitive to the effects of compound interest.[8] In our "baseline" scenario, a real interest rate of 3.5% p.a. is assumed throughout the projection horizon, in line with the corresponding average observed from 1991 onward. This conforms with the expectation that interest rates will move up again from their currently low level in the near future.

All projections for our "baseline" scenario relate to the current legal framework – as of 1 January 2007, including all future changes already enacted – that is relevant in the different social insurance branches covered here. (Brief descriptions of these schemes and the current rules applied there are given in the next section.) Occasionally, we add alternative scenarios based on earlier rules to see what has been accomplished through reforms already enacted, or on changes that are currently being discussed. A number of additional, more specific assumptions regarding future developments in some of the branches have to be made for our projections. They will be explained in the relevant context, i.e., once we go into detail.

4 Projections for Individual Branches of Social Insurance

4.1 The Statutory Pension Scheme

Basic Features and Recent Reforms

The German statutory pension scheme nowadays covers close to 70% of the active labor force. Membership rules for the scheme apply uniformly to unemployment insurance. They also pre-define the pool of potential members of health and long-term care insurance. The main exemptions from compulsory membership are: working in "mini-jobs" at wages below the lower social-insurance earnings threshold (about 15% of average earnings of those insured), being self-employed[9] or being a civil servant[10]. As bene-

[8] At the same time, interest rate assumptions are next to immaterial for our financial projections regarding the different branches of social insurance, as virtually none of these branches holds any substantial reserves.

[9] Some of the self-employed (artisans) are compulsory members of the statutory pension scheme for a limited number of years; others (lawyers, accountants, physicians) have private, but mandatory, cover. All other individuals in self-employment have to seek private insurance on a voluntary basis.

[10] In Germany, civil servants (about 1.7 million) form a particular sub-group of all public-sector employees (about 4.8 million). As they have tenured jobs, they have no unemployment insurance; they are covered in separate schemes regard-

fit entitlements can be linked to short periods of covered employment at some point in the past and as the system also offers survivor benefits to spouses without any entitlements based on their own work record, about 85% of the population aged 65 or older has at least some amount of benefit entitlements in the general scheme.

The statutory pension scheme is a prototypical ("Bismarckian") social insurance based on "notional individual accounts", with a close link between individual contributions – or, rather, earnings – and individual benefit entitlements. Furthermore, it is of the traditional "NDB"-variant of such schemes where, in the absence of pension reform, benefits are assessed and up-rated annually based on pre-determined rules, while contribution rates are adjusted year by year to meet the resulting obligations. The scheme is now almost exclusively financed on a pay-as-you-go basis, i.e., from current contributions plus a regular subsidy taken from the federal budget. The latter is defined based on special rules and does not give the system an open account. After a long period of depleting small amounts of funds that were meant to isolate the scheme against business-cycle fluctuations of current contributions, it nowadays holds next to no financial reserves.[11]

The link that the German public pension scheme establishes between individual earnings and individual pension benefits is largely linear across all earnings brackets as well as over the entire period covered with contributions. In each year, individual earnings that are subject to contributions – between a lower and an upper earnings threshold (the latter being about 200% of average earnings) – are converted into "pension points" reflecting their ratio over average earnings of all active members in the same year. When individuals enter retirement, the sum of these pension points, which then represents an up-rated average of life-time earnings, is simply multiplied by a current nominal "pension value" to obtain monthly benefits. Disability pensions are assessed in a similar fashion, based on fictitious extensions of benefit entitlements actually accrued. Survivor benefits are basically some percentage of benefit entitlements of the deceased spouse or parent, with additional rules governing reductions if these benefits coincide with own, non-derived benefit entitlements of the survivor. All in all, there is thus little redistribution involved in the system.[12]

---

ing their pensions, health care and long-term care. "Regular" public employees are covered in the statutory pension scheme.

[11] According to latest official figures, reserves were about € bn. 1.8 at the end of 2005, just enough to cover pension expenditure for three days.

[12] Of course, we leave out many details here. A comprehensive description of the German public pension scheme as well as the other branches of social insurance can be found in the survey of "Social Security Programs Throughout the

The nominal value attached to pension points is subject to annual up-ratings that can be basically described as wage indexation. The general set-up of the scheme described here has been largely unchanged since 1957, when the scheme was redefined for the post-war period. Afterwards, it took German politicians a while to respond to the fact that the country is now among those hit rather strongly by demographic aging. Since the early 1990s, however, there has been a series of reforms. Major changes became effective in 1992, 2001 and 2004 which were meant to make the scheme more sustainable in the long run. In these reforms, a number of measures were taken – limiting options for early retirement, tightening access to disability pensions, reducing survivor benefits, etc. – that contribute to their total effect. However, what really makes a difference across the several steps to reform are the precise indexation mechanisms applied to annual benefit up-ratings. The indexation rules entailed in all the different arrangements we are going look at here are the following.

- Pre-1992 law: pure gross-wage indexation;
- 1992 reform: pure net-wage indexation (gross wage minus average tax rate and all employees' social insurance contributions);
- 2001 reform: modified net-wage indexation (gross wage minus pension contributions and a "recommended" rate of precautionary savings);
- 2004 reform: modified net-wage indexation (as under the 2001 law) augmented with a "sustainability factor" (reducing annual up-ratings if the pensioner-to-contributor ratio increases)

Note that the pre-1992 legal framework would have implied continuous increases in the net benefit level (i.e., pension benefits per net earnings of current contributors) as contribution rates had gone up. In the face of the growing pressure of demographic aging, the 1992 reform fixed this bug (implying a constant net benefit level of around 70% at that time). All subsequent reforms imply further reductions in the benefit level that will mainly become effective in the long run. As we will see, a consequence is that adequacy of public pensions may really become an issue in the period after 2025, that is, when the German baby boomers retire.

To compensate for the expected reduction in public pension benefits, the 2001 reform also introduced a new framework for supplementary private savings, involving subsidies, tax incentives and new regulation regarding suitable financial products. However, take-up among those eligible for this program has been slow and, in any case, it is outside our focus on the domain of social insurance. In 2004, the government postponed decisions re-

World" provided by the U.S. Social Security Administration (2006) or the European Commission's online database MISSOC (2006).

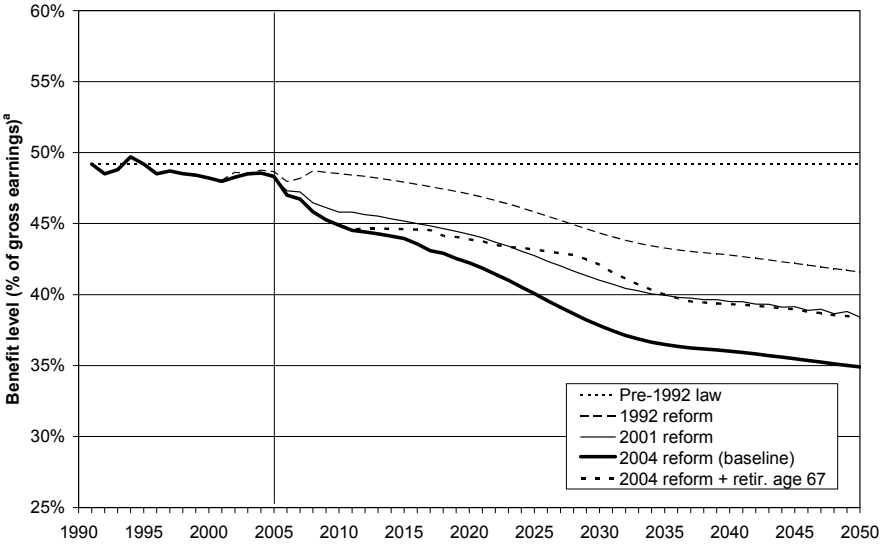
garding another element of reform that had been recommended by an official reform commission (Kommission 2003), viz. a gradual increase in the statutory retirement age (from age 65 to 67, according to an up-dated schedule: between 2012 and 2030). Combined with the new "sustainability factor" applying to benefit indexation, a major effect of this change would be to secure future pensioners a higher level of benefits that they are entitled to receive for a shorter period of time, not only a further reduction in total expenditure. It is now highly likely that this plan will be adopted in the near future.[13] We will therefore include this option in our projections as an additional reform scenario.

Another change which dates back a little longer and is important for our simulations is that, since about 1999, the statutory pension scheme is no longer exclusively financed from contributions. Before, the scheme had received a subsidy from the federal government's budget meant to cover a limited amount of non-contributory benefits. Over the entire 1990s, there were discussions of whether the subsidy was actually large enough to meet this goal. It was repeatedly increased on an ad-hoc basis, thereby also removing up-ward pressure from the contribution rate. In 1999, this policy was put on a firmer footing, accompanied by another substantial increase in the subsidy. It nowadays covers about 31% of total benefit expenditure, so that current cost rates (i.e., total expenditure divided by the scheme's aggregate tax base) are well above current contribution rates. While the rationale behind these changes – reducing non-wage labor costs implied in higher contribution rates to limit unfavorable effects for employment – may be defendable in itself, this is a strategy exactly opposite to the introduction of "demographic buffer funds", such as the OASDI Trust Funds in the US, which has been chosen in other industrialized countries.

Financial Projections

In spite of all the reforms enacted since the early 1990s and the long-term reductions in the benefit level that they will lead to, contribution rates and, even more so, current cost rates of the statutory pension scheme must still be expected to increase substantially in the period from 2015 to 2035. This is clearly illustrated in Figures 1 through 3 which display the main results of our financial projections for the German public pension scheme, based on the assumptions summarized in Sect. 3 and on the different legal arrangements described in the preceding sub-section.

[13] After the 2005 election, this was announced by the new "grand coalition" government, while no further plans for pension reform have been indicated so far.



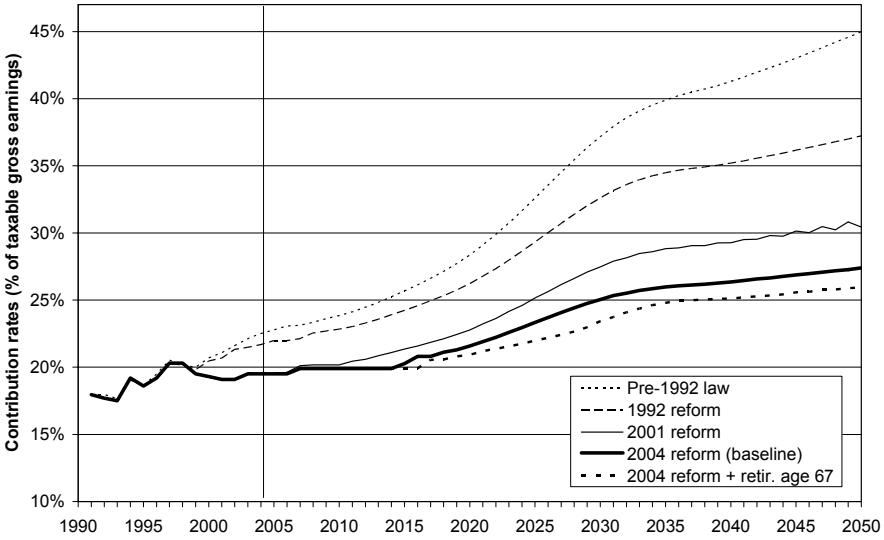
[a]Based on standardized benefit entitlements derived from a full life-time work record (45 years) with average earnings throughout and on current average wages of contributors, all gross of income taxes and social insurance contributions. (Note that pensioners have to pay contributions for health and long-term care.)

Source: CESifo Pension Model (2007 version).

Fig. 1. Level of pension benefits, 1991–2050

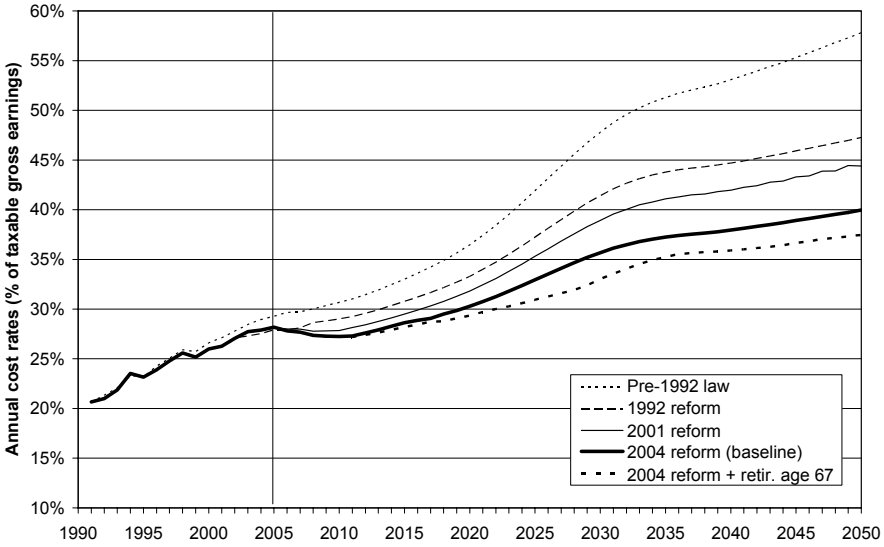
Figure 1 shows the projected development of benefit levels, assessed in a standardized fashion that is widely used in German public debates. Due to a long work record and an unrealistic earnings profile, resulting benefits are higher than the average level of benefits effectively paid. As an unambiguous benchmark, we use gross earnings of current contributors here, the current benefit level of about 48% corresponding to a net replacement rate of 67.5%. Under the current law, our "baseline" scenario, the gross benefit level will go down to 35% until 2050 based on the standardized definition above. Average benefits could thus decline from a current 33% to about 25% of gross wages, almost exactly the current level of means-tested social assistance benefits that individuals with no income of their own are entitled to receive in Germany. As an obvious step to further reform, increasing the statutory retirement age for the German baby boomers could provide for a higher level of annual benefits in the long run – above 38% for a "standard pensioner", that is, close to 30% for the average pensioner.

Figures 2 and 3 depict the corresponding time paths of official contribution rates and actual cost rates (the latter deviating from the former for the



Source: CESifo Pension Model (2007 version).

Fig. 2. Pension contribution rates, 1991–2050



Source: CESifo Pension Model (2007 version).

Fig. 3. Annual cost rates in the pension scheme, 1991–2050

reasons explained above. It is easy to see that the long-term reductions in benefit levels enacted so far brought considerable progress towards making the system financially viable.[14] However, the reforms have not entirely removed the upward pressure from the contribution rate. In fact, according to our projections, one of the goals of the 2001–04 legislation – viz., to limit the official contribution rate to a maximum of 22% until 2030 – cannot be met even if the statutory retirement age is extended starting soon.[15]

It should be noted, nevertheless, that German politicians have clearly done something to address the challenge which demographic aging creates for the statutory pension scheme. Through a series of reforms that may have been initiated rather late, but gained considerable momentum up to the present, operating the scheme in the medium to long run has now at least become manageable – certainly if one compares the current stance of reforms to that in other branches of social insurance and if one keeps in mind the particularly strong impact of aging in Germany. In any case, those advocating further pension reforms are now faced with stark choices. We will discuss the major policy issues that remain in Sect. 6.

4.2 Public Health Insurance

Basic Features

By the current levels of benefit expenditure and contribution rates, the German public health insurance system is the second largest branch of social insurance, following the pension scheme and with a considerable lead over unemployment and long-term care insurance. It actually covers a higher fraction of the total population – almost 88% – than the pension scheme does as it also provides insurance for inactive spouses (or second-earner spouses with wages below the lower social insurance threshold) and dependent children of its members. Membership rules differ from those of the pension scheme in that there is an additional opt-out clause for individuals who are in principle employed subject to social insurance but earn wages that exceed a special upper earnings threshold (of about 160% of average earnings); basically, this option is favorable for those who have no

[14] Of course, part of the progress in reducing the financial burden on future contributors that is seemingly indicated by Fig. 2 is an artifact of the expansion of the tax-financed federal subsidy. In this sense, Fig. 3 is more telling.

[15] Official projections that goals like this are based on (see., e.g., Kommission 2003) build on older demographic projections and assume a much more favorable development of labor markets (mainly, higher increases in participation rates of older workers and stronger reductions in unemployment rates).

family members that could be covered at no extra-charge in the public system.[16] Again, many of the self-employed as well as civil servants are outside the public health insurance system.[17]

German public health insurance is a fragmented system. At present, it encompasses about 250 independent health funds, but their number is shrinking fast through continuous mergers. The budgets of individual funds are linked through an equalization scheme, triggering payments across bodies that are mainly related to differences in average earnings of active members as well as the age and gender composition of all those effectively covered in each fund. Nevertheless, there are remarkable differences in contribution rates between health funds that are due to differences in their effective structure of health risks and in their overhead costs.[18]

Like the public pension scheme, public health insurance in Germany is financed on a pure pay-as-you-go basis, i.e. from current contributions and a small subsidy taken from the federal government's budget. The latter was first introduced in 2004 as a general means of avoiding higher contribution rates. It shall be expanded from 2008 onward, now mainly meant to cover part of the benefits for dependent children. Contributions are earnings-related, being conventionally defined as a proportion of earnings between the lower social insurance threshold and an upper limit of close to 150% of average earnings.[19] For employed members, health insurance provides a wage-replacement benefit during extended periods of sickness (periods of up to six weeks are usually covered through the employer). More

[16] Considering the huge amount of redistribution involved in public health insurance, the opt-out clause is hardly defendable on equity grounds. At the same time, German private health insurance (with full cover) has some special features that are of interest in the context of aging and health care: they offer lifetime contracts which perfectly insure the health-status risk and accumulate a substantial amount of capital reserves as a means of pre-funding for higher health costs at old age (for further details, see Baumann et al. 2006.)

[17] See Footnotes 9 and 10 for further details. Also, note that only a tiny fraction of the German population (0.2%) has no health insurance cover at all.

[18] In fact, establishing competition between health funds with regard to low overhead costs is one of the main goals pursued with the equalization scheme. However, in spite of many attempts to remove incentives for risk-selection – such as the introduction of separate risk pools and disease-management programs for some conditions where treatment is extremely expensive – the scheme works far from perfect. A new, "morbidity-oriented" equalization scheme is currently in preparation and should become effective starting from 2007.

[19] The difference between the two earnings limits that are relevant for membership rules and for contributions is the result of a recent (2003) change which aimed at keeping more members in the public system.

importantly, for all individuals insured, it gives access to a uniform, and rather comprehensive, package of health benefits in-kind. So far, the quality of services provided appears to be satisfactory, but the German health-care system appears to be rather expensive compared to many other countries that do not perform weaker on the quality side. In terms of total health expenditure per GDP,[20] Germany (2003: 10.9%) takes a third rank behind the United States (15.2%, a true outlier) and Switzerland (11.5%), but well ahead of many other OECD countries (the unweighted OECD-wide average being 8.8%; see OECD 2006b). Based on similarly rough comparisons, structures that could help explaining this observation are a relatively low share of patients' co-payments that could impose limits on the utilization of services, a high frequency of out-patient contacts with physicians, and a particularly high density of hospital beds for in-patient care.

For the German public health insurance system, there is no similar list of far-reaching reforms that were already enacted as that for the public pension scheme. Instead, over the past two decades, numerous incremental changes have been made at almost annual intervals. Attempts to establish a limited degree of competition between public health funds were already mentioned; a differentiated system of ceilings for broad categories of expenditure was installed in 1992, but it was used for a "hard" budgeting only temporarily; some types of benefits, mainly located at the fringe of a full benefit package (most prominently: dental prostheses), have been excluded; the limited amount of co-payments that exists was introduced step by step for hospital care (a small per-diem), prescriptions (fixed fees differentiated by price ranges) and, most recently, for out-patient consultations (a quarterly lump-sum); last but not least, the schemes for funding hospitals and for remunerating physicians were altered more than once.

Apart from transitory effects for the public health budget that point to inter-temporal shifts in consumption of health services rather than to genuine behavioral changes on the side of patients and/or providers, these small-scale reforms have at best moderated a long-term increase in public health expenditure that has been observed since the early 1970s. Since 1991, the year of German re-unification, contribution rates (averaged over all existing public health funds) increased from 12.2% to 14.2% in 2004.[21] Some of the short-term measures already mentioned – above all, the intro-

[20] That is, not just focusing on the share of public expenditure which is about 80% of total health expenditure in Germany, slightly above the OECD-wide average of 72% (OECD 2006b).

[21] It appears that contribution rates would have had to increase even more than that if, in spite of a narrow legal limit, public health funds had not started to accumulate a substantial amount of debt in the years before 2004.

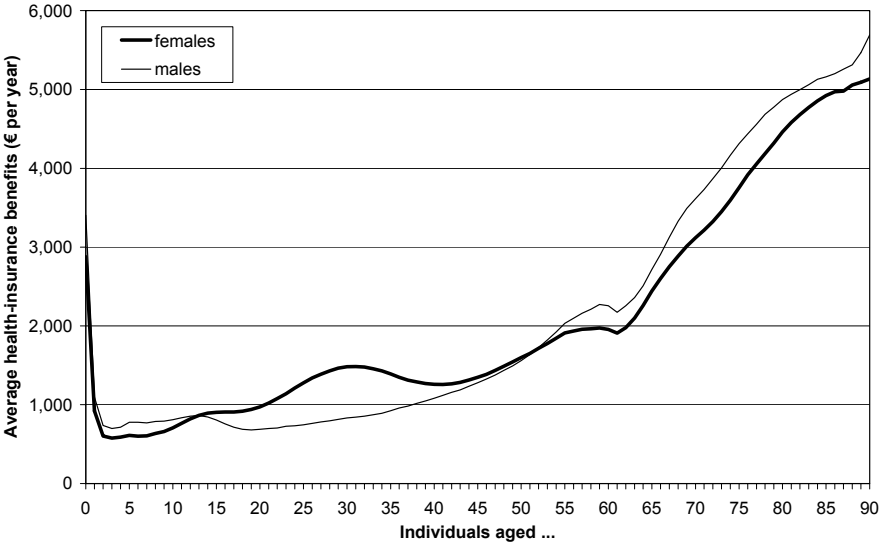
duction of a tax-financed subsidy from the federal government's budget and the new consultation fee – were then implemented and led to a reduction in contribution rates to 13.7% in 2005. But considerable up-ward pressure on contributions is likely to return soon.

Currently, German politicians are split between two competing reform proposals,[22] one side advocating an expansion of the existing system to a universal coverage (with those currently covered in private health insurance as additional contributors and with income from all sources, not just wage earnings, made the tax base of the scheme), the other favoring what would look like a fundamental re-design of the system defined along more insurance-like principles (with a uniform lump-sum contribution for everyone that would no longer affect non-wage labor costs and a tax-financed subsidy for those who otherwise could not afford insurance for themselves and their family members). It is important to note that both these proposals are entirely focused on the revenue side of the health insurance system and, in terms of their overall effects for a given household's financial budget, need not be altogether different. Nevertheless, the highly ideological debate has so far ended in a dead race between the two political camps – just as the latest federal-level election did. None of the plans that are about to be adopted by the new "grand coalition" government installed in late-2005 deserves the name of a true health-care reform.

Financial Projections

The up-ward pressure on health insurance contributions that is likely to become effective in the future is mainly due to two reasons. One is that the system is financed on a pure pay-as-you-go basis and that the current age-related profile of average health expenditure is sharply increasing from around age 60 onward (see Figure 4). In the course of demographic aging, with a higher fraction of the insured population belonging to older age cohorts, aggregate health expenditure must therefore be expected to rise over the next few decades. Another reason that appears to be even more important is a distinct type of technical progress observed in the health-care sector. It implies that, over time, the profiles shown in Figure 4 have to be uprated by more than just the ordinary rate of GDP or productivity growth. At least, this is what past experience suggests. Nevertheless, by its very nature, the impact of technical progress on future health costs is very hard to predict. Unlike with the pension scheme, where benefits are defined in

[22] Up to a point, the same applies to official policy advisors (see, again, Kommission 2003).



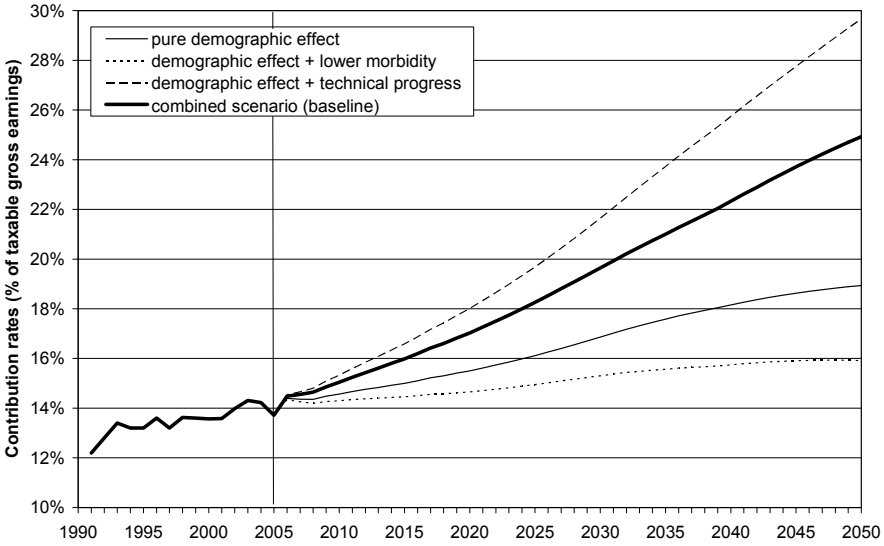
Sources: Federal Insurance Authority (2001); CESifo Pension Model (2007 version).

Fig. 4. Age-related profile of average health-insurance benefits, 2005

terms of nominal amounts of money that can be easily projected into the future based on current indexation rules, health insurance offers coverage for a package of services of which we may not even know all the future components, let alone be able to attach a price to these.

A further issue that is still unsettled is whether there is a specific, positive or negative, impact of increases in longevity on age-related morbidity, hence on the shape of the above health-cost profiles (see, for instance, Zweifel 1990; Zweifel et al. 1999). One view is that new cases of multimorbidity may arise as individuals live longer, implying that health expenditure at higher ages would go up more than proportionally. The alternative view is that higher longevity goes along with an extended period of life spent in better health, implying that the profiles shown in Figure 4 would shift to the right, say, starting from around age 40.

Against this background, there are thus enormous uncertainties involved in estimating the future time paths of aggregate health expenditure and average contribution rates for the German public health insurance system. Technical progress in the health-care sector and potential changes in age-specific morbidity are often entirely ignored in long-term projections – for instance, those prepared on behalf of the OECD (2001, Chap. 4) and the EU Economic Policy Committee (2001). Instead, according to the common methodology devised for these international studies (see Franco 2000), cur-



Source: CESifo Pension Model (2007 version).

Fig. 5. Average contribution rate for public health funds, 1991–2050

rent age-related profiles of health expenditure are up-rated in line with productivity growth. However, neglecting technical progress could lead to a serious underestimation of the up-ward trend in future health costs. For instance, an empirical analysis by Breyer and Ulrich (2000), based on data for West German public health funds from 1970–95, suggests that technical progress accounts for an extra-increase in health expenditure of about 1% p.a.[23] In addition to the standard approach which may be useful to identify a "pure demographic effect", we therefore run financial projections for the German public health insurance system using two alternative scenarios – one with continuous technical progress (modeled following Breyer and Ulrich 2000) and one with continuous reductions in age-specific morbidity[24] – and we tend to consider a fourth scenario that combines all these effects to be a meaningful "baseline" case for our further calculations.

[23] It is of course unknown whether technical progress will change its direction in future years. Under the budgetary pressures exerted by acute demographic aging, cost-saving process innovations and organizational changes may become more prominent than expensive product innovations. We will briefly return to this issue in Sect. 6.

[24] Regarding the morbidity issue, we take a rather optimistic view, assuming that each additional month of average life expectancy will prolong the life span with lower average health costs on a one-for-one basis.

The result of our projections is that, under its current legal framework and using assumptions that are far from extreme, German public health insurance may effectively create not much less of a challenge in terms of fiscal sustainability than the public pension system does. In Figure 5, this is indicated by the fact that average contribution rates needed to balance the scheme, together with a small subsidy financed from the federal government's budget, will increase much more than – and may eventually reach or even exceed – those of the public pension scheme (cf. Fig. 2). More fundamental reforms of the system are thus urgently needed (see Sect. 6 for further discussion). Yet, it appears that German politicians still have to come to terms with this challenge.

4.2 Public Long-Term Care Insurance

Public long-term care insurance is a relatively new scheme. Before it was established, medical expenditure involved in long-term care was basically covered by health insurance, while the cost of pure nursing had to be borne privately. As few individuals had additional cover for this contingency and as the associated cost could soon become excessively high, a substantial amount of the financial burden effectively fell on the social assistance scheme supporting those who had run out of their funds.[25]

The social insurance scheme meant to fill this gap was set up in 1995 – i.e., when the process of demographic aging was clearly indicated in the data. Once more, it is a pure pay-as-you-go scheme. It is operated by public health funds, based on separate budgets, and covers the same sub-population as the public health insurance system does. Long-term care insurance is purely financed from contributions payable at a relatively small rate which has been held constant (at 1.7%) since July 1996 now. Benefits are basically a fixed monthly lump sum, differentiated by three different levels of the intensity of care needed and by whether care is provided in an ambulatory fashion by close relatives (who then receive a small compensation) or by professionals, or in special long-term care institutions.

Since its initiation, long-term care insurance has been operated in a rather cautious way. For a few months in 1995, it only collected contributions (at a reduced rate of 1%) without paying any benefits. The full spectrum of the latter was then gradually phased in until mid-1996. As a consequence, the scheme accumulated a considerable stock of reserves during

[25] Note that, under the social assistance scheme and within certain legal limits as to their ability to pay, adult children were then responsible for covering the costs for their parents.

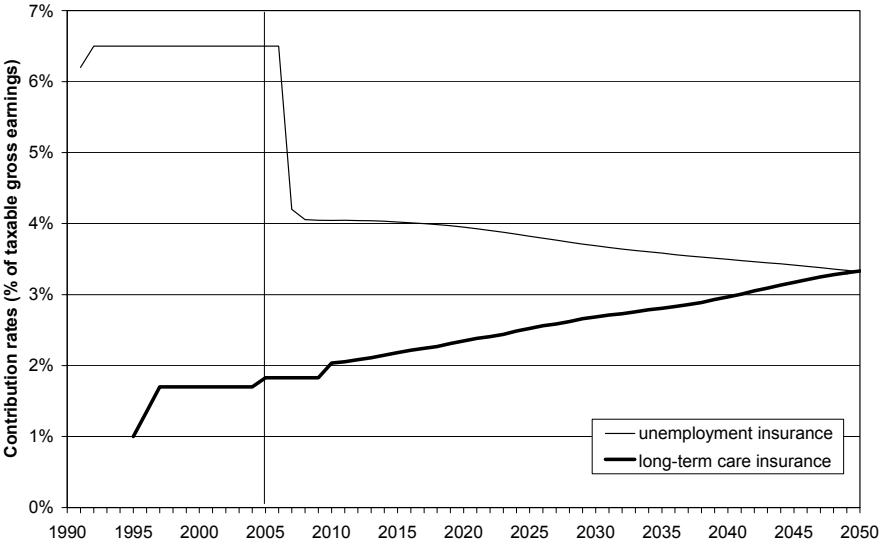
the first two years of its existence. Recent projections indicated that this stock would have been depleted by 2007. Following the introduction of an extra-contribution of 0.25% for childless members aged 23–65 years starting from 2005, this has now been postponed until about 2009.[26] Also, benefits have basically not been up-rated since 1996, implying that the quality of services provided by the system is increasingly becoming an issue. A major reform of the system has been announced for each year since 2001. Yet, conceptual ideas regarding the direction to take are lacking in the political sphere. This is even more so the case as the system is institutionally linked to public health insurance for which there is currently also no political consensus on reforms, the two major political parties blocking each other on questions that do not appear to be central (see Sect. 4.2).

Most of what we have said about aging and health insurance is equally true for public long-term care insurance. Only, the latter is much smaller in size. Age-specific prevalence rates (with pre-defined benefit levels linked to each individual case, differentiated by the intensity and type of care needed) are increasing even sharper than average health costs, in this case from around age 80 onward. Technical progress may not matter so much for long-term care, but this may change in the future – or all types of care may become even more labor-intensive than they are today. Still, one may hope that the profile of prevalence rates shifts in a favorable direction if people tend to live longer. Last but not least, the current strategy of keeping benefits paid in each case constant is not credible over an extended period of time into the future. (Otherwise, this would mean that long-term care insurance is virtually abolished within three to four decades, which could not be considered a meaningful "current policy" scenario.) As a result, we combine the same elements in our ("baseline") projection as we do for health-insurance benefits (see Sect. 4.2).[27] Figure 6 summarizes our simulations in terms of projected contribution rates for long-term care insurance, indicating that the relative increase in expenditure that could result from demographic change will be higher in this scheme than in any of the other branches of social insurance. Only, the absolute increase may not be as worrying as it is elsewhere.

---

[26] This change – in fact, a much smaller one than many observers had expected – goes back to a ruling of the Federal Constitutional Court (2001), not so much to a political decision. It is meant to reduce the free-riding of childless individuals on contributions paid by other people's children which is almost inevitable in any pay-as-you-go financing of expenditure typically increasing in age.

[27] In this case, however, the cost-saving effect of the shift in prevalence rates dominates the increase in costs through technical progress when comparing the results to those for a scenario with purely demographic effects.



Source: CESifo Pension Model (2007 version).

Fig. 6. Contribution rates for long-term care insurance and unemployment insurance, 1991–2050

4.4 Unemployment Insurance

As in most other industrialized countries, German unemployment insurance offers monetary benefits that are meant to replace wages during an initial phase of unemployment for all the individuals covered. Membership rules in this system are the same as for the public pension scheme. It is administered by the Federal Labor Agency which is also responsible for providing all kinds of employment services (counseling, job placement), operating all measures of active labor market policies (ALMP: training, special placement activities, subsidized employment for job-seekers, hiring subsidies for employers, etc.) and administering an important fraction of the prolonged income support (through non-contributory, means-tested benefits that are typically lower) for those whose unemployment insurance benefits have expired. In our projections, we will exclusively focus on the social-insurance part of the system (i.e., on unemployment insurance benefits plus expenditure on employment services and a number of specified ALMP measures).

Labor market reforms that were initiated in Germany in 2002 are mainly focused on an internal re-organization of the labor agency as well as on the activation of the long-term unemployed (that is, those who are no longer

covered by unemployment insurance). The only change that directly affects the unemployment insurance scheme is a reduction in the duration of benefit entitlements for older workers, while the level of benefits (at 60% of previous net earnings for childless individuals, 67% for individuals with dependent children) is unchanged. Entitlement periods now range from up to 6 months (for those who paid contributions for at least 12 months during the last 36 months) over a regular duration of up to 12 months (requiring at least 24 months of contributions paid over the last 36 months) to a maximum of 18 months (for those who continuously paid contributions during the last 36 months and are aged 55 or older).[28]

For more than a decade, unemployment insurance contributions remained fixed at a rate of 6.5% of taxable earnings, with not much attention being paid to what specific types of benefits and services provided by the labor agency should be funded from these revenues. As a rule, the agency ran large deficits that were covered, partly ex post, through injections from the federal government's budget. Following recent reforms that aimed at more transparency in this area, a stricter distinction has now been established between unemployment insurance on the one hand and tax-financed expenditure on labor market policies on the other. Together with the reduction in benefit duration, this allows for a reduction of the contribution rate to 4.2% in 2007.[29] With the moderate decline in (structural) unemployment assumed to take place over the entire projection period, the contribution rate may go down even further over time (see Figure 6). Compared to all other branches of the German social insurance system, this trend is exceptional. Yet, it is mainly driven by our assumptions regarding the long-term trend in unemployment under the conditions of demographic aging (see Sect. 3).

5 Sustainability of the Social Insurance System

As an indicator that is widely-used in Germany to illustrate the growing financial pressure aging exerts on the social insurance system, we so far

[28] Before this change which became effective in January 2006, the maximum duration was 32 months for individuals aged 57 and older.

[29] At the same time, the tax-financed part of the labor agency's total budget is likely to go up as the effects of recent labor market reforms are unfolding only slowly (for an in-depth analysis, see Sinn et al. 2006). Note that virtually all measures of ALMP are currently under evaluation and that the new benefit scheme for the long-term unemployed (first introduced in 2005) is still under construction. Estimating the future development of expenditure in these areas is thus difficult and, in any case, critically dependent on pending policy decisions.

mainly looked at the contribution rates applying in the different branches. Adding up the results obtained for the relevant "current policy" or "baseline" scenarios (taking in all future changes that are already enacted) leads to an estimated increase in total social insurance contribution rates from 41.5% in 2005 to 59.0% until 2050. Due to the precise timing of demographic change in Germany, the increase is strongest in the sub-period between 2015 and 2035. Gauged by its impact on non-wage labor costs for employers and work incentives for employees, the end-of-projection level of social insurance contributions may well be considered prohibitively high.[30] Furthermore, due to a considerable amount of subsidies taken from the federal government's budget, contribution rates alone do not even capture the full fiscal burden that will arise. In any case, the conclusion that the current system is not sustainable – neither economically nor politically – may appear straightforward.

Over the last two decades, considerable effort has been spent on devising measures of fiscal sustainability by which this conclusion could be backed in a more precise, and also more general, fashion. Here, we will apply a number of these sustainability indicators in turn.

5.1 Aging and General Government Fiscal Balances

The starting point for our further calculations is illustrated in Figure 7. It shows the consolidated change in total social insurance expenditure projected in our baseline simulations – taken as a percentage of GDP and purged from double counts resulting from cross-payments (mainly, health and long-term care insurance contributions for pensioners paid by the pension scheme). Building on Blanchard (1990) and Blanchard et al. (1990),[31] we will then perform a stylized exercise for which projected deviations from the current level of corresponding expenditure are most important.

---

[30] In Germany, social insurance contributions are next to equally split between employers and employees. For employment covered by social insurance, labor costs are thus given by gross wages plus about half the total contributions plus fringe benefits (which, to a large extent, are not at the employer's discretion but defined by legal rules or collective agreements). Net wages are gross wages minus half the contributions minus personal income taxes. Keeping 20.9% as the relevant income tax rate (see OECD 2005), the total tax wedge in 2050 could thus be about 62% of labor costs of an employee at average earnings.

[31] This methodology was further developed for real-world applications by Leibfritz et al. (1995) and Roseveare et al. (1996). The same methodology was used in OECD (2001, Chap. 4).

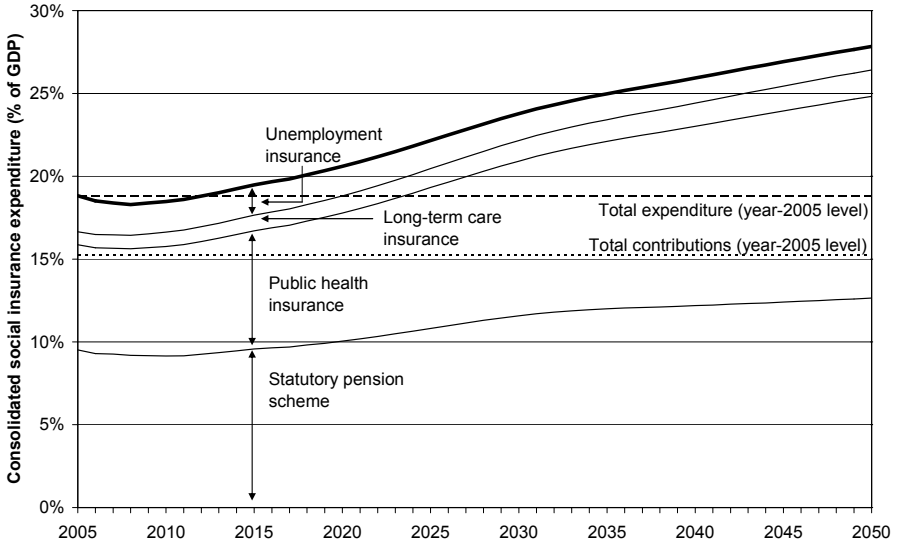
Figure 7 indicates that there is a strong up-ward trend in social insurance expenditure implied in our projections.[32] Taking the current share of social insurance contributions in GDP as another important benchmark (i.e., leaving contribution rates basically constant) and assuming that all other public revenues and expenditures also remain constant as a percentage of GDP (see Seitz 2007, this volume, for an in-depth analysis indicating that growing financial pressure through aging will also be an issue in other areas of general government finances), this up-ward trend directly translates into a hypothetical increase in the primary deficit ratio.[33] Taking into account the consequences for accumulated public debt and annual interest payments, this would have an even stronger impact on the total deficit ratio (see Figure 8).

Figure 8 reflects yet another aspect that has some bearing on the long-term sustainability of German public finances. Given the current level of debt per GDP (the official figure for 2005 is 67.7%) and the total deficit ratio (3.2%), there is an urgent need for short-term fiscal consolidation to meet the standards defined in the German constitution as well as the mutual understandings of the EU Stability and Growth Pact (SGP). To define the size of the adjustment needed – first of all, in the primary deficit ratio – the EU-level framework offers a simple yardstick. If, in line with our projections, the long-term nominal growth rate is assumed to be about 2.5% p.a. in Germany (1% of real growth and 1.5% of inflation; see Sect. 3), then the debt ratio would converge towards 60% (the SGP target level) in the long run if the total deficit were about 1.5% of GDP (60% of the nominal growth rate) in each year. Against the 2005 level, the deficit ratio should thus be reduced by 1.7 percentage points. It is assumed here that this task can be reached, through a reduction in expenditure and/or an increase in revenues, until 2008. Yet if German politicians fail to accomplish this short-term goal, the need for further adjustments necessitated by demographic aging would simply increase correspondingly.

---

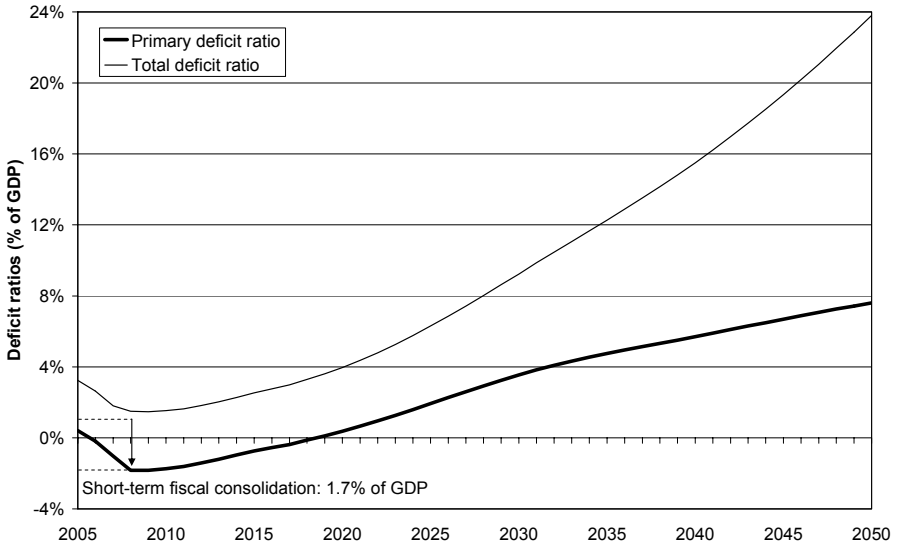
[32] Against its current (year-2005) level, the total increase projected to occur until 2050 amounts to 9.0% of GDP. Parallel results (in brackets: consolidated figures taking out cross-payments) for the single branches are 4.0% (3.1%) for the public pension scheme, 5.9% (5.8%) for public health insurance, 0.8% (0.8%) for long-term care, and –0.7% (–0.7%) for unemployment insurance.

[33] Of course, increasing contribution rates in line with our projections would be one strategy of dealing with the sustainability risks involved in the current legal framework. Relying on measures of this kind only may not be the ideal way of solving these problems, though (see Sect. 6 for further discussion). In any case, to obtain a comprehensive measure of the total sustainability gap this option is deliberately ignored here.



Source: CESifo Pension Model (2007 version).

Fig. 7. Total social insurance expenditure as a percentage of GDP, 2005–2050



Source: CESifo Pension Model (2007 version).

Fig. 8. General government primary and total deficit ratio, 2005–2050

After successful short-term consolidation, however, the financial pressure that demographic aging exerts on the German social insurance system starts to unfold. According to our projections, the primary deficit will rise from –1.8% of GDP (in 2008, effectively a surplus) to no less than 7.6% over the entire projection period. The total deficit ratio will remain below 1.5% until 2009, below 2% until 2013, and below 3% until 2017. Due to the effects of compound interest, however, it will continue to increase at accelerating speed and may clearly exceed 20% of GDP by 2050. In turn, the debt ratio will reach 100% in 2027, 200% in 2040, and 300% in 2048. In other words, by the construction of our stylized scenario, the implicit type of public debt which is inevitably involved in unfunded social insurance schemes is gradually converted into explicit debt. The latter is therefore exploding in a process that will actually not be completed until 2050.

From these observations, two directions can be taken to indicate the "non-sustainability" of current social insurance policies more clearly. One approach is to explicitly calculate the size of implicit debt involved in the social insurance system (Sect. 5.2). The other is to determine a fiscal adjustment in annual general-government budgets that would be required to fully remove the up-ward pressure on public deficits and debt (Sect. 5.3).

5.2 Implicit Social Insurance Debt

Calculations regarding the amount of implicit debt involved in pay-as-you-go public pension schemes that received much attention at an international level have first been run by Van den Noord and Herd (1993, 1994). Since then, there have been a number of follow-up studies and up-dates. At the same time, objections were raised, mainly warning against potential confusion of explicit and implicit public debt measures (see, e.g., Franco 1995). In a more recent paper, Holzmann et al. (2001) distinguish between different notions of implicit debt that are effectively applied in the literature and highlight their relative merits for analyzing the sustainability of existing social insurance schemes. Here, we will take up two of these concepts and calculate the corresponding amounts of implicit debt for the German social insurance system assuming that the latter will develop over time as projected in our baseline simulations (see Sect. 4).

The concept of implicit debt that is closest to the notion of explicit public debt is that of "accrued-to-date liabilities" (ADL) involved in public pension schemes and other branches of social insurance. ADL simply measures, as a percentage of current GDP, the net present value of all outstanding benefit entitlements (effective until around 2060) that are linked to past and current contributions. It is thus determined "as if" the relevant

scheme were closed for new accruals starting from the next year. On the other hand, the concept may fail to fully capture the long-term effects of larger shifts in the population structure ("demographic aging") or, no less important, of policy changes that become effective only over a very long transition period.[34] For this reason, other measures have been devised that address the expected continuation of the scheme and augment ADL measures by the impact of benefits linked to future contributions.

In the limiting case, long-term projections regarding the social insurance system's budget can be extended to cover an infinite ("open") time horizon. "Open-system net liabilities" (OSNL) implied in the current legal framework are then the main result obtained. The term "net liabilities" indicates that, in this case, future contributions that will be collected at current contribution rates over the same, infinite time horizon are also taken into account. Interpreting the amount of all future benefit entitlements that could arise until infinity – not just a fraction of these that would remain unfunded at some benchmark rate of contributions – as an unconditional measure of implicit government debt does not make sense. As a result, OSNL-type measures are more closely related to projections regarding long-term trends in general government fiscal balances (see Sect. 5.1). In fact, they are the full stock of implicit debt which becomes visible there. Being even more forward-looking than ADL measures, they are also more strongly dependent on many long-term assumptions, in particular, on the interest rate used for assessing net present values of future payments.

ADL-type measures of implicit debt are easy to apply to social insurance schemes with a strong link between contributions and benefit entitlements, such as the German public pension scheme. However, extensions to "Beveridgean" schemes, with lump sum benefits that are differentiated only pro rata temporis, i.e., by periods covered with contributions, are straightforward. In our calculations for Figure 9, we apply the same logic to benefit entitlements vis-à-vis the German systems of public health and long-term care insurance.[35] As there is little inter-temporal (hence, inter-

[34] Now that the German baby boomers are already approaching retirement, the first of these problems is no longer really important. Given that the reductions in future benefit levels involved in recent pension reforms will mainly take effect until around 2035 (see Fig. 1) and that similar changes in other social insurance branches are largely lacking, the same applies to the second problem.

[35] In doing so, we specifically assume that benefit entitlements already "accrued" for dependent children (expressed as a percentage of full, age-specific health costs) are contingent on the number of years below age 20 that are covered with contributions paid by their parents; that benefit entitlements for currently active members and their spouses are contingent on the number of years between age

generational) redistribution involved in unemployment insurance, assessing ADL for this scheme does not appear to be meaningful. Note that, again, we have to correct the "consolidated total debt" figure included in this graph for cross-payments to avoid double counts in the aggregation.

For the OSNL measure of implicit debt shown in Figure 10, links between contributions already paid and benefit entitlements already accrued are immaterial. Also, we can now include unemployment insurance which, according to our projections, promises at least some amount of surpluses of benefits over contributions (collected at current rates) during the period of acute demographic aging. This could off-set part of the unfavorable trends expected in all other areas looked at here. However, we now need to extend our projections regarding aggregate benefit expenditure and contributions for all branches of social insurance from 2050 to an infinite time horizon. This is done in two steps. For the period between 2050 and 2100, we run explicit projections – with convergence to something like a new "steady state" – in which no further change in any of the assumptions made so far (see Sect. 3).[36] For the more remote future, we simply take benefits and revenues obtained for the final year of our explicit projections and assume that their end-of-projection growth rates will be constant.[37]

When compared to conventional, explicit debt measures, the amounts of implicit social insurance debt shown in Figures 9 and 10 appear to be enormously high. This is equally true for the ADL variant (with a stricter definition and a shorter time horizon) and the OSNL measure (with some amount of contributions taken into account as a counter-balance). Depending on which of these definitions is chosen, total implicit (net) debt resulting from our calculations varies between 429% and 348% of current GDP, respectively, while the official German debt ratio is currently close to 70% (see Sect. 5.1). Up to a point, if accounting for implicit public debt became a new standard, one would simply have to get used to such high figures.[38]

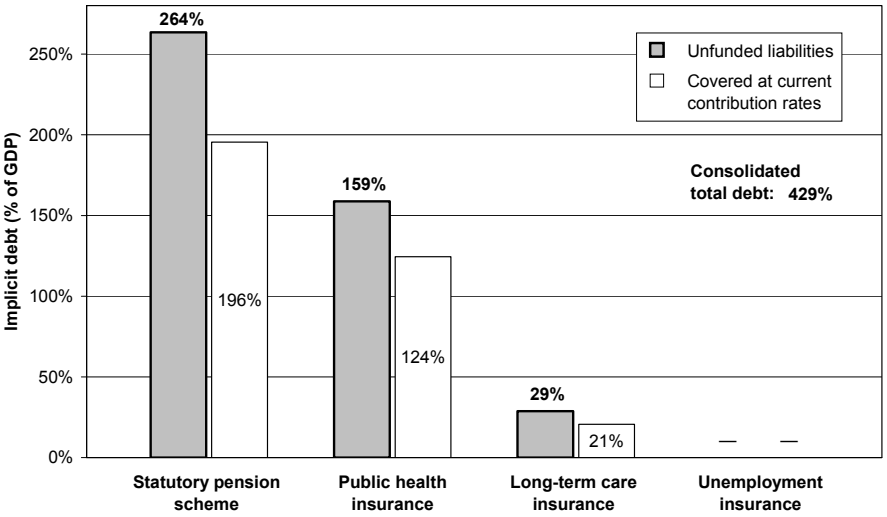
---

20 and 65 covered with contributions; that current pensioners keep the full amount of their benefit entitlements until they are expected to die.

[36] "No further change" also implies that the continuous increase in health costs through technical progress (see Sects. 5.2 and 5.3) is halted from 2050 onward.

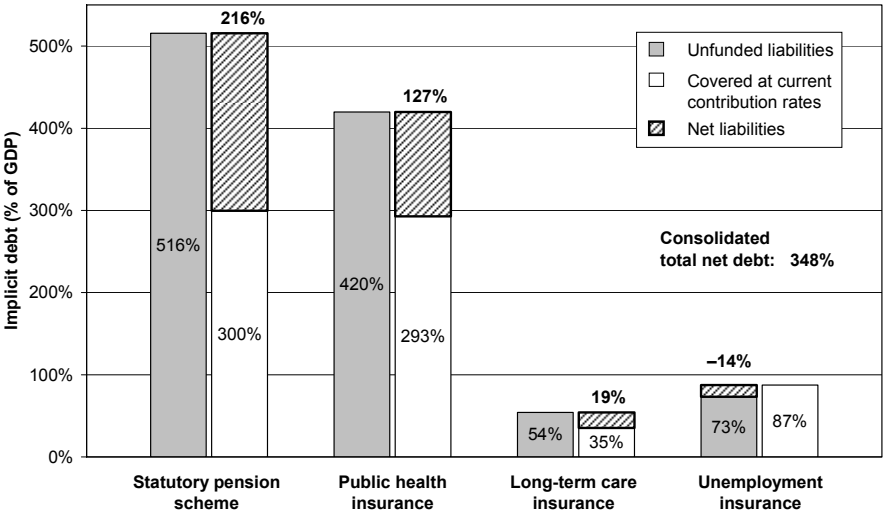
[37] Final-year results can then be used to estimate their open time-horizon present values using the textbook formula for converting infinite geometrical progressions that are converging towards zero into finite numbers.

[38] The implicit debt involved in large-scale social insurance schemes is necessarily sizeable as these schemes are offering various benefits for a substantial fraction of the population for up to 60 years or even longer. Note, also, that assessing implicit debt does not at all change the current and prospective situation of public finances as a whole. It just makes visible what was already there.



Source: CESifo Pension Model (2007 version).

Fig. 9. "Accrued-to-date liabilities" involved in the social insurance system, 2006



Source: CESifo Pension Model (2007 version).

Fig. 10. "Open-system net liabilities" involved in the social insurance system, 2006

In themselves, however, the results are hard to assess, certainly as long as they are not compared to parallel results obtained for other countries. In particular, they offer no clue as to how politicians and other individuals should react to such high levels of implicit debt, or how the latter would be affected by any attempts to reduce these.

5.3 The EPC's "Sustainability Gap"

As we have seen, there are limitations to the concreteness of hypothetically increasing deficit ratios or high levels of implicit debt resulting from the calculations presented here so far. Therefore, the EU Economic Policy Committee (EPC; 2003) suggests yet another simple measure, called "sustainability gap", which boils down the long-term scenarios for public finances sketched in Sect. 5.1 to a single number. The measure also builds on the inter-temporal government budget constraint with an infinite time horizon that was behind the OSNL calculations included in Sect. 5.2.

Following this definition, the sustainability gap corresponds to a fixed percentage of GDP by which annual primary deficit ratios would have to change against our baseline scenario in each year starting from now (2007) in order render public finances "sustainable" – with necessary reductions in the deficit, or higher surpluses, bearing a positive sign. (In other words, the sustainability gap measures the need for further fiscal consolidation necessitated by the long-term impact of aging on public finances in terms of a parallel, downward shift in the graph representing the primary deficit ratio in Figure 8.) The fiscal target for this stylized adjustment is derived endogenously, viz., from the requirement that public revenues must exactly equal all public expenditure over a virtually infinite time horizon.[39] Regarding the more remote future, it is now assumed that the projected expenditure levels (per GDP) remain constant from 2050 onward.

Table 2 shows our final results for the EPC's sustainability gap. As a reminder, the table also includes the corresponding figure for the short-term

[39] From now on, the present value of future revenues must therefore equal the present value of future expenditure plus the current amount of (explicit) public debt. This is the inter-temporal government budget constraint.
Note that the fiscal target could be defined in alternative ways. For instance, it could be given by a pre-defined level of the (explicit) debt ratio which should be reached at some point in time in the future ("60% of GDP in 2050"). It could also be defined in a semi-endogenous fashion ("the debt ratio obtained in 2050 if annual budgets were in balance in each year until then"). Here, we invariably apply the "sustainability gap" in its most elaborate form which has the closest link to the relevant theoretical literature (e.g., Blanchard 1990).

consolidation that is needed (until 2008, see Sect. 5.1) to align the current German deficit and debt ratios with the respective target levels laid down in the EU Stability and Growth Pact. Once more, the sustainability gap involved in the current German social insurance system appears to be really sizeable, now that it is indicated by a simple "flow" measure instead of the "stock" measures used in Sect. 5.2. Based on what we consider the baseline scenario of our financial projections for all the branches of the German social insurance system, the gap amounts to about 5.3% of annual GDP (or about € bn. 120 when measured on absolute terms, as a percentage of preliminary figures for the year-2006 GDP).[40] Together with the target level for short-term consolidation, total public expenditure would have to be reduced by about 16% of its current level in the near future, or public revenues would have to be increased by a similar margin, to make general government public finances in Germany sustainable in the long run.

Table 2. Social insurance and long-term sustainability of public finances

	% of GDP	year-2006 € bn.
Need for short-term fiscal consolidation	1.70	39.3
Sustainability gap[a] involved in the current social insurance system	5.33	123.3
Potential changes through:[b]		
Increasing the statutory retirement age to 67	–0.70	–16.2
Containing public health expenditure	–1.33	–30.8
Reaching full employment until 2035	–1.13	–26.1

[a]Reduction in annual primary deficit ratios required to remove the projected impact of aging on public finances through the social insurance system; based on the "T-3" variant of the "sustainability gap" (taking into account the inter-temporal government budget constraint) defined in EU Economic Policy Committee (2003).
[b]For further explanations regarding these alternative variants, see Sect. 6.

Source: CESifo Pension Model (2007 version).

[40] Deviations from earlier results obtained using the same simulation model and the same methodology (Werding and Kaltschütz 2005) are due to up-dates in the projections and to differences in assumptions. Note that labor market assumptions used here (see Table 1) are largely those of the year-2005 "risk scenario" (projected sustainability gap: 2.9% of GDP), not the "initial scenario" (1.5%). Further changes mainly arise from the use of a new release of official demographic projections (+0.6%), the inclusion of the potential impact of technical progress in the health-care sector (+1.3%), and a less optimistic view on long-term effects of the latest year-2004 health reform. Also, we now leave out the (small) effects of education and civil servants' pensions as they are not part of the social insurance system.

6 Policy Options

One could certainly go a long way in questioning many of the assumptions we have made here to obtain our final results regarding the impact of aging on the current system of social insurance and on German public finances as a whole. Since we are mainly interested in highlighting potential risks for the long-term fiscal sustainability of the existing social insurance system that could plausibly arise from demographic aging, but need not – and, for many reasons, should not – materialize in the future, we will instead round off our considerations by a brief discussion of the major policy implications of our baseline results.

First of all, let us take a second look at the necessary fiscal adjustments indicated by our overall measures of fiscal sustainability. By the way it is defined, closing the EPC sustainability gap could either imply a reduction in aggregate public expenditure or a corresponding increase in public revenues (or any mixture between these two strategies). As our simulations do not capture any behavioral responses of individuals who would be affected by lower benefits or higher taxes and contributions, this basic alternative appears to be perfectly symmetric in our model, requiring changes by the same percentage of annual GDP in each case. However, this conclusion may be highly unrealistic. Under real-world conditions, increasing public revenues may imply higher "excess burdens" – visible, for instance, in the form of lower labor supply and demand, especially with respect to employment that is covered by social insurance – by which the size of the necessary adjustment actually becomes larger than is indicated through our simple sustainability indicator. The reverse might happen if expenditure (hence taxes etc.) could be decreased. Considering the current size of the general government budget (in 2005: 46.8% of GDP), using all options that exist to limit the further growth in social insurance expenditure projected by our simulations therefore appears to be the way to go.

As we have seen, the two single, most important sources of the sustainability risks involved in the current German social insurance system are the public pension scheme and the public health insurance system. This is mainly an implication of the sheer size of the former (already as of today) and of the potentially huge expansion of expenditure of the latter (over the medium to long run). So how can the challenges of aging be addressed in these two fields?

Following the series of reforms already enacted (see Sect. 4.1), placing further limits on the expected growth in public pension expenditure will be difficult. It has long been established that pay-as-you-go pension schemes as such involve no fundamental inefficiencies (see Breyer 1989; Sinn

1990; Fenge 1995). Converting them into funded schemes therefore promises no welfare gains from which the transition costs could be covered.[41] Any retrenchment in the pension scheme's generosity, which should naturally affect the public–private mix of total old-age provision, is thus mainly a matter of inter-generational redistribution. Given that under the current legal framework average pension benefits will approach the level of social assistance when the demographic pressure on the system reaches its peak, there is now little room for further action in this area.

One of the options for incremental changes that remain is already under consideration, viz. a gradual increase in the statutory retirement age – following the increase in life expectancy. Once this amendment has been fully legislated, higher annual benefits will be paid out at an individual level for a shorter period of time, while there is still room for a moderate, further reduction in aggregate expenditure. All in all, the "sustainability gap" (according to the EPC's definition used above) would go down to 4.63, i.e., by 0.7% of GDP.[42] Note that legal changes to limit early retirement have already had some effect as the average retirement age in Germany is now moving up again. This could be reinforced through truly actuarial adjustments in annual benefits which still do not exist.[43]

Supplementary private savings meant to compensate for the expected reduction in public pension benefits are already subsidized and, hence, officially "recommended". To avoid free-riding in the presence of other, subsistence-level benefit programs, some minimum level of supplementary savings could actually be made a legal requirement. Yet, none of these

---

[41] Alternative results that can be found in the literature exploit inefficiencies that arise from intra-generational redistribution (in "Beveridgean" pension schemes) or from a sub-optimal tax structure (wage taxes vs. consumption taxes). Both these aspects could be dealt with separately as they are not an integral part of the pay-as-you-go mechanism proper (for a fuller survey, see Sinn 2000).

[42] For our overall projections, increasing the retirement age has three major effects: it reduces pension expenditure, as there will be fewer pensioners at any given point in time; it should increase GDP if older individuals are able to remain in activity as additional workers; and, due to higher activity, it should also imply higher revenues from contributions or allow for lower contribution rates in all branches of social insurance, not just in the pension scheme. However, by its definition that is solely based on (changes in) expenditure per GDP, the EPC sustainability gap captures only the first two of these effects.

[43] In cases of early retirement, benefit reductions in Germany are currently being assessed based on the pension scheme's internal rate of return (i.e., the average rate of payroll growth), not the market rate of interest. Only the latter would establish full neutrality with respect to individual retirement decisions and the present value of aggregate benefit expenditure.

steps could really avert the up-ward trend in pension expenditure that arises from the demographic fundamentals.

Only the obvious link between raising and educating children on the one hand and financing pay-as-you-go pensions on the other may point to a new direction for further pension reform. It has been shown that unfunded pension schemes themselves create disincentives to have children and may therefore have contributed to the fertility decline (Cigno 1993; Sinn 1997, 2004). Making a considerable share of individual pension entitlements contingent on the number of children, while reducing benefit entitlements mainly for the childless (who would correspondingly have to save more), could therefore be meaningful not only as a measure of fair distribution of the financial burden involved in aging, but also as a measure of improving the current system's efficiency and its long-term financial viability.[44]

Things are different in the health-care sector. International comparisons indicate that German public health insurance may still involve some amount of efficiency reserves. These could be exploited to reduce aggregate expenditure of public health funds well before aging becomes really pressing. Instruments to be considered are, for instance, more direct contracting between insurers and providers to push forward competition in this particular field; higher and more differentiated co-payments aimed at fewer consultations; and more wide-spread elements of managed care resulting in a general shift from in-patient care to ambulatory services.

However, aging alone is not the most pressing problem in the health-care sector as it is in the area of old-age provision. The real challenge, it appears, is how to deal with future medical progress and its potential impact on health costs. Note that removing from our baseline scenario the projected impact of technical progress in health and long-term care would reduce the EPC's "sustainability gap" to 4.00, i.e., by more than 1.3% of GDP. One should of course keep in mind that there are a number of uncertainties involved in modeling future trends in health expenditure. Yet, if this difference is not considered as a pure error margin of our projections, it may as well indicate a certain leeway for political action. If all means to enhance efficiency in the provision of health services are exhausted, there are then two ways to go. Either one could think about measures to change the direction of technical progress in favor of more cost-saving innovations, or one could try to establish a new framework for paying for it. After all, a prolonged life in better health as well as a considerable potential for employment in health research and health-care services are not all bad news. By contrast, pure attempts at cost-cutting could effectively mean

[44] For detailed proposals of this kind, see Sinn (2005) or Werding (1999, 2006).

that everyone forgoes the potential blessings of medical progress and that an engine of potentially strong growth in this sector is stalled.

A viable strategy in this area almost necessarily involves a re-definition of the current public–private mix in health insurance. This would at least remove the expected pressure involved in future health costs from public-sector finances. Corresponding changes could be done in terms of a new distinction of layers, with some basic cover through public health funds for virtually everyone and supplementary private insurance for various types of special treatment for those who are willing, and able, to pay for these. In addition, the element of pre-funding for future health costs involved in current private health insurance contracts should be strengthened, not abandoned, in a new framework. Otherwise, the impact of growing health costs on the inter-generational distribution may well become intolerable.

Finally, a theme that is of vital importance for virtually all the branches of German social insurance is an increase in the flexibility of labor markets, especially in adjusting to the consequences of demographic change. In our "baseline" projections, we have already shown moderate optimism regarding this issue (cf. Table 1). With even more optimistic assumptions, the outlook regarding the overall sustainability of the social insurance system could be substantially improved. Assuming, for instance, that "full employment" (say, an unemployment rate of 3%) will be reached until 2035 and that participation rates of older workers will increase to "Scandinavian" levels (for similar assumptions, see the official report by Kommission 2003), the EPC sustainability gap would go down to 4.20, i.e., by about 1.1% of GDP.[45] Labor market institutions that promote job creation and full utilization of the labor force potential in the period of acute demographic aging are thus one of the key ingredients in restoring the long-term sustainability of social insurance in Germany.

References

Advisory Board of the Federal Ministry of Economics (Wissenschaftlicher Beirat beim Bundesministerium für Wirtschaft, 1998) Grundlegende Reform der gesetzlichen Rentenversicherung. Report. BMWi, Bonn

Baumann F, Meier V, Werding M (2006) Transferable ageing provisions in individual health insurance contracts. Ifo Working Paper No 31, Munich

Blanchard OJ (1990) Suggestions for a New Set of Fiscal Indicators. OECD Economics Department Working Paper No 79, Paris

[45] Without an impact of technical progress on public health expenditure, it would even be reduced to 2.94% of GDP.

Blanchard OJ, Chouraqui JC, Hagemann RP, Sartor N (1990) The Sustainability of Fiscal Policy: New Answers to an Old Question. OECD Econ Stud 15:7–36

Breyer F (1989) On the intergenerational Pareto efficiency of pay-as-you-go financed pension systems. Journal of Theoretical and Institutional Economics 145:643–658

Breyer F, Ulrich V (2000) Gesundheitsausgaben, Alter und medizinischer Fortschritt: Eine Regressionsanalyse. Jahrbücher für Nationalökonomie und Statistik 220:1–17

Cigno A (1993) Intergenerational transfers without altruism: Family, market and state. European Journal of Political Economy 9:505–518

EU Economic Policy Committee (2001) Budgetary challenges posed by ageing populations: the impact on public spending on pensions, health and long-term care for the elderly and possible indicators for the long-term sustainability of public finances. EPC/ECFIN/655/01-EN final, Brussels

EU Economic Policy Committee (2003) The Impact of Ageing Populations on Public Finances: Overview of Analysis Carried out at an EU Level and Proposals for a Future Work Programme. EPC/ECFIN/435/03, Brussels

EU Economic Policy Committee and European Commission (2006) The impact of aging on public expenditure: Projections for the EU-25 member states on pension, health care, long-term care, education and unemployment transfers (2004–2050). European Economy, Special Report No 1/2006. European Commission, DG ECFIN, Brussels

Federal Insurance Authority (Bundesversicherungsamt, 2001) Berechnungen zum Risikostrukturausgleich: Datenzusammenstellungen und Rechnungsergebnisse (Jahresausgleich 2001). On-line database, access via http://www.bva.de

Federal Constitutional Court (Bundesverfassungsgericht, 2001) Ruling of 3 April 2001. BVerfGE 103:242–271

Federal Ministry of Finance (Bundesministerium der Finanzen, 2005) Bericht zur Tragfähigkeit der öffentlichen Finanzen. BMF, Berlin

Federal Statistical Office (Statistisches Bundesamt, 2006) Bevölkerung Deutschlands bis 2050: 11. koordinierte Bevölkerungsvorausschätzung. Statistisches Bundesamt, Wiesbaden

Fenge R (1995) Pareto-efficiency of the pay-as-you-go pension system with intragenerational fairness. Finanzarchiv 52:357–364

Franco D (1995) Pension liabilities: Their use and misuse in the assessment of fiscal policies. EC/ECFIN Economic Papers No 110, Brussels

Franco D (2000) Forecasting the effects of ageing on health expenditure: Note for the Working Group on the Implications of Ageing. ECFIN 609/00, Brussels

Fuchs J, Thon M (1998) Die Schätzung von Potential-Erwerbsquoten, Stiller Reserve und Erwerbspersonenpotential für die alten Bundesländer 1970–1985. IAB-werkstattbericht No 8/1998, pp 3–20

Fuchs J, Thon M (1999) Potentialprojektion bis 2040: Nach 2010 sinkt das Angebot an Arbeitskräften. IAB-kurzbericht No 4/1999, pp 3–6

Fuchs J, Söhnlein D (2003) Lassen sich die Erwerbsquoten des Mikrozensus korrigieren? IAB-werkstattbericht No 12/2003, pp 3–38

Höhn C, Mai R, Micheel F (2007) Demographic change in Germany. In: Hamm I, Seitz H, Werding M (eds) The economic and fiscal consequences of demographic change in Germany. Springer, Berlin Heidelberg New York, pp 9–33 (this volume)

Holzmann R, Palacios R, Zviniene A (2001) Implicit pension debt: Issues, measurement and scope in international perspective. World Bank, Pension Reform Primer, Washington DC

Kommission "Nachhaltigkeit in der Finanzierung der Sozialen Sicherungssysteme" (2003) Nachhaltigkeit in der Finanzierung der Sozialen Sicherungssysteme. Final report. BMGS, Berlin

Leibfritz W, Roeger W (2007) The effects of aging on labor markets and economic growth. In: Hamm I, Seitz H, Werding M (eds) The economic and fiscal consequences of demographic change in Germany. Springer, Berlin Heidelberg New York, pp 35–63 (this volume)

Leibfritz W, Roseveare D, Fore D, Wurzel E (1995) Ageing populations, pension systems and government budgets: How do they affect savings? OECD Economics Department Working Paper No 156, Paris

Missoc (2006) Mutual information system on social protection in the EU member states and in the EEA. Online database, access via http://europa.eu.int/comm/employment_social/social_protection/missoc_en.htm

OECD (2001) Economic outlook No 69 (June 2001). OECD, Paris

OECD (2002) Policy responses to the challenges of ageing populations – a synthesis. DEELSA/ELSA/WP1 (2002) 3, Paris

OECD (2005) Taxing Wages 2004 –2005. OECD, Paris

OECD (2006a) OECD Economic outlook No 79 (May 2006) on-line database. Access via http://www.oecd.org

OECD (2006b) OECD Health data 2006. On-line database, access via http://www.oecd.org

Roseveare D, Leibfritz W, Fore D, Wurzel E (1996) Ageing populations, pension systems and government budgets: Simulations for 20 OECD countries. OECD Economics Department Working Paper No 168, Paris

Seitz H (2007) The Impact of Demographic Change on Fiscal Policy in Germany. In: Hamm I, Seitz H, Werding M (eds) The economic and fiscal consequences of demographic change in Germany. Springer, Berlin Heidelberg New York, pp 129–163 (this volume)

Sinn H-W (1990) Korreferat zum Referat von K. Jaeger. In: Gahlen B, Hesse H, Ramser HJ (eds) Theorie und Politik der Sozialversicherung. Mohr (Siebeck), Tübingen, pp 99–101

Sinn H-W (1997) The Value of Children and Immigrants in a Pay-As-You-Go Pension System. NBER Working Paper No 6229

Sinn H-W (2000) Why a funded system is useful and why it is not useful. International Tax and Public Finance 7:389–410

Sinn H-W (2004) The pay-as-you-go pension system as a fertility Insurance and enforcement device. Journal of Public Economics 88:1335–1357

Sinn H-W (2005) Europe's Demographic Deficit: A Plea For a Child Pension System. De Economist 153:1–45

Sinn H-W, Holzner C, Meister W, Ochel W, Werding M (2006) Redesigning the welfare state: Germany's current agenda for an activating social assistance. Edward Elgar, Cheltenham Northampton MA

U.S. Social Security Administration (2006) Social security programs throughout the world. Online publication, access via http://www.ssa.gov/policy/docs/progdesc/ssptw/

Van den Noord P, Herd R (1993) Pension liabilities in the seven major economies. OECD Economics Department Working Paper No 142, Paris

Van den Noord P, Herd R (1994) Estimating pension liabilities: A methodological framework. OECD Economic Studies No 23, Paris

Werding M (1999) Pay-as-you go public pension schemes revisited: a draft. Jahrbücher für Nationalökonomie und Statistik 218:491–511

Werding M (2006) Kinderrente und Vorsorgepflicht: Der ifo-Vorschlag zur Lösung der demographischen Krise des Rentensystems. Ifo Schnelldienst 58 (No 7/2006):44–53

Werding M, Blau H (2002) Auswirkungen des demographischen Wandels auf die staatlichen Alterssicherungssysteme: Modellrechnungen bis 2050. Ifo Beiträge zur Wirtschaftsforschung, vol. 8. Ifo Institute, Munich

Werding M, Kaltschütz A (2005) Modellrechnungen zur langfristigen Tragfähigkeit der öffentlichen Finanzen. Ifo Beiträge zur Wirtschaftsforschung, vol. 17. Ifo Institute, Munich

Zweifel P (1990) Ageing: The great challenge to health care reform. European Economic Review 34:646–658

Zweifel P, Felder S, Meier M (1999) Ageing of population and health care expenditure: A red herring? Health Economics 8:485–496

The Impact of Demographic Change on Fiscal Policy in Germany

Helmut Seitz*

1 Introduction

A major concern in the political and scientific discussion is the impact of demographic change on the social security system and on public finances in general. Because in Germany the aging process is one of the most rapid in the industrialized world and the fiscal stance of public budgets deteriorated significantly in recent years, this issue is of special relevance for Germany.

Most of these discussions focus on issues associated with creating a sustainable social security system that can cope with the aging process and the shrinking workforce in Germany (see, e.g., Hagemann and Nicoletti 1989; Börsch-Supan 2000; Razin et al. 2002; Economic Policy Committee 2006, Disney 2007; or the contribution by Werding 2007, this volume). However, a subject that is largely neglected are the repercussions of demographic change on the budgets of the different layers of government in federal systems. Lee and Edwards (2001) for the U.S., the Conference Board of Canada (2002) for Canada, and Seitz and Kempkes (2007) for Germany address this issue and show that the different layers of government are affected quite differently by changes in the number and age composition of the population.

In this paper we examine the effects of demographic change on the fiscal position of the federal, state and local government sector in Germany

* The author gratefully acknowledges support by the German Research Foundation (DFG), project no. SE 540/2-1, within the research project (DFG-Schwerpunktprogramm) "Governance of federal systems: theoretical approaches and empirical evidence" ("*Institutionelle Gestaltung föderaler Systeme: Theorie und Empirie*").

and extend the previous study by Seitz and Kempkes (2007). While we take into account tax-financed transfers from the federal government to the social security system, expenditures of the social security system are completely disregarded in the present analysis.[1] In federal countries the various tiers of government are affected by demographic change quite differently because each level of government has different tasks that differ with respect to their sensitivity to demographic change.

The paper is organized as follows. Sect. 2 outlines the most important facts of the public sector in Germany from a federal perspective. In Sect. 3 we present our approach to deriving estimates of age-specific expenditures and incorporate this information in a simple model of sustainable expenditure growth and an endogenous adjustment of age-cost profiles. Sect. 4 presents our empirical results in several steps. In a first step we estimate age-cost profiles for the three layers of government in Germany. In a second step we construct estimates of revenue growth for each layer of government up to the year 2030. Step 3 discusses the most important non-demographic factors that are expected to influence future expenditure growth in Germany. A final step presents an empirical decomposition of sustainable expenditure growth in the period 2004 to 2030 in Germany by several factors and identifies the importance of demographic change for overall expenditure growth. In addition we derive estimates of age-cost profiles in 2030. A final section summarizes our results and derives conclusion for the future of a sustainable fiscal policy in Germany.

2 Institutional Framework

Before we proceed we shortly explain the key features of fiscal federalism in Germany. This is of considerable importance because in a federal system the transmission of fiscal effects caused by demographic change for public budgets depends on the division of tasks between the different levels of government and is considerably influenced by intergovernmental fiscal relations at both the revenue as well as the expenditure side.

Fiscal autonomy of subnational governments is highly restricted in Germany because the states (*Länder*) have virtually no power to tax. The tax system in Germany is characterized by a strong bias towards tax sharing. However, by voting in the *Bundesrat* (Second Chamber) state governments can influence federal tax legislation considerably. In contrast, local governments have a significant taxation power because they can fix the lo-

[1] The paper by Werding (2007, this volume) examines this sector in detail.

cal business tax rate (*Gewerbesteuer*) and the tax rate of the local property tax (*Grundsteuer*). This rather queer constellation – a virtual lack of tax power at the state level and a considerable power to tax at the local level – is due to the fact that there is a strong horizontal fiscal equalization system between the states which equalizes per-capita tax revenues to a considerable degree.[2] This system is rooted in the German constitution (art. 72) which states that policy should aim at "equal living conditions" across regions in Germany. Therefore, the most important variable that determines the distribution of tax revenues among the 16 states and among the numerous local governments within states is the number of inhabitants. Consequently there is a rather weak correlation between per-capita GDP at the state level and total per-capita revenues.[3]

Table 1 reports the structure of tax revenues by level of government in 2004. About 70% of total tax revenues are from shared tax resources. At the federal and local level about 40% of tax revenues are from own resources, whereas at the state level the ratio is only about 15%.

Table 1. The structure of taxes in Germany, 2004

level of government	total tax revenues in mill. Euro	share of tax revenue out of shared taxes	share of own tax resources
federal	208.9	59.5%	40.5%
state	163.3	84.7%	15.3%
local	51.8	58.1%	41.9%
total	424.1	69.1%	30.9%

Source: Own calculations based on data supplied by the Federal Statistical Office.

On the expenditure side too, subnational governments face a number of restrictions due to national standards and co-financing of activities by different layers of government. In addition, wages and working conditions in the public sector are fixed centrally. Recently some rather soft reforms have been introduced which make it possible to manipulate work and pay conditions at the state and local level. However, the effective room for maneuver is limited due to the strong influence of trade unions in the public sector.

---

[2] Apart from horizontal transfers between the states, the federal government provides vertical transfers to states with below-average per-capita tax revenues. For a more detailed description of the fiscal equalization system in Germany, see Seitz (2000).

[3] At the local level the correlation between local tax capacity and total revenues is much stronger because of the power to tax of local governments.

Studying the effects of demographic change on public budgets in a federal system requests a careful investigation of the division of tasks across the different layers of governments. Therefore we examine the distribution of expenditures by function at each level of government. In the first three columns of Table 2 we look at the distribution of net expenditures by 27 spending categories ("functions") as an indicator of the division of tasks across the three tiers of government in the fiscal year 2004. The last column represents the share of net spending in each category for the aggregate government sector. Net spending at each level of government is defined as total (gross) spending net of transfers received by other levels of government. Differences between gross and net expenditures are quite significant at the subnational government level indicating a considerable flow of vertical transfers.

Table 2. Net expenditures[a] by category ("function") as a share of total net expenditures at the federal, state and local level of government in Germany, fiscal year 2004

.	Function	Federal	State	Local	share of total aggregate expenditures
		expenditure share by level of government			
1	General public services and administration incl. tax collection	29.0%	33.0%	38.0%	7.0%
2	Defense	100.0%	–	–	4.0%
3	Public order & safety	11.5%	59.0%	29.5%	3.6%
4	Jurisdiction & prisons	2.8%	97.2%	0.0%	1.9%
5	Schools incl. financial support to school students	1.4%	77.7%	20.9%	9.2%
6	Kindergarten	0.0%	33.5%	66.5%	1.9%
7	Universities incl. financial support to university students	12.6%	87.4%	0.0%	3.7%
8	All other education	28.9%	40.8%	30.3%	0.3%
9	Research outside univ.	71.3%	26.2%	2.6%	1.6%%
5–9	*Education*	*4.5%*	*73.8%*	*21.8%*	*15.1%*
10	Culture	4.7%	43.0%	52.4%	1.4%
11	Health and environmental protection	6.9%	39.9%	53.2%	2.2%

12	Housing & community amenities	5.0%	20.0%	75.0%	3.9%
13	Agriculture, forestry & fishing	19.6%	76.7%	3.6%	0.8%
14	Regional development policy, fuel & energy & water	40.4%	47.2%	12.4%	2.3%
15	urban public transport & street traffic	46.0%	24.6%	29.4%	3.7%
16	Other economic affairs and public property administration	56.0%	15.3%	28.7%	4.1%
17	Pensions for retired public servants	17.9%	67.9%	14.1%	5.6%
18	Interest payments	58.1%	34.3%	7.7%	10.7%
19	Transfers to the pension system	100.0%	0.0%	0.0%	13.2%
20	Transfers to other social security systems	96.3%	3.7%	0.0%	1.9%
21	Administration of social welfare	7.4%	27.4%	65.1%	0.7%
22	Social assistance	0.8%	29.1%	70.0%	5.2%
23	Youth welfare	1.7%	23.3%	75.0%	1.5%
24	Support for families and mothers	51.7%	28.6%	19.8%	2.1%
25	Other social welfare	89.3%	10.3%	0.4%	4.9%
21–25	*Social welfare (net of transfers to the social security system)*	*38.6%*	*22.0%*	*39.4%*	*14.5%*
26	Unconditional transfers to other levels of government (transfers received minus transfers paid)	256.2%	130.9%	-287.2%	1.6%
27	Other expenditures	14.6%	67.6%	17.8%	0.8%
–	*Total net expenditures*	*45.9%*	*36.8%*	*17.3%*	*100.0%*
–	*Total net primary expenditures*	*44.5%*	*37.0%*	*18.4%*	*89.3%*

[a]Net expenditures = total expenditures minus transfers received from other levels of government.

Source: Own calculations based on data supplied by the Federal Statistical Office.

About 15% of total public outlays fall on education. State governments account for about 74% of total education expenditures whereas the share of the local government sector is about 21%[4] and the federal government's share is only 5%. Of equal importance are the federal transfers to the public social security system, most of which are directed to the public pension system. These transfers absorb about 1/3 of federal expenditures and constitute the largest item in the federal budget. The third most important expenditure category is social welfare which accounts for about 14.5% of total public spending. Both the federal as well as the local government sector account for about 40% of welfare spending and the bulk of these expenditures are social assistance transfers as well as expenditures on special programs, such as youth welfare, housing subsidies etc. High public debt in Germany is reflected in the fact that almost 11% of public spending are interest payments. At the federal level interest payments account for about 13.5% of total spending and at the state level this share is about 10%, whereas local governments spend only about 4.7% of total net expenditures on interest payments. Another important expenditure item are pension payments to retired public servants which absorb about 5.6% of total public expenditures. In Germany, a considerable share of public servants have a special status ("*Beamte*") and are not included in the public pension scheme but, upon retirement, are financed directly out of the current budgets of federal, state and local governments.[5] Finally, one has to mention that health care expenditures are virtually of no importance at the state and local government sector. The federal government provides direct transfers to public health insurance and long-term care insurance (see Werding 2007, this volume) which are included in the expenditures in Table 2 (line 20). In addition, some spending on social assistance (line 22 in Table 2) is directed to handicapped people but the share of these expenditures is rather small.

We finally take a look at transfers between the various levels of government. As the upper part of Table 3[6] shows, about 46% of federal expenditures are in fact transfers to other levels of government and to the social

[4] Local governments are responsible for financing kindergarten services and for the maintenance of school infrastructure. Teachers – with the exception of the state of Bavaria where local governments employ a significant share of school teachers – are paid by state governments.

[5] Only quite recently some state governments started to set up pension funds for these public servants to cover future expenditures.

[6] As the social security system receives considerable transfers from the federal government, we include this sector in Table 3 too.

Table 3. The flow of transfers in Germany between the different levels of government, 2004

Transfer payments in mill. Euro

	total transfers paid	to state gov.	to local gov.	to the social security system	to federal gov.	transfers paid as a % of total expenditures
		thereof:				
Federal government	126.8	35.4	0.7	90.7	0.0	46.3%
State	56.5	0.0	52.2	0.4	4.8	22.0%
Local	4.9	4.4	0.0	0.2	0.2	3.2%
Social security	0.0	0.0	0.0	0.0	0.0	0.0%

Receipt of transfers in mill. Euro

	total transfers received	from state gov.	from local gov.	from the social security system	from federal gov.	transfers received as a % of total revenues
		thereof:				
Federal government	3.5	3.2	0.2	0.0	0.0	1.5%
State	41.4	0.0	4.3	0.3	36.8	17.7%
Local	49.3	47.8	0.0	0.7	0.9	33.7%
Social Security	88.4	0.0	0.0	0.0	88.3	18.8%

Source: Own calculations based on data supplied by the Federal Statistical Office.

security system. At the state level about 22% of expenditures are grants, most of which are directed to the local government sector.

On the revenue side (see the lower part of Table 3) the importance of transfers is negligible at the federal level. States receive about 18% of their revenues out of federal transfers, both conditional and unconditional, and about 50% of these transfers are directed to the East German states, including Berlin, despite the fact that only about 20% of the German population lives in East Germany and Berlin.[7] Local governments receive about 1/3 of

[7] See Seitz (2006). The bulk of federal transfers to East Germany will expire in 2019. These "reconstruction transfers" are meant to support the reconstruction of public infrastructure in East Germany and to finance regional development programs, such as capital subsidies to manufacturing companies that invest and create jobs in East Germany.

their total revenue out of state transfers.[8] In addition, Table 3 reveals that almost 20% of total revenues of the social security system come out of tax financed transfers.

From our descriptive analysis of the public sector in Germany we can derive some important conclusions with respect to the potential effects of demographic change for public budgets in Germany.

1. The figures in table 2 indicate that subnational government expenditures have a strong bias towards spending on the younger generation because states and local governments finance the bulk of education expenditures. Contrary to this, federal expenditures are biased towards the elderly because about 30% of federal expenditures are direct transfers to the public pension system. State and local governments do not have to carry a high fiscal burden to finance the elderly. Both sectors have to pay for retired public servants as the only significant budget item that is exclusively directed to the elderly population. In addition, some part of social assistance transfers is spent on elderly persons who do not have sufficient claims on social security to pay for their living expenses. However, the quantitative importance of these expenditures is quite modest.
2. Interjurisdictional transfers are generally directed top-down and are a significant source of revenue for subnational governments. Consequently there is no clear division of tasks between the various levels of government. Thus, despite the fact that local governments are responsible for the provision of kindergarten services, considerable expenditures in this function fall upon the state level (see line 6 in Table 2) through conditional grants to local governments. Therefore in many spending categories changes that affect lower levels of government spill over to upper levels of governments. By using the net expenditure concept we take these diffusion effects into account and avoid double counting.
3. Due to the predominance of shared taxes and the strong fiscal equalization system there is only a very weak link between per-capita GDP and per-capita revenue at the level of single states. Because population size is the most important variable that determines the distribution of revenues across states, the elasticity of state revenue with respect to population size is c.p. virtually 1. Thus, changes in the age structure within states have virtually no impact on individual state government revenues because tax-sharing and the fiscal equalization system distribute these effects over the country as a whole. In addition, in the decades ahead

[8] The German constitution does not allow direct transfer payments from the federal government to local governments because local governments are an integral part of the states.

there is no reason to expect a significant impact of aging on *per-capita* tax revenues at the aggregate level. A recent report for the German Federal Ministry of Finance (Bach et al. 2002) shows that, despite the fact that many taxes have a pronounced age structure, the impact of the changing age structure in Germany on total per-capita tax revenues is rather small. The most important demographic variable that determines the growth of *total* public revenue is the growth of the labor force whereas neither the age structure of the total population nor the age structure of the work force is of significant importance.

From our presentation of the institutional framework in Germany we can conclude that our investigation can focus on the expenditure side and that we can model revenues quite simple. On the revenue side we can disregard age-structure effects and refrain from modeling revenue growth at each level of government differently, using the simplifying assumption that revenue growth is identical at the federal, state and local government level.[9]

3 Methodology

Our analysis starts by splitting up public expenditures by functions:

$$E_t = \sum_{j=1}^{J} E_{j,t} \tag{1}$$

$E_{j,t}$ denotes expenditures in spending category (function) j in period t. Next we assign spending in each function to different age groups:

$$E_{j,t} = \sum_{x=1}^{\bar{x}} E(x, j, t)\,, \tag{2}$$

where x denotes the age group ($\bar{x}$ is the maximum age). For our empirical investigation age specific spending is written in terms of age-cost profiles:

$$e(x, j, t) = \frac{E(x, j, t)}{N(x, t)}\,, \tag{3}$$

with N(x,t) denoting the population of age x in period t and $N_t = \Sigma_x N(x,t)$ total population. The variable e(x,j,t) is the age-cost profile which indicates per-capita spending for citizens aged x for public good j (such as educa-

[9] Because tax sharing is not perfect our modeling approach is of course an approximation.

tion, health, etc.) in period t. If the public good j is not age-specific (such as, for example, defense) the entries in e(x,j,t) are identical across all age groups. Thus, we can rewrite equation (2) in terms of age-cost profiles as:

$$E_t = \sum_{j=1}^{J} \sum_{x=1}^{\bar{x}} N(x,t)\, e(x,j,t) \tag{2'}$$

If information about the age-cost profiles of the various spending categories as well as population forecasts – differentiated by age – were available one could make a forecast of the impact of demographic change on public expenditures. Such a forecast is a very simple exercise if age-cost profiles are assumed to be time-invariant, i.e., $e(x,j,t) = e(x,j,t+\tau) = e(x,j)$, for $\tau > 0$, in which case total spending in period $t+\tau$ is estimated by

$$E_{t+\tau} = \sum_{j=1}^{J} \sum_{x=1}^{\bar{x}} N(x,t+\tau)\, e(x,j)\,. \tag{4}$$

However, there are numerous reasons to expect changes in cost profiles (see, e.g., Franco and Munzi 1997). A very simple procedure to make age-cost profiles time-dependent is to assume that public spending keeps pace with productivity growth and that price increases can be different across spending categories, in which case we get a rather mechanical adjustment process:

$$e(x,j,t+\tau) = e(x,j,t)\, q(t+\tau)\, \pi(j,t+\tau) \tag{5}$$

Here, $q(t+\tau)$ denotes the productivity growth factor in the period t to $t+\tau$ and $\pi(j,t+\tau)$ the price increase in function j relative to the GDP deflator. For example, Lee and Edwards (2001) assume an annual productivity growth rate of 2.5%, i.e., $q(t+1) = 1.025$, and further assume that per-capita expenditures keep pace with productivity growth. In addition, they assume that the cost of service provision in the health sector exceeds the GDP-deflator by 1% each year, e.g. $\pi(\text{health}, t+1) = 1.01$.

However, productivity growth and inflation are not the only forces that affect age-cost profiles, and we identify at least four other important sources of change: relative price effects, cohort-size effects, changes in political preferences and changes in participation rates.

As the number of beneficiaries changes, the average cost of public service provision per worker or per tax payer changes, taking as given a specific benefit-level (see Lee and Edward 2001). For example, the aging of society increases the share of old-aged people and consequently the per-worker cost of providing for the elderly increases even if per-capita spending on the elderly is left unchanged. Under neoclassical reasoning this

price effect should induce a downward pressure on per-capita provision for the elderly in order to limit the growth of the tax burden for workers. Gruber and Wise (2001) report evidence that an increase of the share of the elderly by 1% increases spending on the elderly – measured as a share of GDP – by 0.5 percent.

Cohort-size effects frequently result from the sluggish response of public inputs to changes in the demand for public services. Poterba (1997) or Fernandez and Rogerson (2001) for the U.S., Grob and Wolter (2005) for Switzerland and Seitz and Baum (2003) for (West) Germany find that total spending on public schools does not change significantly as the number of school-age children changes. This suggests that the age-cost profile for schooling depends on cohort size and can be written as e(t,N(6–20,t)), with N(6–20,t) denoting the number of school-aged people in period t. This age-cost profile has the property $\delta e(\cdot)/\delta N(6–20) < 0$ and the elasticity of e with respect to N, $\eta_{e,N}$, is approximately –1. This means, that total education expenditures are virtually left unchanged if the size of the school-age cohort changes. However, while price effects are derived from neoclassical reasoning, cohort size effects are due to political or bureaucratic slackness because fiscal plans are very often made by looking at past expenditures rather than based on a careful consideration of the determinants of the demand for public services in the various spending categories. In addition, because the provision of public services – disregarding pure transfer programs – is usually rather labor intensive, implicit long-term contracts with public servants and resistance of interest groups that benefit from public spending in the specific function make it very hard to adjust current expenditures downward if there is a negative change in the demand for public services.[10] Thus, one should also expect some asymmetry in adjustment behavior because downward adjustment is much more difficult to achieve than upward adjustment. Nevertheless, one should expect that rather strong and permanent changes in factors that determine the level of spending in the various categories, such as the size of the cohort of school-aged persons, should result in significant adjustments in the medium or long-run and consequently $\eta_{e,N} \rightarrow 0$ should hold, i.e., cohort-size effects should be rather small in the long run.[11] Contrary to that, one should expect that price effects are rather small in the short-run – benefit provision to the elderly cannot be cut immediately – and increase in size in the long-run.

[10] Capital spending, especially infrastructure spending, can be adjusted at rather short notice.

[11] The evidence presented by Kempkes (2007) on school inputs in East Germany suggests that in cases of massive and rapid demographic change adjustments in inputs occur even in the short-run.

A very important issue that is hard to handle empirically is the impact of demographic change on the distribution of *voting power* at the ballot box and the consequences for the political decision process to adjust the supply of public services. One should expect that the aging of society works in favor of political parties and policy makers that have stronger preferences for goods provided to the elderly (see, e.g., Poterba 1997; or Lee and Edwards 2001). Consequently, one should expect that per-capita benefits for the elderly increase, whereas younger generations will live to see cuts in public goods provision. However, the elderly have to take into account that they benefit from an increase in productivity and thus have to take care that sufficient resources are spent on productivity enhancing public service provision, such as education and research, and to ensure that taxes and contributions to the social security system do not result in disincentives to work (see, for example, Gradstein and Kaganovich 2004).

Another important source of changes in age-cost profiles is the *participation effect*, implying that the demand for public services for some specific age cohort can change over time. This can easily be seen from an alternative derivation of age-cost profiles that starts from calculating the average cost of service provision per person who actually benefits from services in function j, P(x,j,t):

$$c(x, j, t) = \frac{E(x, j, t)}{P(x, j, t)} \tag{3'}$$

$P(x,j,t) \leq N(x,j,t)$ is the number of persons that actually consume the public good and $c(\cdot)$ is the average cost of providing the public service to a representative client. Thus, we can define a participation rate, q(x,j,t),

$$q(x, j, t) = \frac{P(x, j, t)}{N(x, j, t)}, \tag{6}$$

which gives the share of people aged x who actually consume the public good j. Given that

$$q(x, j, t)c(x, j, t) = \frac{E(x, j, t)}{N(x, j, t)} = e(x, j, t), \tag{7}$$

we can examine the assumptions regarding $c(\cdot)$ and $q(\cdot)$ that are implied in a constant age-cost profile by evaluating

$$de = qdc + cdq = qdc + \frac{cdP}{N} - \frac{cPdN}{N^2}. \tag{8}$$

The assumption of a constant $e(\cdot)$ implies that $c(\cdot)$ is unchanged and that P changes proportionally to N, i.e., that the participation rate is constant. However, if participation rates change over time and $c(\cdot)$ is constant, $e(\cdot)$ changes even if N is kept constant. Consequently, if there are strong a-priory reasons to expect changes in participation rates, forecasts of future expenditures have to be made by applying the formula:

$$E(x, j, t+\tau) = e(x, j, t)\cdot N(x, j, t+\tau)\ \lambda(x, j, t) \tag{9}$$

$$\text{with: } \lambda(x, j, t) = q(x, j, t+\tau)/q(x, j, t)$$

Note that the participation effect is independent of demographic change and reflects changes of cohort behavior over time, the causes of which can be changes of preferences or responses of firms and individuals to market signals or policy. For example, if the number of students changes proportionally to the change in the size of the relevant age cohort, this does not indicate a change in participation rates. A change in participation rates would however be observed if the ratio of students to the number of people aged 20–28 changes. It should be noted that taking into account changes in participation induce a change in the age-cost profile, implying that $e(x,j,t+\tau) = e(x,j,t)\cdot\lambda(x,j,\tau)$.

In a final step we incorporate the age-cost profiles in the dynamic budget constraint of the government to construct a simple model of fiscal sustainability in order to derive an endogenous adjustment of age-cost profiles compatible with sustainability. This makes it possible to get rid of the highly restrictive assumptions on age-cost profiles in other studies. We start this extension by looking at the dynamic government budget constraint,

$$B_t - B_{t-1} = i\, B_{t-1} + E_t - R_t, \tag{10}$$

where B_t denotes public debt at the end of period t, E primary expenditures and R government revenues. The nominal interest rate i is assumed to be time-invariant throughout our exposition.

Taking into account the budget constraint requires an estimate of the time path of revenue growth. As we argued above, due to the institutional settings in Germany we can take revenue growth to be equal at each level of government. We assume a constant per-worker productivity growth rate and measure the work force by the population aged 20-67.[12] Assuming a GDP elasticity of revenues of one at all levels of government, GDP and revenue growth rates are identical and equal to total productivity growth,

[12] Thus we take into account the prolongation of the working life in Germany from 65 to 67 which has already been decided upon by politics.

$$g_t = w_t + n(20–67)_t, \tag{11}$$

with g denoting real GDP growth, w the growth of per-worker productivity and n(20–67) the growth rate of the work force defined as the population aged 20-67. Consequently in our model the revenue-to-GDP ratio is constant.

To derive a primary expenditure growth rate that is compatible with sustainability we have to select one of the competing sustainability concepts that are used in the literature and in policy analysis (see, for example, Blanchard et al. 2000). Here, we simply define fiscal policy to be sustainable if it keeps the budget in balance. Note that this implies a declining debt-to-GDP ratio. Of course, we can also use other sustainability criteria, for example, a constant debt-to-GDP ratio (stable-public-debt rule) or a policy to stabilize the debt-to-GDP ratio at some target level.[13] However, our simplifying, but by no means unrealistic, assumption[14] makes the derivation of the sustainable level of total primary expenditure quite simple because primary expenditures are given by revenue minus interest payments:

$$E_t = R_t - i\,B_0, \tag{12}$$

with B_0 denoting inherited public debt.

Against this background, we decompose the growth of sustainable primary expenditures into four components:

1. The first component is the growth of expenditures which is enforced by demographic change taking real age-cost profiles as given.
2. The second component is the change in demand for public services induced by behavioral changes which we discussed under the heading of "participation effects" above.
3. The third component is the growth of expenditures induced by changes in policy that have already been decided upon or are scheduled to be introduced in the near future. Note that these "policy effects" are different from changes in political preferences that can be induced by the aging of

[13] The incorporation of alternative sustainability rules is straightforward and can easily be accomplished by re-defining primary expenditure growth in equation (3) correspondingly.

[14] Recently a reform commission consisting of policy makers and experts is discussing the implementation of much stricter debt restrictions in the federal and state constitutions. Due to strong growth of public debt in the recent history of Germany, the implementation of zero-deficit rules over the business cycle at least at the state level is quite plausible.

society. Whereas the policy effects discussed here refer to political decisions that have already been decided upon, or will emerge out of current discussions in politics, the latter refer to changes that will be induced by demographic change in the future.

4. The fourth component is calculated as a residual and corresponds to the additional expenditure growth that can be financed under conditions of sustainability, after having financed adjustments that are due to demographic change, to changes in individual behavior, and to policy-induced expenditure changes.

To make this decomposition operational we start from the definition of total primary expenditures as already stated in equation (2) above taking into account our extensions by participation effects as well as effects induced by changes in politics:

$$E_t = \sum_{j=1}^{J} \sum_{x=1}^{\bar{x}} N(x,t)\, e(x,j,t,Z)\, \lambda(j,t) \qquad (2'')$$

The policy variable Z in the age-cost profile captures policy-induced changes in service levels. For example, in the function kindergarten services, German policy is currently discussing a significant increase in resources, and therefore per-capita expenditures in this policy area may increase. Another example is the impact recent policy reforms will have on federal transfers to the public pension system in the future.

Differentiating equation (2") with respect to time yields

$$\frac{dE_t}{dt} = \sum_j \sum_x e\lambda \frac{dN}{dt} + \sum_j \sum_x N(\cdot)\lambda \frac{d\lambda}{dt} + \sum_j \sum_x N\lambda \frac{de}{dZ}\frac{dZ}{dt} + \sum_j \sum_x N\lambda \frac{de}{dt} \qquad (13)$$

from which we can identify the various reasons for primary expenditure changes. On the left hand side of equation (13) we have sustainable total primary expenditure growth that can be derived from the budget constraint. The first term on the right hand side is the change in primary expenditures induced by demographic change, taking service levels as given. Note that this effect includes both pure population size effects as well as changes in the age structure of the population. The second component is expenditure growth that is induced by changing behavior of individuals as depicted by the participation rate. The third component is expenditure growth due to expected changes in politics. The last component is expenditure growth that can be financed after taking into account the expenditure growth induced by changes in demographics, politics as well as behavior, calling this term “residual primary expenditure growth” because it is calculated by solving equation (13) for the last component on the right-hand side.

Of course, demographic change, policy changes as well as behavioral changes can be expenditure-saving or expenditure-increasing, and these effects can vary across government functions as well as across levels of government. To distinguish policy-induced expenditure changes from residual expenditure growth we assume that the latter is identical across all government functions. Residual expenditure growth thus results in a general increase in service levels across all spending categories. Note that, while the first component on the right hand side in equation (9) does not affect the age-cost profile, the other components result in an adjustment of per-capita expenditures. Thus the age-cost profile is now endogenous.

This simple framework incorporates the age-cost profile into models of fiscal sustainability as developed by Blanchard et al. (1990).[15] However, sustainable primary expenditure growth in our model has to be interpreted quite differently when compared to these models because we ask the question, which expenditure growth can be financed after taking into account the cost of adjusting expenditures to demographic change, responding to changes in behavior as well as financing policies that have already been decided upon or are about to be introduced. Because the first three components in equation (9) can be either positive or negative the sustainable residual primary expenditure growth can be either greater or smaller than total primary expenditure growth.

Finally, two important notes have to be made. First, our decomposition of the sources of expenditure growth has the obvious shortcoming that these sources are not independent from each other. Small and large age cohorts face different conditions on the labor market etc., and thus a changing behavior of individuals might in fact be a response to changes in demographics. The same holds true for policy changes because politics respond to perceived changes in demographics. For example, the current debate in Germany on expanding kindergarten services for children below the age of 3 is aimed at supporting an increase in fertility rates.

Second, our modeling strategy implies a recursive determination of expenditure growth in the various government functions. In step 1 we determine sustainable *total* primary expenditure growth using a forecast of government revenues. In a second step we "finance" primary expenditure growth enforced by demographic change, plus changes in the behavior of individuals and policy changes. In a final step we determine residual expenditure growth by calculating the difference between total primary expenditure growth and aggregate expenditure growth derived in step 2.

---

[15] In fact, the papers by Blanchard (1990) and Blanchard et al. (1990) use the tax rate as the instrumental variable to achieve sustainability, whereas we use expenditures taking tax rates as given.

Using equation (13) we can derive the following relation for the growth rate of total primary expenditures in function j, $w^e(j)$,

$$w_t^e(j) = w_t^N(j) + w_t^Z(j) + w_t^\lambda(j) + w_t^R(j), \tag{14}$$

where w^N, w^Z , w^λ and w^R denote the primary expenditure growth rates induced by demographic change, politics, change in behavior and residual expenditure growth. In addition, the endogenous adjustment of the age-cost profile in the period t to t+τ is given by

$$e(x, j, t+\tau) = e(x, j, t)(1 + w_t^p(j))(1 + w_t^\lambda(j))(1 + w_t^R). \tag{15}$$

Note that w^N does not affect the age-cost profile. The relation of w^R to w^e can be used as an indicator of the future maneuverability of policy. If w^Z is rather large compared to w^e, current policy has already made decisions that have a significant impact on future expenditures and less flexibility is left for future generations. If w^N is large compared to w^e, the cost of adjusting to demographic change is high and reduces the discretionary power of future generations. On the other hand, the greater w^R is in relation to w^e the more future generations will be able to implement own policy objectives. Thus the relation between w^R and w^e can also be used to evaluate the consequences of current policy with respect to the freedom to act of future generations.

4 Data and Empirical Results

We start by deriving estimates of age-cost profiles at the different levels of government in Germany for the fiscal year 2004. In a second step we use these estimates to conduct a very simple comparative static experiment, demonstrating the impact of demographic change on fiscal expenditures if all other variables that drive public expenditures – inflation, real growth, changes in behavior and policy changes – are disregarded. In a final step we construct a very simple model of the fiscal sector in Germany taking into account the growth of revenues as well as non-demographic factors that influence the future devolution of public expenditures.

4.1 Estimating Age-Cost Profiles

In a first step we estimate age-cost profiles for the base year 2004, using the method suggested by Seitz and Kempkes (2007). Specifically, we construct an age-cost profile indicator matrix, I(j,x), which captures all infor-

mation available about the "demand" for public services by the various age groups. Index j = 1, … J (J being equal to 27 in our application) denotes the government function and index x = 1, … X (with X = 6) is the age category.

Table 4 presents the age-cost profile indicator matrix that we use in our investigation. The functions in the first column correspond to the spending categories that are briefly described in Table 2. The entries in the age-cost profile indicator matrix can be looked upon as estimates of the (normalized) probability of the relative degree of utilization of the public good in question by the various age groups. A "0" entry in the matrix means that the specific age group does not consume the public good provided within the specific government function. If all entries in a row are "1", this public service is consumed by all age groups with the same intensity. The entries are normalized such that the age group that demands the specific public services most intensively takes on the value "1".

Table 5 reports on an example for the derivation of the entries in the case of prisons.[16] Here we compare the age structure of the population with the age structure of prisoners and use this information to derive estimates of the age-cost indicators for penitentiaries. The age cohort 20–28 has the highest probability (0.23%) to be in prison and thus gets an entry "1", whereas the age group 28–65 has a probability of only about 0.10% and thus gets an entry of 0.44 (= 0.10% / 0.23%).

The entries in the age-cost indicator matrix have been derived by using data on the age structure of clients/users in the various fields of activities as well as a-priori reasoning.[17] Note, that the age-cost profile indicator matrix is assumed to be identical across all levels of government which is a simplifying but by no means far-fetched assumption.

[16] In Table, 4 the entries in line 4 are an average of age-cost profile indicators for penitentiaries, courts of justice and public prosecution service.

[17] In the case of general public administration, defense, etc. there is no reason to assume that different age groups are served differently, and consequently each age cohort is assigned the value "1" in the age-cost indicator matrix. For more details on how to derive the entries in Table 4, see Seitz and Kempkes (2007).

Table 4. Age-cost profile indicator matrix for Germany

	age group					
Function[a]	0–6	6–20	20–28	28–65	65–80	>80
1	1.00	1.00	1.00	1.00	1.00	1.00
2	1.00	1.00	1.00	1.00	1.00	1.00
3	0.40	0.91	1.00	0.71	0.50	0.46
4	0.58	0.93	1.00	0.80	0.65	0.62
5	0.00	1.00	0.23	0.00	0.00	0.00
6	1.00	0.00	0.00	0.00	0.00	0.00
7	0.00	0.11	1.00	0.06	0.00	0.00
8	0.00	1.00	1.00	1.00	0.00	0.00
9	0.00	0.00	1.00	1.00	0.00	0.00
10	0.00	0.13	0.27	1.00	0.78	0.18
11	0.00	1.00	1.00	1.00	0.50	0.50
12	0.20	0.20	1.00	1.00	0.20	0.20
13	0.00	0.00	1.00	1.00	0.00	0.00
14	0.20	1.00	1.00	1.00	0.20	0.20
15	0.50	1.00	1.00	1.00	0.50	0.20
16	1.00	1.00	1.00	1.00	1.00	1.00
17	0.00	0.00	0.00	0.11	0.63	1.00
18	1.00	1.00	1.00	1.00	1.00	1.00
19	0.00	0.00	0.00	0.11	1.00	0.76
20	0.00	0.00	1.00	1.00	0.50	0.20
21	1.00	1.00	1.00	1.00	1.00	1.00
22	1.00	0.63	0.63	0.48	0.37	0.87
23	0.20	1.00	0.50	0.00	0.00	0.00
24	1.00	1.00	0.00	0.00	0.00	0.00
25	1.00	1.00	1.00	1.00	1.00	1.00
26	1.00	1.00	1.00	1.00	1.00	1.00
27	1.00	1.00	1.00	1.00	1.00	1.00

[a]See Table 2.

Source: Seitz and Kempkes (2007).

Table 5. Derivation of the entries in the age-cost profile indicator matrix in the case of prisons, 2004

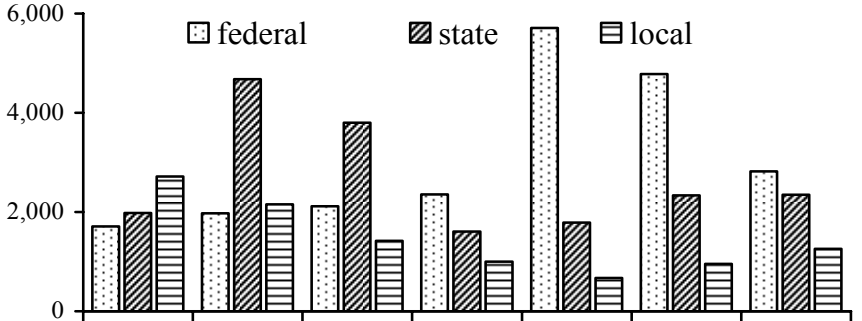
	age group					
	0–6	6–20	20–28	28–65	65–80	>80
Population in 2004 (1,000s)	4,435	12,277	7,772	42,649	11,810	3,557
Number of prisoners	0	3,236	17,621	42,206	614	0
Probability to be in prison	0.00%	0.03%	0.23%	0.10%	0.01%	0.00%
Normalization[a]	0.00	0.12	1.00	0.44	0.02	0.00

[a]Using the highest probability reported in line 3.

Figure 1 represents the estimated age-cost profiles by level of government in Germany based on net expenditures in 2004. At the local government level average per-capita spending is about 1.260 €. Spending is highest for the age group <6 because local governments have to carry the burden of financing kindergarten services. Above average per-capita expenditures also accrue for the school-aged population 6–20. Apart from the age group 80–100 per-capita spending on the various age groups is strongly decreasing in the age of the population. At the state level, average per-capita spending is about 2.350 € and the age-cost profile has a pronounced peak at age 6–20 and 20–28, reflecting state spending on school teachers and universities. At the federal level, which spends on average about 2.820 € per capita, expenditures are significantly lower for the younger generation whereas per-capita spending on the age group 65–80 amounts to almost twice the average per-capita spending. To summarize, at the state level we have an inverted u-shaped age-cost profile with a strong left skew, whereas at the federal level the profile is strongly right-skewed. At the local government level the age-cost profile is almost steadily falling by age.

The differences in the shape of the age-cost profiles are of course mainly due to the peculiarities of the division of tasks between the different layers of government in Germany. Whereas local governments finance kindergarten services and school infrastructure, state governments cover all expenditures for school teachers and universities. The federal government makes only small indirect contributions to financing the education system by providing investment transfers to state governments for university construction.[18] High spending on the elderly at the federal level is due

[18] A recent reform of fiscal federalism in Germany even reduced the direct financing of education expenditures by the federal government.



	0-6	6 - 20	20-28	28-65	65-80	80-100	average
federal	1,710	1,976	2,114	2,354	5,711	4,779	2,821
state	1,982	4,677	3,800	1,605	1,789	2,337	2,348
local	2,717	2,155	1,421	1,000	669	958	1,258

Source: Own calculations based on assumptions as set out in table 2 and data on net expenditures provided by the Federal Statistical Office.

Fig. 1. Net primary spending per capita of the relevant age group across all government functions in Euro by levels of government in Germany, 2004

to the transfers from the federal government to the public pension system. Specific spending on the elderly at the state and local government level is of rather small importance. The only significant spending for the population 65+ at the subnational level is due to pension payments for retired public servants.

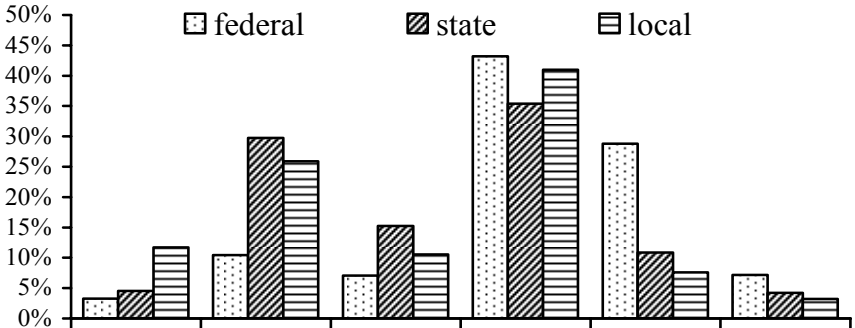
A concept closely related to the age-cost profile are age-expenditure shares which are derived by calculating

$$\varepsilon(x) = \frac{\sum_{j=1}^{J} e(x, j)N(x)}{\sum_{j=1}^{J} E_j} \tag{16}$$

Here, $\varepsilon(x)$ denotes the share of expenditures devoted to age group x. Whereas age-cost profiles provide information about per-capita spending per person at some specific age, the age-expenditure shares inform about the distribution of public expenditures across the various age groups.

Figure 2 presents the estimated age-expenditure shares at the three levels of government in Germany in 2004. These expenditure shares are strongly influenced by the population shares of the various age cohorts. Spending on the young (<28) absorbs about 47% of total spending at the

state and local government level, whereas the federal government spends only about 22% of its total expenditures on this age group. States devote about 15% of total spending to the elderly (65+), and at the local government level this share is even only about 11%, while the federal government has to spend about 1/3 of all expenditures on the elderly.



	0-6	6 - 20	20-28	28-65	65-80	80-100
federal	3.28%	10.46%	7.06%	43.22%	28.81%	7.17%
state	4.56%	29.75%	15.24%	35.40%	10.84%	4.22%
local	11.71%	25.88%	10.57%	41.00%	7.62%	3.23%

Source: Own calculations based on assumptions as set out in table 2 and data on net expenditures provided by the Federal Statistical Office.

Fig. 2. Age-expenditure shares: distribution of net primary spending across the various age groups by level of government in Germany, 2004

4.2 The Impact of Demographic Change on Public Expenditures, 2004–2030

In a first comparative static experiment we examine the pure effects of demographic change on the distribution of expenditures across the six age groups and investigate whether demographic change is expenditure-saving, expenditure-increasing, or does not affect expenditures at all. To see this we assume that the age-cost profiles as depicted in Figure 1 do not change until the year 2030, which is our time horizon for the subsequent calculations. In addition, we completely disregard productivity growth, inflation effects, the effects of policy changes as well as changes in behavior (i.e., the participation effect). Thus, we conduct a comparative static experiment, isolating the effects of demographic change by fictitiously transfer-

ring the demographic structure of 2030 to the year 2004.[19] We call these simple calculations the "pure demographic change" experiment.

Table 6. Age-expenditure shares by levels of government in Germany, 2004 and 2030: "pure demographic change" experiment (measured in terms of net primary expenditures)

	year/change	0–6	6–20	20–28	28–65	65–80	>80
federal	2004	3.28%	10.46%	7.06%	43.22%	28.81%	7.17%
	2030	2.53%	7.49%	5.15%	35.71%	36.88%	12.23%
	Δ	–0.75%	–2.97%	–1.91%	–7.51%	8.08%	5.06%
	%Δ total expenditure: 5.45%			%Δ per-capita expenditure: 11.16%			
State	2004	4.56%	29.75%	15.24%	35.40%	10.84%	4.22%
	2030	4.08%	24.70%	12.89%	33.91%	16.09%	8.33%
	Δ	–0.48%	–5.05%	–2.35%	–1.49%	5.25%	4.12%
	%Δ total expenditure: –9.04%			%Δ per-capita expenditure: –4.12%			
Local	2004	11.71%	25.88%	10.57%	41.00%	7.62%	3.23%
	2030	10.69%	21.73%	9.26%	40.14%	11.62%	6.56%
	Δ	–1.03%	–4.15%	–1.31%	–0.86%	4.01%	3.33%
	%Δ total expenditure: –11.52%			%Δ per-capita expenditure: –6.35%			

Source: See text.

In Table 6 we compare the age-expenditure shares by levels of government in 2004 and those in 2030 resulting from the "pure demographic change" experiment. Taking into account the trend towards an aging society in Germany, we get quite considerable reductions in the expenditure shares of all younger age groups, whereas spending shares for the elderly increase considerably. Table 6 also provides information about the change in total and per-capita spending by levels of government. As Germany will experience a drop in the population size by about 5.1% until 2030, it is important to differentiate between total and per-capita expenditure growth. Pure demographic change will put a considerable upward pressure on per-capita federal spending which will increase by almost 10% until 2030. Contrary to this, per-capita expenditures will drop by almost 4% at the state level and by about 6% at the local government level. Across all levels of government, per-capita expenditure will increase by about 2%.

[19] With respect to interest payments, the neglect of productivity effects implies that the debt-to-GDP ratio as well as real interest rates in 2030 are identical to those in the base year 2004.

Thus, our simple "pure demographic change" experiment shows that public budgets – outside the social security system – will on the whole not be affected that much. However, these modest changes at the aggregate level are accompanied by quite significant changes in the distribution of expenditures across the three levels of government. Whereas in 2004 about 46% of total public expenditures fall upon the federal government, this share will increase to about 49.5% in 2030 and thus a considerable redistribution of tax resources towards the federal level will be necessary. These results are in sharp contrast to empirical evidence derived for other federal countries. For example, in Canada the aging process will put pressure on provinces and will contribute to an improvement of the fiscal stance of the federal government (see Conference Board of Canada 2002). The main reason for the differences between Canada and Germany seems to be that the Canadian Provinces are responsible for providing tax financed health care. Thus, the federal distribution of the fiscal burden of demographic change can be quite different across federal countries due to varying institutional frameworks.

4.3 Building a More Complete Model

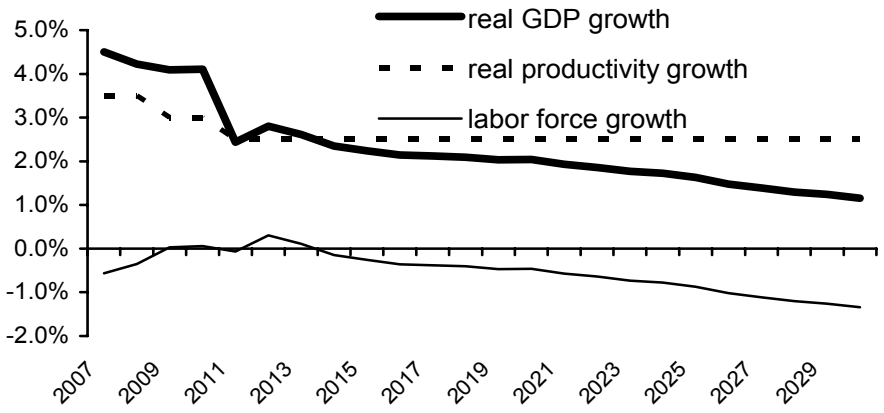
In the preceding sub-section we have isolated the impact of demographic change on public expenditures disregarding the revenue side as well as other driving forces of expenditure growth. These very restrictive assumptions will now be relaxed step by step.

Revenue Growth

In a fist step we derive a simple forecast of the growth of public revenues at the three levels of government. Because we use net expenditures – that is, expenditures minus transfers received – we also have to use net revenues which are defined correspondingly, i.e., as total revenues minus transfers received. Because in Germany the bulk of tax revenues are from taxes that are shared between the different layers of government we simplify our calculations by using the same forecasting procedure for tax revenues of all government levels.[20] Our revenue forecast rests upon (preliminary) figures for the fiscal year 2006 and is based on equation (13). Since the German economy is currently in a strong recovery, we assume a real produc-

[20] A refined simulation model would have to take into account that some tax resources accrue to one level of government only. At the current stage of our modeling we disregard this complication.

tivity growth of 3.5% in 2007–2008, reducing this rate to 3.0% in 2009 and to 2.75% in 2010. In the remaining years, 2011–2030, real productivity is assumed to grow by 2.5%. The growth rate of real GDP in the period 2006–2010 is adjusted by assuming that the unemployment rate[21] drops from about 8.4% in 2006 to 4% in 2010 and all subsequent years.[22]



Source: Own calculations, see text.

Fig. 3. The growth of real GDP, real productivity per worker and the labor force in the simulation period, 2007–2030

Figure 3 depicts the assumed time path of real per-worker productivity growth, real GDP growth as well as the growth rate of the labor force in the simulation period. In the period 2007–2010 the most important reason for real GDP growth to exceed real productivity growth is the assumed drop in the unemployment rate. After the year 2013 the growth rate of the labor force is negative in each year, and this decrease is steadily accelerating.[23] This effect reduces the growth of real GDP and consequently the growth of public revenues.

We use the calculated growth rate of real GDP to forecast future revenues at all levels of government assuming a GDP-elasticity of revenues of 1. Because we do not handle the three levels of government differently, we

[21] We do not use the official rate of registered unemployment. We calculate the unemployment rate by dividing the number of unemployed persons by the labor force (population 20–67).

[22] The drop in the unemployment rate is not taken into account in equation (11).

[23] The number of people aged 20–67 decreases by about 14% in the 2006–2030 period.

implicitly assume that the distribution of revenues across the federal, state and local government sector is stable in our simulation model. Indeed, in Germany a change in the distribution of revenues across the various levels of government can only be achieved within a complicated political negotiation process between government levels.

Participation Effects

There are a lot of government functions in which participation effects arise. For example, the demand for tertiary education (line 7 in Table 2) increased strongly in the past resulting in a significant increase in the ratio of university students relative to the relevant age cohorts. Whereas only about 12% of people aged 20–28 attended a university in the mid-1970s, this ratio increased to about 26% in 2003, and differences between male and female enrolment rates are now quite small (~2.7%) as compared to about 8% in 1975. For the near future a further increase in the demand for university education is expected. Using a simple forecasting technique, we estimate that the total enrolment rate will increase to about 35% in 2030, which means that the participation factor, $q(x,t+\tau)/q(x,t)$, in the university system is about 1.35 in 2030 (see Seitz and Kempkes 2007). However, there is a counter-effect because in Germany the university system is currently under adjustment, introducing Bachelor and Master programs which substitute for the traditional "diploma courses". This reform is associated with a significant reduction in the duration of studies. To take this effect into account we adjust the participation factor in the university system downward to 1.2. We also apply a participation factor of 1.2 to the function "research outside universities" (line 9 in Table 2). We justify this assumption by reasoning that investment into research outside universities should at least keep pace with human capital accumulation as measured by the ratio of university students relative to the population 20–28.

Expenditures on "pension payments for retired public servants" (line 17 in Table 2) are completely financed out of taxes. In forecasting these expenditures we have to take into account that the number of retired public servants relative to the number of old-aged persons (65+) changes in the period up to 2030. In 2004 there were a total of about 935.000 retired public servants (including surviving dependants). The majority, about 65%, is currently financed by state governments, 24% fall on the federal government and 11% to the local government sector. Recently, the Federal Ministry of the Interior (2005) published a report on public sector pension obligations from which we can derive an estimate of the number of public pensioners relative to the total number of the elderly (65+) in 2030. This ratio is used as an estimate of the participation factor in forecasting public

pension payments. At the federal government level this factor is 0.65, at the state government level 1.11 and 0.89 at the local government level.

Our assumptions regarding the improvement of economic conditions in Germany have repercussions on welfare spending, especially on social assistance transfers that are provided by local governments and not by the social security system. While in 1980 about 1.4% of the German population received (means-tested) social assistance, this ratio was about 3.4% in 2004. The main reasons for this increase have been an increasing and high unemployment rate and strong immigration (see Seitz and Kurz 1999). Thus a significant drop in the unemployment rate will result in reduced expenditure on welfare benefits. In addition, in 2005 a far-ranging reform of the welfare system has been introduced ("Hartz-IV reform") which is expected to lead to significant expenditure savings.[24] However, both these effects are very to quantify and to forecast. As a rough estimate we assume that the ratio of recipients of social assistance returns to the level in the early 1990s, implying a participation factor of 0.85 for spending on the function "social assistance" (line 22 in Table 2).

Policy Changes

Across all political parties in Germany there is currently a consensus to increase the supply of kindergarten services considerably, especially for children below the age of 3. In 2004 state and local government spent about 11.4 bill. € on kindergarten services. In the current political and public discussion an increase in kindergarten expenditures by 3 bill. € is frequently referred to by policy makers. Therefore we assume an increase in real resources spent in this area by 25% in the near future. Despite the fact that the federal level is not responsible for the provision of kindergarten services, members of the federal government provoked this debate. Consequently the federal government is put under public and political pressure to support state and local governments to finance this increase in public provision. Therefore we assume that 50% of the additional expenditure on kindergarten will have to be covered by the federal government and 25% by both the state and local government sector.

Reforms introduced in recent years will result in a significant drop in federal transfers to the public pension system. According to the results of Werding and Kaltschütz (2005) as well as those of Werding (2007, this volume), pensions in 2004 would be about 15% lower if the rules that will

[24] We could also treat the effects of this reform in the following subsection on the effects of policy changes. However, we subsume the effects under the expected drop of the unemployment rate.

be in force in 2030 had already been introduced in 2004. Therefore, we set the participation factor λ to 0.85 at the federal government level in function 21 ("subsidies to the old-age pension system") when we calculate federal expenditures in 2030.

Other Effects

A final effect we have to take into account is the fact that a considerable share of federal transfers to the East German states will expire step by step until 2019. Currently the federal government spends about 12.5 bill. € (net of transfers from the EU to the East German states) for this purpose (see Seitz 2006) and therefore we reduce federal spending by this amount up to the year 2019 according to the rules fixed by law.

In addition the federal government will achieve significant expenditure savings due to the fact that in East Germany there are special supplementary pension payments (AAÜG) that will fade out because the number of beneficiaries steadily decreases. We estimate that these savings amount to about 4.5 bill. Euro (Seitz 2003). Therefore, in addition to the drop in transfers to East German states, we reduce the transfers of the federal government to the public pension system until 2030 by another 4.5 bill. €.

Finally, we have to address interest payments. Because there is already an upward trend in interest rates, we increase the interest rate on government debt by 1 percentage point until the year 2015.

Summarizing the Assumptions for Our Policy Simulations

Let us summarize the assumptions for our policy simulations

- Demographic developments in Germany until the year 2030 follow the most recent population forecast of the Federal Statistical Office, taking the average value of variant W1 and W2.
- Revenue growth is assumed to be equal to GDP growth. We assume a long-run real productivity growth of 2.5% and approximate the growth of the labor force by the growth rate of the population aged 20–67.
- In the university system assume an steady increase in per-capita spending by 20% until 2030 and we assume the same growth rate for spending in research outside universities.
- While the relative burden of spending on pensions for retired public servants will steadily decrease by about 35% at the federal level and by about 11% at the local level until the year 2030, this burden will increase by about 11% at the state level.

- Spending on social assistance is assumed to drop by 15% until the end of this decade.
- Kindergarten spending will increase by 25% on real terms until the end of this decade. The additional financial burden is distributed to the federal, state and local government sector in the relation 50% : 25% : 25%.
- There will be a real cut in pension payments by about 15% up to the year 2030. These cuts are assumed to affect federal transfers to the public pension system proportionally.
- Federal transfers to the East German states will steadily decline by 12.5 bill. € until the year 2019, and there will be a further decline in federal spending by about 4.5 bill. € until 2030 due to savings in supplementary pension payments in East Germany.
- The nominal interest rate on public debt will increase by 1% until the year 2015.
- Budgets at all levels of government are assumed to be balanced in 2010 and remain in balance until 2030.

Introducing the various adjustments step by step we can identify the isolated impact of each aspect and determine the relative importance of demographic change for the future evolvement of public expenditures.

4.4 Simulation Results

The results of our calculations are presented in Table 7 which reports the decomposition of primary expenditure growth by the various sources for each level of government. At the federal level net primary expenditures may increase by about 1.94% per year on average in the 2004–2030 period. At the state level and at the local government level this increase is much stronger (2.08% and 2.35%). The main reason for these differences is the fact that in the base year 2004 the fiscal deficit and public debt is significantly higher at the federal level and thus the federal government has to keep primary expenditures growth in the period 2004–2010 considerably below that at the state and local government level to achieve a balanced budget in 2010. In the period 2010–2030 net primary expenditure growth at the three levels of government is virtually identical because revenue growth is assumed to be the same at each level of government,

The effects of pure demographic change will increase federal expenditures by about 0.2% per year on average, whereas state and local expenditures decrease by about 0.4%. The main reason for the strong drop in subnational spending is the decrease in the number and share of people attending schools and universities.

Table 7. Decomposition of average annual net primary expenditure growth by levels of government in Germany, 2004–2030

	federal government	state government	local government
total net primary expenditure growth, thereof:	1.94%	2.08%	2.35%
Induced by demographic change	0.20%	–0.36%	–0.47%
Induced by behavioral changes	0.00%	0.10%	–0.15%
Induced by policy changes	–0.15%	0.01%	0.03%
Induced by other factors	–0.26%	0.00%	0.00%
residual expenditure growth	2.15%	2.33%	2.94%

Source: Own calculations, see text.

Policy changes will bring about a drop in federal expenditure growth by about 0.15% p.a. The most important reason is the change in the public pension system that will result in a drop of federal transfers to the system. At the state and local level there is a modest expenditure push from policy changes because of the expected increase in kindergarten services.

Behavioral changes account for an annual increase in spending by about 0.1% at the state level and an annual decrease in spending by about 0.15% at the local level. About 2/3 of the increase in expenditure at the state level is due to the assumed increase in demand for university education. The rest stems from the increase in spending on pensions for retired public servants. At the local level the negative effect is due to the decrease in social assistance expenditures associated with the drop in the unemployment rate. The federal level is not significantly affected by behavioral changes.

Other factors affect only the federal government level. Here, significant savings at the federal level are due to the cut in transfers to the East German states.

Residual expenditure growth as an indicator of the room for maneuver of policy is strongest at the local level. It significantly exceeds total primary expenditure growth because of demographic expenditure savings. At the federal and the state level residual expenditure growth also exceeds total primary expenditure growth but the differences are rather small. While at the state level potential demographic savings outweigh the increase in expenditures due to other factors, at the federal level demographic expenditure increases are counter-balanced by expenditure savings from policy changes and other factors, notably reductions in federal transfers.

In addition there is another demographic factor at work resulting from the drop in the work force. The latter leads to a drop in the annual average growth rate of revenues by about 0.25% at all levels of government.

Whereas this decrease in revenues is overbalanced by cost savings at the state and local government level, the demographic losses in revenue growth enhance the expenditure-increasing effect at the federal level.

From our calculations we can conclude that the impact of demographic change on government revenues and expenditures is significant albeit not dramatic. However, our estimates imply that there are significant distributive effects across the different layers of government. While subnational governments achieve expenditure savings, the federal level has to spend about 0.2% of expenditure growth on average on coping with demographic change.

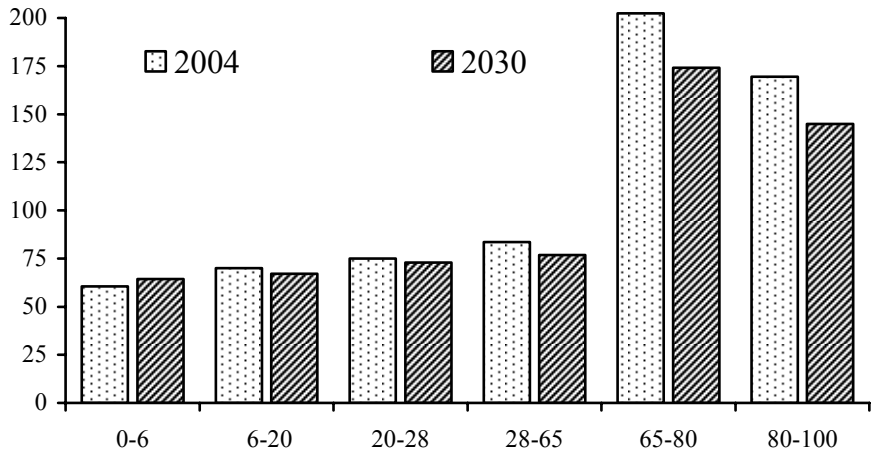
Table 8. Age-expenditure shares measured in terms of net primary expenditures by level of government in Germany, 2004 and 2030

	year/ change	0–6	6–20	20–28	28–65	65–80	>80
federal	2004	3.28%	10.46%	7.06%	43.22%	28.81%	7.17%
	2030	2.98%	7.98%	5.56%	36.58%	35.26%	11.63%
	Δ	–0.29%	–2.48%	–4.90%	–6.64%	6.45%	4.46%
State	2004	4.56%	29.75%	15.24%	35.40%	10.84%	4.22%
	2030	4.08%	24.01%	13.53%	33.50%	16.35%	8.52%
	Δ	–0.48%	–5.73%	–16.22%	–1.89%	5.51%	4.31%
Local	2004	11.71%	25.88%	10.57%	41.00%	7.62%	3.23%
	2030	11.16%	22.11%	9.32%	40.12%	11.19%	6.10%
	Δ	–0.56%	–3.77%	–16.56%	–0.87%	3.57%	2.87%

Source: See text.

Table 8 reveals that these rather modest effects are underpinned by dramatic changes in the distribution of expenditures across the various age groups. For example, at the state level the share of expenditures devoted to the population <28 will decrease by almost 8%, whereas spending on the elderly, 65+, will increase by almost 10%. These changes necessitate significant adjustments in the structure of public budgets, and one should expect stiff opposition from interest groups and policy makers who concentrate their activities in those fields of politics that lose budget shares.

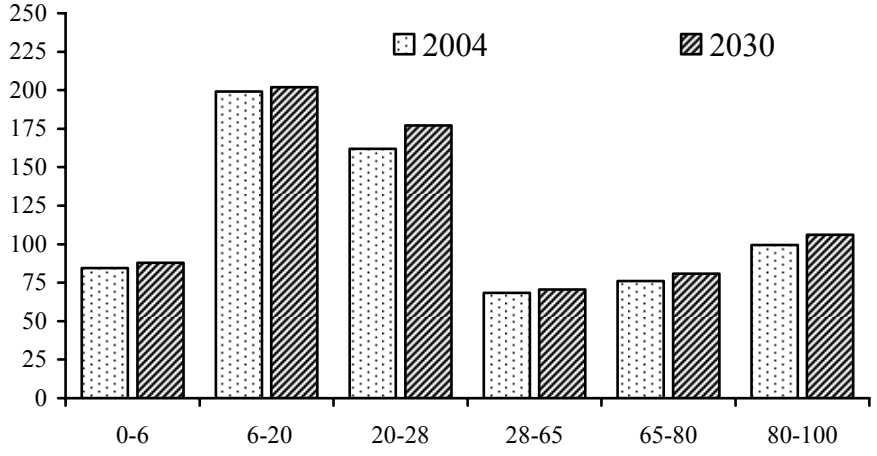
Finally we look at the endogenous adjustment of the age-cost profiles which we depict in a normalized form in figures 4a (federal), 4b (state) and 4c (local). Normalization has been achieved by dividing per-capita spending for each age group by total average per-capita spending. At the federal level per-capita spending on the elderly in relation to total average per-capita spending decreases considerably because of the latest cuts in pension payments that will become effective over the next twenty years. Relative



[a]Age-cost profiles are divided by average per-capita spending across all age groups.

Source: Own calculations.

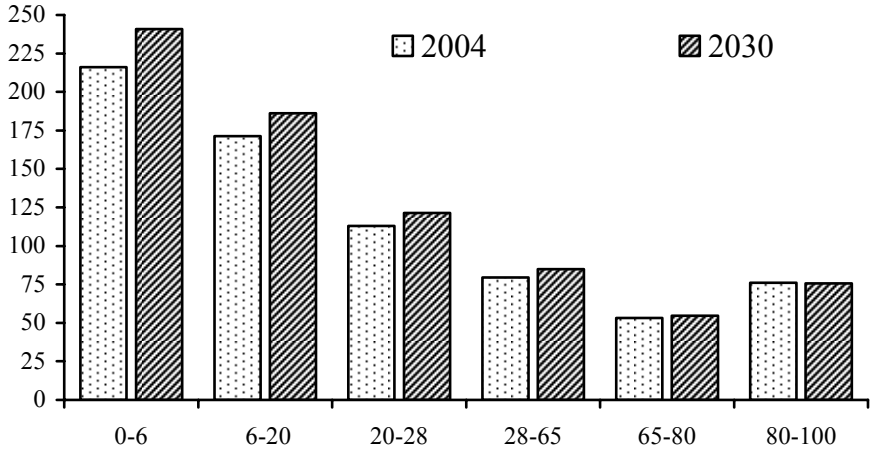
Fig. 4a. Normalized[a] net primary spending per capita of the relevant age group at the federal level, 2004 and 2030



[a]Age-cost profiles are divided by average per-capita spending across all age groups.

Source: Own calculations.

Fig. 4b. Normalized[a] net primary spending per capita of the relevant age group at the state level, 2004 and 2030



[a]Age-cost profiles are divided by average per-capita spending across all age groups.

Source: Own calculations.

Fig. 4c. Normalized[a] net primary spending per capita of the relevant age group at the local government level, 2004 and 2030

state spending on the population 20–28 will increase most strongly due to our assumption of an increasing participation rate in university education. At the local government level, the increase in kindergarten services will push up per-capita spending on the population <6.

5 Summary and Conclusions

This paper has examined the impact of demographic change on public budgets in Germany (disregarding the social security system which is analyzed by Werding 2007 in this volume). We started our presentation with a discussion of the most important features of the institutional framework in Germany because these features determine the potential channels for the fiscal effects of demographic change to work themselves through public budgets at different levels of government. Our methodology for analyzing these effects rests upon the age-cost profile concept. We integrate them into a simple model of sustainable public finances to make age-cost profiles endogenous. In the empirical part of the paper we present estimates of the age-cost profiles at the different layers of government and estimate the impact of demographic change as well as other factors upon primary expenditures. Our results suggest that demographics affect public budgets

significantly albeit not dramatically. In addition we show that the federal, state and local governments in Germany are affected quite differently by demographic change. The federal government has to carry a significant demographic burden, whereas subnational governments may experience expenditure savings when properly adjusting their budgets to the changing age structure of the population. If the distribution of tax revenues across the three layers of government is not changed within the next decades, the subnational government sector will live to see a considerable increase in its room for maneuver, while the federal government may experience a relative loss of political power.

References

Bach S, Bork C, Krimmer P, Raffelhüschen B, Schulz E (2002) Demographischer Wandel und Steueraufkommen. Report prepared for the Federal Ministry of Finance. DIW Materialien No 20, Berlin

Blanchard OJ (1990) Suggestions for a New Set of Fiscal Indicators. OECD Economics Department Working Paper No 79. Paris

Blanchard OJ, Chouraqui JC, Hagemann RP, Sartor N (1990) The Sustainability of Fiscal Policy: New Answers to an Old Question. OECD Econ Stud 15:7–36

Börsch-Supan A (2000) A model under siege: A case study of the German retirement insurance system. Economic Journal 110:F24–F45

Conference Board of Canada (2002) Fiscal prospects for the federal and provincial/territorial governments: Economic performance and trends. Conference Board of Canada, Ottawa, ON

Disney R (2007) Population ageing and the size of the welfare state: Is there a puzzle to explain? European Journal of Political Economy 23:542–553

Economic Policy Committee and European Commission (2006) The impact of aging on public expenditure: Projections for the EU-25 member states on pension, health care, long-term care, education and unemployment transfers (2004–2050). European Economy, Special Report No 1/2006. European Commission, DG ECFIN, Brussels

Federal Ministry of the Interior (2005) Dritter Versorgungsbericht der Bundesregierung. BMI, Berlin

Fernandez R, Rogerson R (2001) The determinants of public education expenditures: Longer-run evidence from the States. Journal of Education Finance 27: 567–584

Franco D, Munzi T (1997) Ageing and fiscal policies in the European Union. In: European Commission, DG ECFIN (ed) The welfare state in Europe: Challenges and reforms. European Economy, Reports and Studies No 4, pp 239–388

Gradstein M, Kaganovich M (2004) Aging population and education finance. Journal of Public Economics 88:2469–2485

Grob U, Wolter SC (2005) Demographic change and public education spending – A conflict between young and old? CESifo Working Paper No 1555

Gruber J, Wise D (2001) An international perspective on policies for an aging society. NBER Working Paper No 8103

Hagemann RP, Nicoletti G (1989) Population ageing: Economic effects and some policy implications for financing public pensions. OECD Econ Stud 12:51–96

Kempkes G (2007) Rapid demographic change and the allocation of public education resources. Manuscript, Dresden University of Technology

Lee R, Edwards R (2001) The fiscal impact of population change. In Little JS, Triest RK (eds) Seismic shifts: The economic impact of demographic change. Federal Reserve Bank of Boston Conference Series No 46, pp 220–237

Poterba JM (1997) Demographic structure and the political economy of public education. Journal of Policy Analysis and Management 16:48–66

Razin A, Sadka E, Swagel P (2002) The Aging Population and the Size of the Welfare State. Journal of Political Economy 110:900–918

Seitz H (1999) Subnational Government Bailouts in Germany. Inter-American Development Bank, Working paper No R-396

Seitz H (2003) Die Leistungen der neuen Länder im Rahmen des AAÜG – Bestimmungsgründe und Belastungsdynamik. Studie im Auftrag der Länder Berlin, Brandenburg, Mecklenburg-Vorpommern, Sachsen, Sachsen-Anhalt und Thüringen

Seitz H (2006) Zur Quantifizierung des „Korb 2“ im Rahmen des Solidarpakts II. Ifo Dresden berichtet 5:24–30

Seitz H, Kempkes G (2007) Fiscal Federalism and Demography, in: Public Finance Review 35:385–413

Seitz H, Baum B (2003) Demographie und öffentliche Bildungsausgaben in Deutschland: Eine empirische Untersuchung für die westdeutschen Flächenländer. Vierteljahreshefte für Wirtschaftsforschung 72:205–219

Seitz H, Kurz C (1999) Arbeitslosigkeit, Zuwanderungen und Sozialhilfe: Eine Analyse der Determinanten und der Finanzierung der Sozialhilfeausgaben. Finanzarchiv 56:518–555

Werding M, Kaltschütz A (2005) Modellrechnungen zur langfristigen Tragfähigkeit der öffentlichen Finanzen. Ifo Beiträge zur Wirtschaftsforschung, vol. 17. Ifo Institute, Munich

Werding M (2007) Social Insurance: How to Pay for Pensions and Health Care? In: Hamm I, Seitz H, Werding M (eds) Demographic Change in Germany: The Economic and Fiscal Consequences. Springer, Berlin Heidelberg New York, pp 89–128 (this volume)

Education and Fertility in Germany

Michaela Kreyenfeld, Dirk Konietzka *

1 Introduction

Germany's completed fertility rates are among the lowest in Europe. The total number of children born to West German women of the 1965 birth cohort is estimated to be 1.5 children per woman. A Swedish or French woman of the same cohort will have given birth to almost 2 children during her life time (Council of Europe 2004). Germany's low fertility in part is manifest in a high proportion of childlessness. Even though childlessness is advancing in many European countries (Dorbritz and Ruckdeschel 2007), Germany stands out with exceptionally high figures. More than 20 percent of the West German female cohort of 1960 are remaining childless at the end of their reproductive life (Konietzka and Kreyenfeld 2007).

The causes of low fertility and high childlessness are manifold. Most attention probably has been paid to women's changing role in society. Educational opportunities and gender equality have become central elements of the value system of modern societies. The upsurge in gender equality has been accompanied by a rapid decline in fertility. Women's rising education and labor market orientation, thus, have been regarded as central factors that have suppressed birth rates in industrialized countries (Becker 1993; Joshi 1998). According to Hirschman (1994: 222), a "negative relationship between women's education and fertility, both at the individual and aggregate level", is one of the most consistent empirical findings.

Comparative welfare state research, however, has viewed this issue from a different perspective (Gauthier 1996; Gornick et al. 1998; Esping-Andersen 1999). Several authors pointed out that in the past there indeed has been a strong correlation between increasing female employment and declining fertility. Nowadays, however, it is the very countries that successfully modernized their gender systems that also have higher fertility

* We are grateful to Susann Backer for the language editing of this paper.

levels (McDonald 2000; Brewster and Rindfuss 2000; Ahn and Mira 2002). Castles (2003) even speaks of a world 'upside down', meaning that countries that are unable to integrate women with children into the labor market are also losing out in their fertility development.

The central argument in this context is that social policies play a crucial role in shaping fertility behavior. Fertility choices are discouraged in societies that promote gender equality in the labor market but do not provide the opportunity to combine work and family life. In Germany, the incompatibility between work and family life is very pronounced. Thus, one should expect that the educational status of women makes a large contribution towards explaining German fertility differences.

This paper provides an overview of the relationship between education and fertility in Germany. We focus on the behavior of women living in the former West Germany. We exclude foreigners from the analysis because the behavior of this group would require a separate investigation (Andersson and Scott 2005). We do not analyze fertility behavior in the East German states for the following reasons. Since unification, period fertility rates have declined rapidly in this region and the age at first birth has sky rocketed. While there were only small differences in the age at childbearing between highly educated and lowly educated women before unification, these differences have increased after unification. The increase, however, was not the same for all birth cohorts. The cohorts born around 1968 show particularly odd patterns. The lowly educated women mostly had a child before unification and, thus, at young ages. More highly educated women had children after unification, mostly at very high ages. This contributed to very pronounced educational differences in the fertility behavior of the 'unification cohorts' (Huinink and Kreyenfeld 2006; Kreyenfeld 2004, 2006). Given the particular demographic situation in East Germany, one would need a separate investigation of its fertility pattern.

In the following section, we develop our main research hypothesis. Section 3 describes the data set. Section 4 displays summary fertility measures and section 5 provides the results of our multivariate analysis.

2 Education and Fertility

2.1 Theoretical Considerations

The standard economic approach is the most prominent theoretical concept of investigating the relationship between education and fertility. Education is seen as an investment in individual human capital which increases the worker's productivity and enhances his or her wages. The new home eco-

nomics assumes that work and family life are incompatible and that traditional gender roles are the dominant household arrangements. The traditional division of labor is viewed as a product of the rational, unanimous, and free decision of two partners, with one partner concentrating on household activities and the other on labor market activities. The opportunity costs of having children arise from earnings foregone due to caring for the child instead of being gainfully employed. In this framework, more highly educated women who earn higher wages encounter higher opportunity costs of childrearing and thus tend to have lower fertility (Schultz 1976: 103; Becker 1993: 140).

Education also plays a central role in cultural approaches to fertility. Demographic transition theory stresses the part education plays in diffusing new values and ideas. In studies on developing countries in particular, female education is frequently used as an indicator that captures an amalgam of novel values, attitudes, ideas, and the ability to plan life rationally and to use contraceptive methods efficiently (Castro Martin 1995; Axinn and Barber 2001: 481; Kravdal 2002). According to the 'second demographic transition theory', rising education, value change, and female emancipation are strongly interrelated factors that explain fertility decline in contemporary Europe (Lesthaeghe 1995).

Comparative welfare state research has shown another facet to the education and fertility nexus by focusing on the way in which public policies shape people's life chances. Contemporary European welfare states differ considerably in the degree to which they support families, promote gender equality, and integrate women into paid employment (Mc Donald 2000; Castles 2003, Neyer 2003). Esping-Andersen (1999) introduced the concept of 'de-familiarization' in order to differentiate policies according to the degree to which they 'free' women from housekeeping tasks and from dependence on the family. Familialistic regimes primarily support caregiving within the family, while de-familialized regimes typically provide institutional care arrangements and, more generally, have a reliable service infrastructure that reduces women's family obligations and enhances the compatibility between work and family life. In this institutional framework, the birth of a child has much less of an adverse effect on women's employment activities. Given that children are not a severe impediment to their mother's employment career, one could assume that highly educated women decide in favor of parenthood, too. Therefore, the association between female education and fertility should be weaker in countries that support the compatibility between work and family life.

The approaches discussed above are primarily concerned with explaining the total number of children per woman. Besides variations in average family size, individuals differ in the timing of first birth and in spacing

subsequent births. From a life-course perspective, fertility choices are viewed as consecutive life-course decisions (Elder 1985; Huinink 1995). Empirical analyses on the timing of first and subsequent birth have provided a complex picture of the relationship between education and fertility.

With respect to the progression to the first child, evidence undoubtedly shows that educational participation delays family formation (Marini 1984; Hoem 1986; Rindfuss et al. 1988; Blossfeld and Huinink 1989; Klein and Lauterbach 1994; Kravdal 1994; De Wit and Ravanera 1998; Liefbroer and Corijn 1999; Lappegård and Rønsen 2005). The literature is less consistent, however, when it comes to the impact of the educational level on fertility. Most studies show that women with a university education are older at first childbirth (Rindfuss et al. 1996; Martin 2000). However, event-history approaches that use educational participation and the educational level as covariates in their first-birth models have found a weak or even a positive impact of the educational level on first-birth risks (Blossfeld and Huinink 1991; Kravdal 1994; Lappegard and Ronsen 2005). It has also been shown that the impact of the educational level on first-birth risks varies by marital status, age, and time since completion of education (Santow and Bracher 2001; Kreyenfeld 2004).

There is also only ambiguous evidence on the effect of child care on first-birth decisions. The idea that good access to affordable day care positively impacts first-birth risks particularly among the highly educated women is underpinned strongly by theoretical argument, yet researchers have been unable to provide strong micro-level evidence. Most studies on this issue only provide weak or no support at all (Kravdal 1996; Del Boca 2002; Hank and Kreyenfeld 2003). However, there has been critical discussion on whether these studies are able to capture childcare availability in a meaningful manner.

Studies on higher-order births have shown a uniform, but unexpected pattern. Most studies investigating progression to higher-order birth have found that a woman's educational level increases the transition rate to the second and third child (Hoem 1996; Hoem et al. 2001; Kravdal 2001; Oláh 2003). This pattern is explained by a 'time squeeze effect' (Kreyenfeld 2002b; Köppen 2006), meaning that highly educated women tend to postpone parenthood to later stages in their life and this is why they have less (exposure) time available for subsequent children before they reach their biological limit to fertility. Consequently, they space births more closely and therefore accelerate the transition rate to the next birth.

2.2 Germany's Socio-Political Context

Similarly to most other Western European countries, Germany has experienced a period of fertility decline since the 1970s. Fertility rates dropped from a level of more than two to less than 1.5 children per woman. Since the late 1970s, (West) Germany's fertility has been remarkably stable at 1.3 children per woman. However, the stability in the total period fertility rate is hiding major changes in demographic behavior, changes that are evident when cohort fertility rates are examined.

The cohort perspective produces evidence that fertility levels have continuously fallen, starting from the 1940 cohort. A woman of this cohort bore roughly two children during her life time. The average number of children is 1.7 and 1.6 for the cohort of 1950 and 1960, respectively. The steady drop in the average number of children per woman has been accompanied by an increase in the age at childbearing and rising levels of childlessness. While childlessness is relatively uncommon in the 1940 and 1950 cohorts, more than 20 percent of the 1960 female cohort stay childless. Unfortunately, German vital statistics do not provide reliable figures in this context because parity information is collected for marital births only. Estimates based on survey data suggest that the median age at first birth is below 25 for the cohorts born between 1940 and 1950. For the younger cohorts, the median ages at childbirth increased towards 30 (Kreyenfeld 2002a; Hullen 2003).

Social policy researchers claim that the German government's disregard of family issues is one of the major causes behind Germany's 'low fertility regime'. Kaufmann (1995) introduced the term 'structural neglect of the family' to describe what he calls the ignorance of the government, firms, and society as a whole of family needs. Public debate has taken up the idea of 'structural neglect' to demand rigorous support of families with children, particularly expressed in more extensive monetary transfers to women who are care givers of children and elderly (Wingen 1997).

Recent comparative research has shed a different light on German family policies. It has been shown that Germany's expenditure for families is fairly high by cross-national standards (Alber 2002). However, policies had a narrow focus on supporting traditional family models. Compared to other countries, the married one-earner couple receives substantial financial support, while the needs of other family arrangements, particularly the needs of dual earner families for child-care services, have been largely ignored. There is strong support of the male-breadwinner family model in Germany, so that the country has been labeled as the prototype of a 'conservative and familialistic welfare regime' (Gauthier 1996: 155; Gornick et

al. 1998; Esping-Andersen 1999: 65; Stier et al. 2001; Treas and Widmer 2000: 1431).

A tax and transfer system that provides joint taxation for married couples is a central element of this regime. Germany has a progressive tax schedule, thus there are significant labor supply disincentives for married women. According to Sainsbury (1996: 171), the German tax system penalizes working wives most heavily and, therefore, provides the highest 'housewife-bonus' compared to other countries. This view, however, overstates the role that the tax system plays in female employment (Dingeldey 2001: 653) and disregards the marked importance of the incompatibility between work and motherhood.

Even though there is a long tradition of public daycare in Germany (Kreyenfeld et al. 2001), the day care system has primarily been institutionalized as a means to educate pre-school children and to a much lesser extent so to help mothers to combine work with family life. Public day care in the Western states primarily offers part-time care arrangements for children between ages three and school age. For children below age three ('*Krippe*') and at school age ('*Hort*'), however, public child care is hardly available in West Germany (in East Germany, the situation is different, though) (Deutsches Jugendinstitut 2005). Parental leave regulations currently provide a generous three-year period of leave, combined with an income related parental leave benefit of maximum 300 Euro, which is paid for up to two years. Recently, major reforms have been brought on its way. As of 2007, parental leave benefits will be restricted to a period of 14 months and they will constitute 67 percent of the previous income. Also, a law has been passed that aims at increasing public childcare for children below age 3 ('*Kinderbetreuungsausbaugesetz*'). However, it is still unclear what impact the new law will have on the availability of public day care.

Given the institutional background we have described, work and family life appear to be mutually exclusive life domains for women in Germany. In this background, women in most cases are forced to decide 'either' 'or': either to have children or to pursue an employment career. Huinink (2002) claims that this 'dilemma' fuels a 'polarized fertility pattern': Women with a relatively high work orientation remain in the employment sphere and stay childless, while women who are less work oriented branch off in the family sphere and have two or more children.

In the following empirical analysis, we investigate the interrelation between education and fertility in Western Germany within a life-course framework. We primarily address the question of whether there are major changes in the education and fertility nexus across cohorts.

3 Data

The data for our analysis has been taken from the German Socio-Economic Panel (SOEP) (SOEP Group 2001). The SOEP is a yearly follow-up household survey that contains a rich battery of socio-economic questions. In this paper, we primarily look at the female respondents of SOEP sample A, a sample that contains mainly German nationals. There are 6,964 valid interviews of female respondents. Women with missing fertility histories are omitted as well as women who no longer were or were not yet at risk of childbirth during our observation period. This period encompasses the years 1984 to 2004. The remaining sample comprises 2,248 women at risk of first birth, 1,320 women at risk of second birth, and 1,199 women at risk of third birth. We observe 772 occurrences of first birth and 630 and 197 incidences of second and third births, respectively.

We apply event-history techniques to our analysis of birth risks (Allison 1984; Yamaguchi 1991; Blossfeld and Rohwer 2001). The process time is measured in months. In the first-birth model, it starts in January of the year during which the woman turned age 15. In the second and third-birth model, the process starts at the birth of the previous child. The cases are censored at the date of interview, at age 45 or when the person drops out of the sample. Since we only account for the fertility behavior of women during the panel period (1984–2004), the cases can be left-truncated for women already at risk of childbirth when entering the survey. In some few cases (in 6 percent of all births) we were unable to identify the exact month of childbirth. We assume that the birth occurred in June of the year when the relevant information was missing.

All covariates in our analysis are entered as time-dependent variables. In order to construct these variables, we used the information given at the time of each year's interview and assume that there is no change until the next interview is conducted. We use a piecewise linear function to model the baseline hazard.

The major independent variable in our model is the respondent's educational level. We distinguish between women who received a university degree, women who gained a vocational degree, and women with neither (labeled 'no degree'). This is a simplification, as women without university education or vocational training in most cases have successfully completed general secondary schooling. The German labor market does, however, not reward general schooling degrees, unless they are combined with formal post-secondary (vocational) or tertiary (academic) education (Solga und Konietzka 1999; Konietzka 2003). Therefore, it makes sense to summarize in one category all respondents who never went beyond general schooling.

A vocational training degree encompasses the standard degree issued in the German dual vocational training scheme ('*Lehrabschluss*') as well as similar forms of vocational education ('*Beamtenausbildung*', '*Fachschulabschluss*'). The most common educational level is a vocational degree. Among the 1951–1960 cohorts, roughly 70 percent of all women received this qualification (see below). In order to further break up the large group, we distinguish between two groups of vocational degrees. The first is labeled 'vocational degree – low schooling' and includes women with a vocational training certificate who had previously received a compulsory secondary school degree ('*Hauptschulabschluss*'). The second group contains women who received a vocational degree and completed secondary school with an '*Abitur*' or '*Mittlere Reife*'. This group is labeled 'vocational degree – high schooling'. The university degree category includes a university degree ('*Universitätsabschluss*') as well as a degree from a technical college (university of applied science; '*Fachhochschulabschluss*').

Our estimate also controls for the activity status of the respondent. We distinguish respondents who are in education from those out of education. In the first-birth model, educational participation is further differentiated by general schooling, university education, or vocational training.

We also consider the partner's characteristics. They are constructed in a manner similar to the women's characteristics. The educational participation of the male partner embraces military service. The partner's characteristics are included only for the time period during which the woman cohabits with the partner. They are no longer considered should the partner have moved out. If a new partner has moved in, it is only his characteristics that are taken into account.

The calendar period is another covariate in the model. It is grouped in years as follows: 1984–1990, 1990–1996, and 1996–2004. In the second and third-birth models, we also accounted for the age at first birth grouped into one of the four categories and we considered the gender composition of the previous children. It has been shown to play some role in higher-order birth decisions (Brockmann 2001; Andersson et al. 2006).

4 Descriptive Results

In order to generate up-to-date summary fertility indicators, sample A of SOEP cannot be used in a straightforward manner. The sample has been drawn in 1984 for the first time. Like other follow-up studies, it has since suffered from panel mortality. However, this is not of major importance to

the event-history models which account for right-censoring (assuming non-informative censoring). To generate summary fertility indicators such as the total number of children, sample A would, however, be too skewed.

The following descriptive analysis provides summary fertility indicators for the year 2004. Completed fertility measures can only be generated for women who have reached the end of their reproductive period. We therefore limit the descriptive part of the analysis to the 1941–1960 cohorts; these are seen as past childbearing age as of 2004. We use female respondents of sample F for this part of the analysis. The sample is a large refreshment sample of the SOEP. In order to account for non-response or sample attrition, we weight the subsequent analysis with a factor provided by the SOEP group. In line with the multivariate analysis, the descriptive part only includes German nationals living in Western Germany.

Table 1 gives an overview of the education level by birth cohort. Educational attainment has increased in particular for women, starting from the cohorts born in the 1940s (Blossfeld 1989). For the more recent cohorts, there are no major differences in primary and secondary school qualifications by gender (Statistisches Bundesamt 2004). Similar to developments in other countries, females have become slightly more likely to complete secondary school with higher degrees than males. Even though there is a substantial variation in the type of training or education they choose, the overall percentage of men and women completing tertiary education is the same (ibid.: 83). As can be seen from Table 1, about 20 percent of the younger cohorts received a university degree, as compared to less than 15 percent among the older cohorts.

Table 1. Highest educational level at the time of survey, West German women, column percentages

	1931–1940	1941–1950	1951–1960
No degree	31%	17%	13%
Vocational degree, lower schooling	41%	45%	35%
Vocational degree, higher schooling	17%	25%	32%
University degree	11%	14%	20%
Total	100%	100%	100%
Sample size	448	421	542

Note: The sample comprises female respondents of German nationality.

Source: SOEP 2004, sample F, (weighted estimates)

Given that female educational attainment has increased over the cohorts, one would assume that some of the overall decline in the number of children is due to an increase in the number of highly educated women. Table

2 provides partial support for this assumption. There is a strong negative association between female education and fertility, and this applies to all cohorts. However, there are some peculiarities worth pointing out.

Table 2. Final number of children by educational level and birth cohort, West German women

	1931–1940	1941–1950	1951–1960
No degree	2.34	2.31	2.00
Vocational degree, lower schooling	1.91	1.86	1.52
Vocational degree, higher schooling	1.56	1.47	1.45
University degree	1.39	1.41	1.47
All	1.92	1.78	1.56
Sample size	448	421	542

Note: The sample comprises female respondents of German nationality.

Source: SOEP 2004, sample F, (weighted estimates)

First, the group of women without tertiary education clearly stands out. The replacement level fertility is a classic landmark in demographic research. It numbers roughly 2.1 children per woman. Even though average fertility has drastically dropped below this landmark, women without a degree still display a fertility level around replacement.

Another striking aspect is, second, the behavior of university educated women. In essence, university graduates of all cohorts have the smallest number of children. Nevertheless, major changes have occurred over time. While in the older cohorts (1931–1950), university graduates stood out showing a remarkable low number of children, the fertility gap to the other educational groups has narrowed in the younger cohorts. For the 1951–1960 cohorts, we find no major differences in the total number of children between university graduates and women with a vocational and a higher secondary school degree. We find that university graduates are catching up in their fertility behavior and this may be explained by the fact that university educated women have become less selective as the system of higher education has opened up for females. Among the older cohorts, only few women completed education with a university degree; and those who did might have been a very particular group with a very pronounced career orientation. For the younger cohorts, who are able to receive a university degree more readily, highly educated women may represent a less select group. Another explanation may be that work and family life have become increasingly compatible in Germany in recent years, even though public day care provision is still low compared to most other European countries.

Table 3. Distribution of the number of children by educational level and birth cohort, West German women, column percent

No degree	1931–1940	1941–1950	1951–1960
Childless	6%*)	4%*)	13%
1 child	31%	23%	19%
2 children	25%	36%	41%
3 and more children	38%	37%	27%
Total	100%	100%	100%
Sample size	124	69	62
Vocational degree, lower schooling	1931–1940	1941–1950	1951–1960
Childless	14%	13%	17%
1 child	28%	20%	32%
2 children	30%	44%	39%
3 and more children	28%	24%	12%
Total	100%	100%	100%
Sample size	195	194	184
Vocational degree, higher schooling	1931–1940	1941–1950	1951–1960
Childless	20%	18%	22%
1 child	23%	27%	23%
2 children	42%	45%	45%
3 and more children	14%	10%	10%
Total	100%	100%	100%
Sample size	84	96	195
University degree	1931–1940	1941–1950	1951–1960
Childless	38%	26%	24%
1 child	17%*)	22%	28%
2 children	24%	40%	33%
3 and more children	21%	12%*)	15%
Total	100%	100%	100%
Sample size	45	62	101

Note: The sample comprises female respondents of German nationality. *) sample size less than 10 cases.

Source: SOEP 2004, sample F, (weighted estimates)

Table 3 provides the distribution of the number of children by education. It shows that the 'two-child family' is the dominant family size for all educational groups. Three or more children are primarily found among women who never went beyond general schooling. Even among the 1951–1960 cohorts, a quarter of the women without a degree had three or more children.

The table also shows that the percentage of childless university graduates has been declining substantially over the cohorts. While 38 percent of the older cohorts remained childless, this applies to 'only' 24 percent of the younger university educated women. However, this result should be treated with care since it is based on a fairly small sample of older women with a university degree. Strikingly, childlessness no longer is restricted to women with an academic education. It has become a common pattern particularly among women with a vocational training degree and higher general schooling. Taken together, our findings suggest that fertility differences between women with a vocational degree and a university degree have declined across the cohorts.

5 Analysis of the Event-History Model

5.1 Transition to First Births

Table 4 displays the results of the event-history model on the transition to the first child. The control variables provide the expected pattern. Age has a bell shaped impact on first-birth risks. The chances to become a mother are highest in the age bracket 26 to 30. There is a negative time trend which is, however, not significant.

In previous analyses, educational participation has been shown to be the most influential factor in fertility postponement (see above). In order to arrive at a deeper understanding, we distinguish three types of educational activity: general schooling, vocational training, and university education. As can be seen from Model 1, all types of educational enrolment have a deferring impact on fertility. However, there is some variation in the extent to which educational participation postpones fertility choices. Women and men generally do not have children during general schooling. Vocational training seems to have less of an adverse effect on fertility than does university education.

In Model 2, we control for the respondent's educational level. The model distinguishes individuals who are currently undergoing education from those who are not. The latter group is further divided by their educational level. The empirical results support findings from previous studies that have shown that there is no major impact of the educational level on first-birth risks when educational participation is taken into account. More highly educated women encounter first-birth risks that are similar to their less educated counterparts. One may assume hat highly educated women postpone fertility choices more often since they will try to establish themselves in the labor market before having children. However, highly edu-

Table 4. Results of piecewise constant event-history model, relative first-birth risks

	Model 1	Model 2	Model 3
Age			
15–20	0.35***	0.38***	0.51***
20–22	0.55**	0.61**	0.72*
22–24	1	1	1
24–26	1.37**	1.32**	1.31*
26–28	1.72***	1.65***	1.33*
28–30	1.72***	1.67***	1.30*
30–34	1.43***	1.41***	1.06
34–38	0.64**	0.63**	0.45**
38–45	0.11***	0.10***	0.07***
Period			
1984–1990	1	1	1
1990–1996	0.93	0.93	0.90
1996–2004	0.88	0.88	0.88
Activity status			
Not in education	1		
In general schooling	0.17***		
In vocational training	0.61***		
In university education	0.29***		
Woman's education			
In education		0.38***	0.48***
Not in education			
No degree		1	1
Vocational degree, lower schooling		1.02	0.98
Vocational degree, higher schooling		1.09	1.02
University degree		0.94	0.93
Partner's education			
No partner			0.32***
In education/ military service			0.77
Not in education			
No degree			1
Vocational degree, low schooling			1.21
Vocational degree, high schooling			0.94
University degree			1.27

Note: ***: $p \leq 0.01$ **: $0.01 \leq p \leq 0.05$ *: $0.05 \leq p \leq 0.10$.

Source: SOEP 1984–2004, sample A (own estimates)

cated women are older when they complete education, and this is why they have less 'exposure time' between the end of education and their biological fertility limits. The approaching age limits of fertility should therefore accelerate the transition rate to the first child for university educated women.[1] Thus, there are two diverging forces at work on the fertility behavior of university educated women: advancing age limits accelerate first-birth risks, the need to get established in the labor market defers parenthood. Our finding supports the idea that German university graduates are relatively reluctant in their fertility choices, despite their approaching biological limits of fertility.

Model 3 accounts for the partner's characteristics. Unsurprisingly, having no partner drastically lowers first-birth risks. The partner's educational activity reduces these risks, but the coefficient is not significant. The inclusion of the partner's educational level does not give a clear pattern, too. University educated men have elevated first-birth risks, and so do men with a vocational degree and lower secondary schooling. It appears that there is no simple linear relationship between partner's education and first-birth fertility.

5.2 Transitions to the Second and Third Child

Table 5 reports the results on second-birth risks. The control variables provide the expected signs. Second-birth risks are highest 3 to 4 years into first birth. The age at first birth strongly affects second-birth risks. Women above age 32 at first birth experience low second-birth risks. By contrast, women who had a first child when they were teenagers have very high transition rates to the second child. There are no major changes in second-birth risks over time.

Similar to other studies, we find a strong positive gradient for female education on second-birth risks. The risks are twice as high for university educated women than they are for other women. This probably is related to a 'time-squeeze effect'. Given that university graduates are already approaching their biological limit at first childbirth, they need to space the

[1] The coefficients for the educational level need to be interpreted with some caution. The piecewise constant model is a proportional hazard model which assumes that the hazard ratio for two individuals with different values of the independent variables does not depend on time. This assumption is restrictive, particularly in view of the role that education plays in fertility. The fertility schedule of university educated women mostly follows a different age pattern than does the fertility pattern of other educational groups.

Table 5. Results of piecewise constant event-history model, second-birth risks

	Model 1	Model 2
Duration since previous birth		
0–1 years	0.01***	0.01***
1–2 years	0.56***	0.57***
2–3 years	1	1
3–4 years	0.82*	0.84*
4–6 years	0.45***	0.50***
6–8 years	0.21***	0.23***
8 and more years	0.08***	0.09***
Age at first birth		
15–20	1.21***	1.50***
20–24	1.01	1.07
24–28	1	1
28–32	0.82*	0.74*
32–45	0.38***	0.34***
Period		
1984–1990	1	1
1990–1996	0.98	1.05
1996–2004	1.07	1.17
Woman's education		
No degree	1	1
Vocational degree, low schooling	1.07	0.98
Vocational degree, high schooling	1.31**	1.15
University degree	2.04***	1.74***
Partner's education		
No partner		0.36***
No degree		1
Vocational degree, low schooling		0.96
Vocational degree, high schooling		1.23
University degree		1.51***

Note: ***: $p \leq 0.01$ **: $0.01 \leq p \leq 0.05$ *: $0.05 \leq p \leq 0.10$.

Source: SOEP 1984–2004, sample A (own estimates)

birth of their subsequent children closer than do other women. This, in turn, increases the progression rate to the second child.

Selection effects, too, are worth considering in the context of higher-order fertility. Highly educated women more often remain childless throughout their lives. Those who nevertheless decide to have children

form a special group. Either they have a low labor-market profile (despite having high qualifications) or they display strong family values, which makes them particularly prone to continue to subsequent childbirth (Kravdal 2001; Kreyenfeld 2002b).

The education of the male partner has a very strong positive impact on second-birth risks. The second-birth risks of women who have a university educated partner are increased by 74 percent compared to women who have partners without a degree. After controlling for the partner's characteristics, the effect of female education is somewhat reduced.

Table 6 finally displays the results for the transition to the third child. Third-birth risks are highest 1 to 4 years into second birth. Compared to the results on second-birth risks, the impact of age at first birth is even stronger. Women who had the first child before age 24 stand out as a group with particularly high third-birth risks. Women who had their first child past age 28 encounter relatively low chances of having a third child.

The estimate has a significant negative time trend, which means that third-birth risks have been declining since the 1980s. The sex composition of the previous two children has a remarkable impact on subsequent births. Having a boy and a girl substantially reduces the chances to have another child compared to women with two children of the same sex. There is a polarized pattern as to the educational level. Women without any degree and those with a university degree display the highest relative risks of having a third child. The male partner's education has a positive impact on third-birth risks. Having a partner with a university degree elevates the transition rate to the third child by roughly 150 percent compared to having a partner with no degree.

6 Conclusions

The aim of this article was to provide an overview of the relationship between education and fertility in Western Germany. It is common knowledge that female education and fertility are inversely related. In the theoretical part of the paper, however, we argued that the 'education-fertility nexus' is also shaped by a country's institutional framework. In countries where work and family life are compatible, fertility differentials by female education should be smaller than in countries that offer less attractive conditions for women to combine work and motherhood. Even though maternal employment rates have been gradually increasing in Germany since the 1990s, the public policy set-up still inhibits employment opportunities for

Table 6. Results of the piecewise constant event-history model, third-birth risks

	Model 1	Model 2
Duration since previous birth		
0–1 years	0.07***	0.07***
1–2 years	0.98	0.99
2–3 years	1	1
3–4 years	0.95	0.95
4–6 years	0.60**	0.60**
6–8 years	0.27***	0.27***
8 and more years	0.07***	0.07***
Age at first birth		
15–20	1.87***	2.07***
20–24	1.63***	1.68***
24–28	1	1
28–32	0.65*	0.61*
32–45	0.44**	0.38**
Sex of previous children		
Only boys	1	1
Only girls	0.90	0.90
Mixed	0.69**	0.69**
Period		
1984–1990	1	1
1990–1996	0.88	0.88
1996–2004	0.79	0.80
Woman's education		
No degree	1	1
Vocational degree, low schooling	0.56***	0.56***
Vocational degree, high schooling	0.92	0.82
University degree	1.39	0.87
Partner's education		
No partner		0.46***
No degree		1
Vocational degree, low schooling		1.08
Vocational degree, high schooling		1.13
University degree		2.41***

Note: ***: $p \leq 0.01$ **: $0.01 \leq p \leq 0.05$ *: $0.05 \leq p \leq 0.10$.

Source: SOEP 1984–2004, sample A (own estimates)

women with children below school-age. Thus (West) Germany is one the countries that should be expected to have a strong association between female education and fertility.

Our descriptive analyses supported the view that highly educated women have fewer children compared to the average. Childlessness is more widespread among university educated women than among other educational groups. However, our analysis showed that childlessness among university educated women has declined over the cohorts, while it has increased for the other educational categories. The overall picture is that fertility differences between women with a university degree and a vocational degree have narrowed over the cohorts. Our findings therefore suggest that researchers should spend more of their attention to the fertility behavior of women who have graduated from non-academic vocational training. They are the largest educational group in Germany by far, and they also display relatively high levels of childlessness.

We analyzed the transition to the first, second, and third child within an event-history framework. In line with other studies, we find that educational participation strongly defers fertility choices. We do not find any major impact of the educational level on first-birth risks, however. In line with other studies, our results show that university educated women have higher transition rates to the second and third child. We explained this pattern by a 'time squeeze effect'. Highly educated women have less time available for subsequent children before reaching the biological limits of fertility because they more often postpone parenthood to later stages in their life course. As a result, they space their births more closely and this accelerates the transition rate to the next child. Moreover, the partner's university education has a very strong impact on the transition to second or third child.

These findings have several implications for policy makers. Firstly, our results show that the fertility behavior of highly educated women is strongly influenced by a long period of educational participation during the life course. An extended phase of educational enrollment does not only defer family formation but it also affects subsequent childbearing behavior, putting women under a time-squeeze to have further children. By cross-national standards, German university graduates are fairly old when they complete their studies. Policies that are directed at reducing the length of university education will probably carry on to fertility behavior.

Secondly, we have shown that childlessness is not restricted to university educated women. There is a high fraction of women with '*Mittlere Reife*' or '*Abitur*' and a vocational degree remaining childless throughout their lives. Hence, the current public debate in Germany might too narrowly focus on the behavior of university educated women.

German family policies are currently undergoing major reforms, with the extension of public day care for the under-three-year-old and the reform of the parental leave being major components of it. These policies have been fueled by gender role considerations as well as the hope to increase fertility. Even though it is undisputed that the policies support gender equality, it is unclear how they will impact fertility. The new parental leave regulations (the eligibility to parental benefits now depends on the income gained previous to the benefit application) could have an ambivalent effect. They may induce women to time parenthood more strategically in accordance with their employment careers, and this, in turn, may well increase their age at childbirth. Nevertheless, German policy makers have started to shift their focus from supporting the one-earner family to supporting the dual-earner family, a family model that is generally considered to be more adapt to a world of changing gender roles and labor markets that no longer provide stable male employment careers.

References

Ahn N, Mira P (2002) A note on the changing relationship between fertility and female employment rates in developed countries. Journal of Population Economics 15:667–682

Alber J (2002) Allmählicher Umbau bei nach wie vor deutlichen nationalen Unterschieden. Analysen zu jüngsten Wandlungstendenzen in westlichen Wohlfahrtsstaaten. Informationsdienst Soziale Indikatoren 28:1–6

Allison PD (1984) Event History Analysis: Regression for Longitudinal Event Data. Sage Publications, Newbury Park

Andersson G, Hank K, Rønsen M, Vikat A (2006) Gendering family composition: sex preferences for children and childbearing behavior in the Nordic countries. Demography 43:255–267

Andersson G, Scott K (2005) Labour-market status and first-time parenthood: the experience of immigrant women in Sweden, 1981–97. Population Studies 59: 21–38

Axinn WG, Jennifer SB (2001) Mass education and fertility transition. American Sociological Review 66:481–505

Becker GS (1993) A treatise on the family. enlarged edn. Harvard University Press, Cambridge MA

Blossfeld H-P (1989) Kohortendifferenzierung und Karriereprozess. Campus, Frankfurt am Main

Blossfeld H-P, Huinink J (1991) Human capital investments or norms of role transition? How women's schooling and career affect the process of family formation. American Journal of Sociology 97:143–168

Blossfeld H-P, Rohwer G (2001) Techniques of Event History Modeling: New Approaches to Causal Analysis, 2nd edn. Lawrence Erlbaum, Mahwah

Brewster KL, Rindfuss RR (2000) Fertility and women's employment in industrialized nations. Annual Review of Sociology 26:271–296

Brockmann H (2001) Girls preferred? Changing patterns of gender preferences in the two German states. European Sociological Review 17:189–202

Castles FG (2003) The world turned upside down: below replacement fertility, changing preferences and family-friendly public policy in 21 OECD countries. Journal of European Social Policy 13:209–227

Castro Martin T (1995) Women's education and fertility: Results from 26 demographic and health surveys. Studies in Family Planning 26:187–202

Council of Europe (2004) Recent Demographic Developments in Europe. Council of Europe, Strasbourg

Del Boca D (2002) The effect of child care and part time opportunities on participation and fertility decisions in Italy. Journal of Population Economics 15: 549–573

De Wit ML, Ravanera TR (1998) The changing impact of women's educational attainment on the timing of births in Canada. Canadian Studies in Population, 25:45–67

Deutsches Jugendinstitut (2005) Kinderbetreuung im Spiegel der Statistik. DJI, München

Dingeldey I (2001) European tax systems and their impact on family employment patterns. Journal of Social Policy 4:563–672

Dorbritz J, Ruckdeschel K (2007) Kinderlosigkeit in Deutschland – Ein europäischer Sonderweg? Daten, Trends und Gründe. In: Konietzka D, Kreyenfeld M (eds) Ein Leben ohne Kinder.– Ausmaß, Strukturen und Ursachen von Kinderlosigkeit. VS-Verlag, Wiesbaden (forthcoming)

Elder G (ed, 1985) Life Course Dynamics. Cornell University Press, Ithaca NY

Esping-Andersen G (1999) Social Foundations of Postindustrial Economies. Oxford University Press, Oxford

Gauthier AH (1996) The State and the Family. A Comparative Analysis of Family Policies in Industrialized Countries. Clarendon Press, Oxford

Gornick JC, Meyers MK, Ross KE (1998) Public policies and the employment of mothers: A cross-national study. Social Science Quarterly 79:35–54

Hank K, Kreyenfeld M (2003) A multilevel analysis of child care and women's fertility decisions in Western Germany. Journal of Marriage and Family 65: 584–596

Hirschman C (1994) Why fertility changes. Annual Review of Sociology 20:203–233

Hoem B (1996) The social meaning of the age at second birth for third-birth fertility: A methodological note on the need to sometimes respecify an intermediate variable. Yearbook of Population Research in Finland 33:333–339

Hoem JM (1986) The impact of education on modern family-union initiation. European Journal of Population 2:113–133

Hoem JM, Prskawetz A, Neyer G (2001) Autonomy or conservative adjustment? The effect of public policies and educational attainment on third births in Austria. Population Studies 55:249–261

Huinink J (2002) Polarisierung der Familienentwicklung in europäischen Ländern im Vergleich. In: Schneider NF, Matthias-Bleck H (eds) Elternschaft heute. Leske und Budrich, Opladen, pp 49–73

Huinink J, Kreyenfeld M (2006) Family formation in times of social and economic change: An analysis of the East German cohort 1971. In: Diewald M, Goedicke A, Mayer KU (eds) After the Fall of the Wall – Life Courses in the Transformation of East Germany. Stanford University Press, Stanford CA, pp 170–190

Hullen G (2003) Tempo und Quantum der Reproduktion. In: Marbach J, Bien W (eds) Partnerschaft und Familiengründung – Analysen der dritten Welle des Familiensurveys. Leske und Budrich, Opladen, pp 13–42

Joshi H (1998) The opportunity costs of childbearing: More than mothers' business. Journal of Population Economics 11:161–183

Kaufmann FX (1995) Zukunft der Familie im vereinten Deutschland: gesellschaftliche und politische Bedingungen. Beck, München

Klein T, Lauterbach W (1994) Bildungseinflüsse auf Heirat, die Geburt des ersten Kindes und die Erwerbsunterbrechung von Frauen. Kölner Zeitschrift für Soziologie und Sozialpsychologie 46:278–298

Konietzka D (2003) Vocational training and the transition to the first job in Germany – New risks at labor market entry? In: Bills D (ed) The Sociology of Job Training: Research in the Sociology of Work, vol 12. Elsevier, Amsterdam, pp 161–195

Konietzka D, Kreyenfeld M (eds, 2007) Ein Leben ohne Kinder – Ausmaß, Strukturen und Ursachen von Kinderlosigkeit. VS-Verlag,Wiesbaden (forthcoming)

Köppen K (2006) Second births in Western Germany and France, 2006. Demographic Research 14:295–330

Kravdal Ø (1992) The emergence of a positive relation between education and third birth rates in Norway with supportive evidence from the United States. Population Studies 46:459–475

Kravdal Ø (1994) The importance of economic activity, economic potential and economic resources for the timing of first births in Norway. Population Studies 48:249–267

Kravdal Ø (1996) How the local supply of day-care centers influences fertility in Norway: A parity-specific approach. Population Research and Policy Review 15:201–218

Kravdal Ø (2001) The high fertility of college educated women in Norway: An artefact of the separate modeling of each parity transition. Demographic Research 5:185–213

Kravdal Ø (2002) Education and fertility in sub-saharan Africa: Individual and community effects. Demography 39:233–250

Kreyenfeld M (2002a) Parity specific birth rates for West Germany – An attempt to combine survey data and vital statistics. Zeitschrift für Bevölkerungswissenschaft 27:327–357

Kreyenfeld M (2002b) Time-squeeze, partner effect or self-selection? An investigation into the positive effect of women's education on second birth risks in West Germany. Demographic Research 7:15–48

Kreyenfeld M (2004) Fertility decisions in the FRG and GDR. Demographic Research Special Collection 3:276–318
Kreyenfeld M (2006) Family formation in East and West Germany before and after Unification. In: Gustafsson S, Kalwij A (eds) Education and Postponement of Maternity: Economic Analyses for Industrialized Countries. Springer, Berlin Heidelberg New York, pp 225–236
Kreyenfeld M (2007) Bildungsspezifische Unterschiede in der Geburtenentwicklung in Ost- und Westdeutschland. In: Barlösius E (ed) Demographisierung des Gesellschaftlichen. VS-Verlag, Wiesbaden (forthcoming)
Kreyenfeld M, Spieß K, Wagner G (2001) Finanzierungs- und Organisationsmodelle institutioneller Kinderbetreuung. Luchterhand, Neuwied
Lappegård T, Rønsen M (2005) The multifaceted impact of education on entry into motherhood. European Journal of Population 21:31–49
Lesthaeghe R (1995) The second demographic transition in western countries: An interpretation. In: Mason KO, Jensen AM (eds) Gender and Family Change in Industrialized Countries. Clarendon Press, Oxford, pp 17–62.
Liefbroer A, Corijn M (1999) Who, what, and when? Specifying the impact of educational attainment and labour force participation on family formation. European Journal of Population 15:45–75
Marini MM (1984) Women's educational attainment and the timing of entry into parenthood. American Sociological Review 49:491–511
Martin SP (2000) Diverging fertility among U.S. women who delay childbearing past age 30. Demography 37:523–533
McDonald P (2000) Gender equity, social institutions and the future of fertility. Journal of Population Research 17:1–16
Neyer G (2003) Family policies and low fertility in Western Europe. Max-Planck-Institute Rostock Working Paper No 2003-021, Rostock.
Olah L (2003) Gendering fertility: Second births in Sweden and Hungary. Population Research and Policy Review 22:171–200
Rindfuss RR, Morgan PS, Offutt K (1996) Education and the changing age pattern of American fertility, 1963–1989. Demography 33:277–290
Rindfuss RR, Morgan PS, Swicegood G (1988) First Births in America: Changes in the Timing of Parenthood. University of California Press, Berkeley CA
Sainsbury D (1996) Gender, Equality and Welfare States. Cambridge University Press, Cambridge MA
Santow G, Bracher M (2001) Deferment of the first birth and fluctuating fertility in Sweden. European Journal of Population 17:343–363
Schultz TP (1976) Determinants of fertility: a micro-economic model of choice. In: Coale AJ (ed) Economic Factors in Population Growth. MacMillan, London, pp 89–124
SOEP Group (2001) The German Socio-Economic Panel (GSOEP) after more than 15 years – Overview. Vierteljahreshefte zur Wirtschaftsforschung 70:7–14
Solga H, Konietzka D (1999), Occupational matching and social stratification: Theoretical insights and empirical observations taken from a German–German comparison. European Sociological Review 15:25–47

Statistisches Bundesamt (2004) Datenreport 2004. Bundeszentrale für politische Bildung, Bonn
Stier H, Lewin-Epstein N, Braun M (2001) Welfare regimes, family-supportive policies, and women's employment along the life-course. American Journal of Sociology 106:1731–1760
Treas J, Widmer ED (2000) Married women's employment over the life course: Attitudes in cross-national perspective. Social Forces 78:1409–1436
Wingen M (1997) Strukturelle Benachteiligung von Familien als Herausforderung im Umbau des Sozialstaats. Jahrbücher für Nationalökonomie und Statistik 216:561–573
Yamaguchi K (1991) Event History Analysis. Sage Publications, Newbury Park

Perspectives on the Political Governance of Demographic Change

Johannes Meier

1 Introduction

In most industrialized countries the demographic trends of increasing life expectancy and decreasing fertility have emerged as key factors that will fundamentally influence living conditions and the structure of society in the medium and long term. More specifically, whether a society has a robust future or not depends to a significant extent on these demographic trends.

Germany stands out in that it was among the first countries to experience a decline in fertility, although high numbers of immigrants initially tended to obscure the trend towards a shrinking population. With reunification, a massive migration among the German regions primarily from the Eastern to the Western states made the developments even more diverse. Thus, we now find communities that have grown 10 percent or more in the last decade and are projected to continue to grow at a similar rate. Others have lost 30 percent or more of their inhabitants and are likely to lose another 30 percent by 2020. Within and across the communities, differences in terms of personal experience are widening between those who raise children and those who don't, those who care for the elderly and those who don't, those whose talents are sought and those who feel un-needed, and those who are integrated into society and those who feel left out.

This raises some fundamental questions:

- How can politicians and the German people, who are primarily used to administering growth, deal with shrinkage?
- How can a society deal productively with the type of diversity that is driven by demographic change?
- How can the cohesion of German society be maintained in the face of powerful opposing forces?

These questions are essentially questions of governance, in the sense of "steering" as suggested by the Latin origin of the term. More specifically, the World Bank defines governance as the exercise of political authority and the use of institutional resources to manage society's problems and affairs.

This paper analyzes the problems of governance of demographic change in Germany in three steps [oder soll section 3 eigentlich 2.4 sein?].

1. First, a brief overview of demographic challenges in Germany is given.
2. The challenge of budget consolidation is then presented in more detail, since it stands at the core of good governance of demographic change.
3. Finally, key success factors for good governance of demographic change are presented and applied to the challenge of budget consolidation.

2 Demographic Challenges in Germany

In this section, demographic challenges in Germany that lead to specific governance challenges are described. They are grouped into three main themes: shrinkage, aging, heterogeneity.

2.1 Shrinkage

A fertility rate of 1.3 essentially means that the next generation will be about a third smaller than the previous generation. A simple sensitivity analysis shows that the levels of immigration that would be necessary to compensate for this loss are highly unlikely if not unfeasible. Assuming a net immigration level of 300,000 p.a. – which is significantly higher than the current level – the total population is thus likely to stay the same until 2050.

The shrinkage becomes more pronounced if one does not look at the total population but at the working population. As the baby boomers move towards retirement, the age quotient defined as the ratio of persons aged 65 or older in relation to persons between 20 and 64 years will double by the year 2050. The situation is further complicated by low employment quotas of females and extended usage of early retirement schemes. A model shows that the working population may shrink by up to 36 percent by 2040.

On the other hand, economic productivity and taxes are related to the size of the working population. That is why the phenomenon of population

shrinkage in combination with aging constitutes an economic challenge. Answering that challenge means addressing a number of long-term issues:

- How can effective retirement be postponed significantly? How can expectations for retirement benefits in a pay-as-you-go system be brought in line with the shrinking payments of the next generations?
- How can the employment ratios of women and the age group 55+ be increased?
- How can younger persons be brought into the work force at an earlier age?
- How can lifelong learning, technology or other factors maintain or increase individual productivity to compensate for productivity losses as a result of population shrinkage?

Clearly, these economic issues need to be addressed. However, it would be foolhardy to reduce the demographic challenges to the economic dimension.

2.2 Aging

Over the last 25 years the expected life span has increased by more than 7 years for boys and more than 6 years for girls. The length of the so-called "third age" – the time after gainful employment when physical and mental capabilities allow an independent and good life – is increasing. At the same time, it cannot be denied, neither on an individual nor a collective level, that for many elderly there follows a "fourth age" which is characterized by physical disabilities, dependence on care, multimorbidity and a significant increase in the share of the elderly who are mentally disabled.

Against this biological background a number of questions regarding our ideas of aging and our concepts of care need to be raised:

- How can negative stereotypes of the elderly be overcome? In particular, how can active aging become the norm for third-agers?
- Can we expect increasing solidarity among the elderly when there are no robust family contexts to provide intergenerational help?
- How can society provide the basis for a dignified life for increasing numbers of persons in the fourth age?
- More specifically, how can the system of care for the elderly be integrated into the system of curative medicine?

It is important to note that answers to these questions depend on fundamental value decisions. Even the technical issue of integrated care processes inherently calls for a fundamental debate on the role of medicine and care and on how society deals with dignity and death.

2.3 Heterogeneity

The demographic trends highlight many dimensions of heterogeneity in German society. I want to focus on three dimensions of heterogeneity: regional differences, family context and participation in society.

Regional differences have always been real, although the German constitutional goal of equivalent living conditions may have been – wrongly – interpreted by many to mean "the same standards everywhere." Due to demographic changes and migration within Germany, heterogeneity is increasing, as can be seen from the projection regarding regional population trends illustrated in Figure 1.

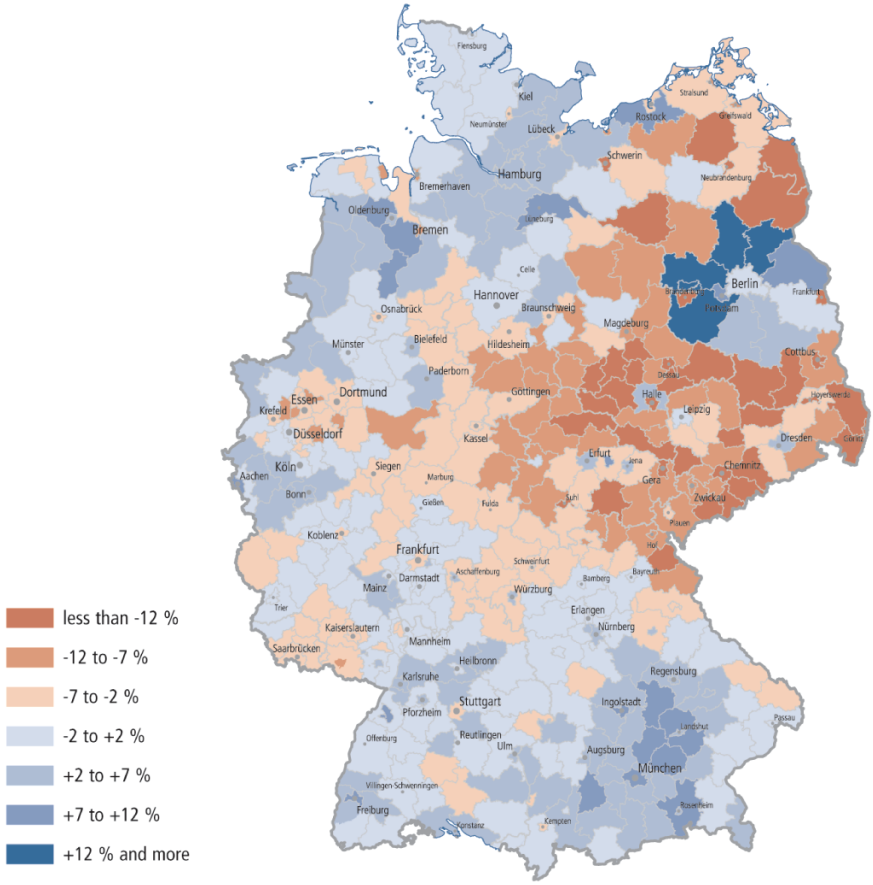
This development translates into multiple aspects of regional heterogeneity, in particular a diverging age distribution as can be seen from the projection for the regional pattern of mean ages of the population across German cities and municipalities in the year 2020 (Figure 2).

As a result of these regional differences, the following issues need to be addressed:

- How should we define or reinterpret equivalent living conditions?
- How should transfer mechanisms between regions operate in the future? (Note: today many transfer mechanisms effectively operate on a per-capita basis.)
- How can we avoid or reduce fixed costs in changing environments?
- How can we foster decentralized infrastructures?

Differences in family contexts have also been a normal phenomenon throughout the ages. However, the significant shift in the distribution of various groups – singles, single parents, patchwork families, parents with one child, parents with two children or parents with more than two children – is leading to a new quality of heterogeneity. In particular, since 1974 the share of single parents has doubled to 25 percent of all families in Germany and topping 40 percent in Berlin.

Clearly traditional images of the full-time working father and the mother who stays at home raising children are no longer reference points for life in modern society. The traditional role models simply no longer reflect the socio-economic realities, particularly among society's low-income and high-income segments. Individual and flexible family concepts are becoming more important in modern German society, while at the same time traditional patriarchal family models are still prevalent in many immigrant cultures. The difficulties encountered with the integration of immigrants also have to be seen in the context of different family concepts and parental role models.

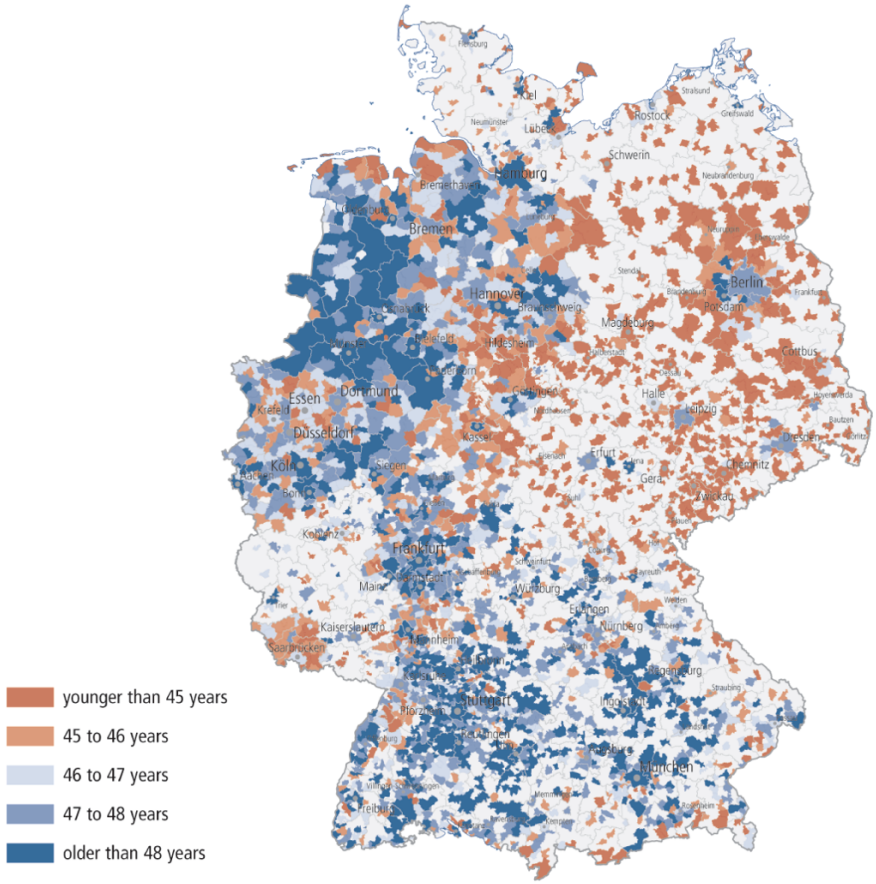


Source: Wegweiser Demographischer Wandel, Bertelsmann Stiftung.

Fig. 1. Population development 2003 to 2020 (percentage changes)

Thus, a fundamental discourse is necessary on the roles and functions of families in modern society.

- Which fundamental functions – from value education to positive fiscal externalities of children – do we expect families to perform in society?
- Given the heterogeneity of family concepts, how can the state – and business community – support families in performing these functions?
- Should the government compensate for non-performing families, i.e. families that do not provide a healthy and caring environment for children? Specifically, when should the government intervene in early childhood education?



Source: Wegweiser Demographischer Wandel, Bertelsmann Stiftung.

Fig. 2. Mean age in cities and municipalities with more than 5,000 inhabitants in 2020 (years)

Differences in participation provide another important dimension for looking at increasing heterogeneity. On the one hand, it is a basic tenet of a social market economy that those capable of participating in society also need to participate. The subsidiarity principle from Catholic social teachings provides not only a defining logic for the division of work between institutional levels but also for the interface between individual citizens and the government. On the other hand, we observe large groups, especially at both ends of the social strata, that do not participate in society and ignore the moral imperative of the subsidiarity principle. The lack of participation may take many forms, from tax evasion to segregation.

- Should participation in society be measured systematically? Can an accounting of individual contributions and transfers be established?
- What consequences should a decision not to contribute to society entail for the individual?
- Where are the prerequisites for participation inadequate? In particular, where does the education system prevent participation?
- In the context of demographics and migration an especially interesting question is: what is the expected participation and contribution of immigrants?

Other dimensions of heterogeneity could be added to the analysis, but the basic conclusion remains the same: we need to find productive ways to deal with increasing heterogeneity in society.

3 Challenges for Governance of Demographic Change

The characteristics of demographic change pose specific challenges for the governance of demographic change.

The current policy-making paradigm is characterized not least by an explicit or implicit assumption of growth. Many if not most political compromises rely on economic growth to provide for the distribution of resources to various stakeholders. A consensus is usually easy to reach if all stake-holders can be appeased by allowing them to participate in an ever-growing pie. However, if the pie is shrinking, the difficulties of reaching consensus increase.

This situation is becoming more complicated as society ages. On the one hand, we should expect different voting patterns as the median voter ages significantly. Moreover, as older persons tend to vote more regularly than younger persons, we should expect a formal majority of the elderly. On the other hand, it is not at all clear whether such a majority of the elderly would vote to optimize their well-being at the expense of the well-being of their children and grandchildren. For talented young people, the global war for talent would also provide ample opportunity to bail out from a negative scenario of dominant self-interest on the part of the elderly. That in turn might also deter short-term opportunism on the part of the elderly. In other words, the rational choice in an aging society may be to pay special attention to the well-being of the young.

Both shrinkage and aging are rather slow-moving processes. Thus, there is no equivalent to the disaster at Chernobyl, which provided a catalytic sense of urgency to the environmental movement. A key governance challenge of demographic change is to create a sense of urgency by finding

ways to communicate how demographic change will be felt personally on an individual level. Lessons from turnaround experts in industry point to the need to communicate relentlessly, consistently and repeatedly. Indeed, a relentless and consistent communication strategy may be the best antidote to the dangerous complacency that results from the slow-moving nature of demographic change.

The governance challenge is complicated by the fact that the impacts of demographic change are not restricted to one domain. On the contrary, all fields of policy, from social policies to the health and education systems to the robustness of financial systems, are affected in a highly interconnected way. This goes against the norm of independent fields of policy-making ("*Ressortzuständigkeit*"), and the interdisciplinary nature of most adaptation and prevention strategies calls for new ways of setting priorities across domains and then collaborating to achieve them. In particular, progress towards these goals and priorities need to be measured in order to be able to set the right incentives and to gain confidence in the management of both adaptation and prevention strategies. The clearer the goals, the easier it is to find good measures for monitoring progress. In the context of demographic change this clear setting of goals is especially difficult in Germany, as Germans have shied away from the terminology of population policies since the Nazi era. Explicit population policies are also felt to be at odds with a modern and liberal mindset. Yet it is hard to imagine how to set good priorities for managing demographic change, instead of reacting aimlessly, unless we find ways to discuss quantitative goals of aggregate fertility and qualitative goals of education, integration and participation.

While shrinkage and aging are rather slow-moving processes, it is important to note that the increases in heterogeneity in the course of demographic change are more visible and often locally more pronounced. Thus, the increase in heterogeneity poses probably the most immediate governance challenge, in that social cohesion needs to be maintained while solutions that are structurally different have to be pushed for.

4 Budget Consolidation as a Core Challenge

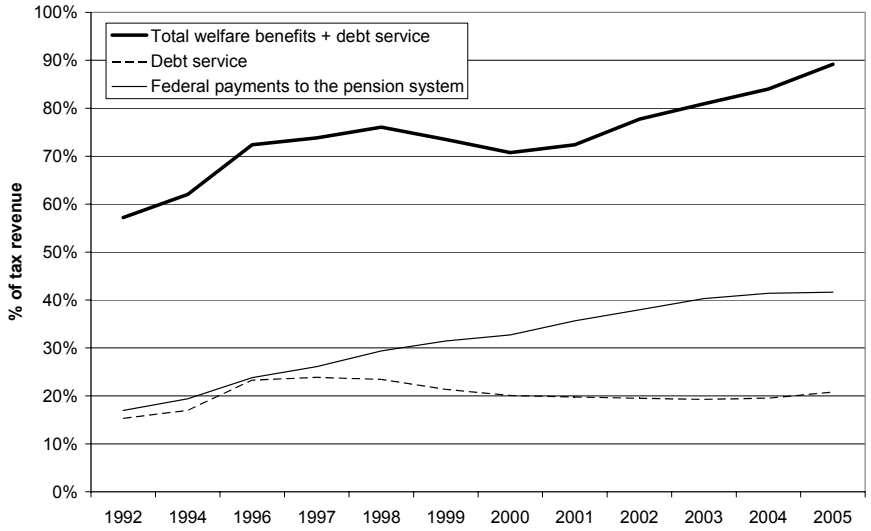
The financial system of public budgeting provides a perfect application for addressing the different governance challenges. As a result of demographic change, within the social and welfare systems the ratio of persons receiving pensions and transfers to persons contributing to these systems is going to change dramatically.

Even if a new integration policy supported the effective integration of highly fertile immigrants, we can expect the group aged 65 or older to be in a very different family situation in 2020 than it is today. The number of pensioners without children will increase to about 30 percent. This implies that they can only have family relationships with siblings – however, siblings will also have decreased in frequency. It needs to be emphasized that today about 70 percent of the care of elderly takes place within families in Germany. With decreasing numbers of children available to take care of their parents, new networks and professional care will have to fill the future gap. Currently, Germany's social security systems are largely financed on a pay-as-you-go basis, a fact that leads to the fundamental issue of social justice. Today's children would have to pay for the costs of professional care for the elderly although that care would be increasingly used by persons without children.

A special challenge is posed by the baby boomer generation. As its members turn from contributors to social security systems to recipients once they become pensioners, current systems will be stretched to a breaking point. In other words, we are facing a turnaround challenge in social security systems. If we ignore this challenge, public debt is certain to explode. Different models of the German national budget over time show that explicit and implicit debt adds up to more than three times GNP. Almost 90 per-cent of today's total tax revenue is already required to pay for social welfare programs, pensions and interest – and this in times of very low interest rates (see Figure 3).

An additional political complication of an aging population needs to be kept in mind. When thinking about the reform of social security programs, it is important to assess the implications of a change of median-voter age. As the median-voter age increases from 47 years today to 55 years in 2040, it may become increasingly difficult to reform social security systems by putting a heavier load on the elderly, or rather on older voters. In particular, by 2022 there will be a majority of voters that could oppose any reform of the pay-as-you-go social security programs on individually rational grounds.

Given all these demographic facts and dynamics, it is clear that intergenerational justice needs to become a central anchor for the political debate. In the theoretical debate there is an emerging consensus that debt is contrary to intergenerational justice. The national public debt in Germany is increasingly limiting policy-making opportunities. That is why budget consolidation is both a core challenge for mastering demographic change and a good case in point for discussing governance issues of demographic change.



Source: Bundesrechnungshof.

Fig. 3. Share of welfare benefits, subsidies to the pension scheme and interest payments in total tax revenues

Today a number of system deficiencies are leading to increasing public debt. First of all, there is not enough transparency on the amount and dynamics of actual public debt. When referring to public debt, one usually thinks only in terms of explicit amounts. Without proper accruals in the public accounting systems for pension promises and social security rights, however, it is imperative to also consider implicit debt.

The following table summarizes a projection of debt at the state and federal level. The projections illustrate how the current implicit debt, i.e. the promises for future care and pensions that are not balanced by appropriate accruals, becomes explicit debt over time.

These threatening dynamics of explicit and implicit debt in Germany's current budgets are also driven by a lack of accountability that results from the country's federal system of finance. Fiscal responsibilities are highly interlinked between communities, states and the federal government. A number of factors contribute to a lack of accountability, including lack of transparency and an insufficient uniformity of duties, responsibilities and rights in imposing taxes at different levels. It is difficult for voters to identify who is responsible for excessive expenditures and increasing debt at all levels. Budget consolidation seems an increasingly elusive goal.

Table 1. Projection of per-capita debt (in Euro)

	2002	2010	2020	2030
Federal States incl. municipalities:				
Baden-Wuerttemberg	3.753	6.813	14.046	28.029
Bavaria	2.619	6.330	15.290	33,076
Berlin	13.172	29.182	75.547	174.601
Brandenburg	6.358	13.639	41.618	112.188
Bremen	14.505	32.718	79.298	170.059
Hamburg	10.535	21.887	49.544	103.105
Hesse	5.351	10.962	24.783	51.945
Mecklenburg-Western Pomerania	6.165	15.211	47.272	125.574
Lower Saxony	6.005	12.142	27.204	56.307
North Rhine-Westphalia	6.244	12.035	26.060	53.326
Rhineland-Palatinate	6.242	12.951	29.655	62.935
Saarland	7.010	15.412	37.901	82.707
Saxonia	3.669	7.069	26.032	78.247
Saxony-Anhalt	7.399	18.328	59.886	163.863
Schleswig-Holstein	6.927	12.642	26.486	54.124
Thuringia	6.296	13.383	40.783	109.398
National government	8.723	12.929	18.899	29.599
Total	14.390	24.579	47.002	92.302

Source: Schuldenmonitor, Bertelsmann Stiftung 2005.

5 Key Factors of Success for Good Governance of Demographic Change

Using the key challenge of budget consolidation as an example, the success factors for good governance of demographic change shall now be addressed. First, other countries' experiences with budget consolidation provide a starting point. Second, the implications for Germany are presented.

5.1 Experiences from Other Countries

Experiences from other countries show opportunities to break out of the pattern of increasing debt. For example, in Sweden there are three notice-

able mechanisms supporting long-term political rationality. First, a mandatory set of royal commissions supports the legislative process. Membership in these commissions is an honor for politicians. The commissions' objective is to address basic issues of both short-term government efficiency and the long-term effectiveness of political initiatives. Second, long-term socio-economic forecasts ("*langtidsutredningen*") form the basis for important long-term laws. Third, reform of budget legislation led to a number of automated control mechanisms designed to prevent overspending. These reforms have resulted in a budget surplus after years of major deficits.

The Netherlands Bureau for Economic Policy Analysis (CPB) acts as a watchdog monitoring the long-term consequences of Dutch government policies. Election manifestos and coalition agreements are evaluated with regard to their effects on labor market, financial and environmental policies and on economic growth. These evaluations are not dominated by debates on economic principles such as supply-side or demand-side politics. The emphasis is put on pragmatic verification of policy claims and evaluation of performance of selected policies from a short- and long-term view. It needs to be noted that the CPB has worked hard to gain and maintain an outstanding reputation for excellence and independence for more than 50 years.

Finally, independent commissions may be installed with a view towards long-term impact. In Israel the Knesset Commission for Future Generations analyzes systematically whether new laws support intergenerational justice and sustainability. The scope of the commission includes environmental, social and economic policy. Not surprisingly, demographic change is featuring prominently in the commission's deliberations.

5.2 Implications for Germany

How can these experiences be translated into key success factors for German fiscal policy in particular and governance of demographic change in general?

- First, there needs to emerge a consensus across all political parties that demographic change invariably calls for fundamental changes in fiscal policy. As with any turnaround, there can be no success without a clear definition of the goal. To support the emergence of such a fundamental consensus, the Bertelsmann Stiftung in cooperation with the ZEW Mannheim has established a monitoring tool for public debt at the national and federal levels – the so-called "debt monitor."

- Second, automatic controlling mechanisms against excessive debt need to be institutionalized based on this consensus. Politicians are inherently prone to take a short-term view, and strong mechanisms are therefore needed in order to avoid the pitfalls of political opportunism. These mechanisms should take the form of regulations preventing excessive debt; they need to be transparent and clear to make it easier for voters to sanction those who contravene them. Specifically, the Bertelsmann Stiftung is proposing a commitment to a permanent combined surplus of 2 percent of GDP for federal and state budgets. Denmark and Sweden have shown the feasibility of such a commitment.
- Third, the sanctions following failure on such commitments must be clear and drastic. This calls foremost for more transparency and accountability to the voters. One example is an automatic increase in taxes if certain debt thresholds are crossed, something that has been introduced in some Swiss cantons.
- Finally, we are calling for regular and long-term evaluations of budget structures at all levels, with a special attention to demographic robustness. Ideally, independent bodies will guarantee the quality and integrity of such evaluations.

Given the severity of the demographic challenges in Germany – and in many other industrialized nations – a pragmatic agenda is necessary to address society's long-term viability and stability. An elementary consensus on the goals of mastering demographic change, in particular on intergenerational justice and budget consolidation, is necessary to stay focused and build support across parties for institutional safeguards against short-term opportunism.

6 Conclusion

The governance of demographic change needs to be seen in the context of two fundamental challenges. On the one hand, the degree of change required for adjusting to the aging and shrinking of German society is such that it is necessary to begin thinking in terms of turnarounds. On the other hand, the increasing heterogeneity of society does not allow for standardized solutions.

How can this Gordian knot be severed?

With budget consolidation as a relevant reference point, the following four success factors can provide orientation for political leaders.

- Transparency regarding the effects of demographic change at different levels needs to be established. It is not adequate to look at demographic change only at an aggregate level. As demographic change is a long-term process, long-term trends need to be analyzed using projections, sensitivity analyses and scenario planning techniques. From a political point of view it is essential that the transparency is such that the individual citizen can grasp the impact and anticipate the personal relevance of trends.
- Based on transparency, a framework for local adaptation strategies needs to be established. Essential elements in this framework include the definition of clear goals and a systematic monitoring of progress towards these goals. Again, as demographic change is a long-term process, the monitoring needs to include long-term consequences. The inclusion of implicit debt in the focus of budget consolidation is a good example.
- The framework for local adaptation strategies needs to be anchored in a positive vision for society. The vision needs to address the fundamental issues of cohesion, accountability, economic dynamics and justice in modern society. Clearly, such a collective orientation lies far beyond any technocratic measures and goals. In fact, the search for purpose and principles at this level is a perennial quest. The inevitable logic of many demographic dynamics, however, allows for a critical examination of existing visions. Are these visions consistent with demographic realities, or are they wishful thinking? Do the visions cross an innovation and excitement threshold, or is it all about defending a status quo that is no longer sustainable? Are the visions caught in the present or do they envision new ways of living and interacting? More specifically, do the visions provide us with a sense of the opportunities that longer life entails?
- Governance is ultimately about impact. This leads to a crucial success factor for implementation. Not only is it necessary to create transparency and foster discussion about the success of adaptation strategies among experts, it is crucial to link the vision and adaptation strategies to incentives for politicians and administrators. Successful innovators need to be recognized in public and praised. Those who ignore the need for change also need to become the focus of public attention. In other words, the incentive structures need to be based on a multi-level communication and information architecture. The design of the information architecture on demographic change and adaptation strategies should be such that every citizen can track the actions that will affect him or her. The Bertelsmann Stiftung has taken initial steps in this direction by pro-

viding an information system on demographic change in all German communities with at least 5,000 inhabitants. This information system is available to the public at www.wegweiserdemographie.de. Users can use it to get a sense of the need for local change and benchmark it against best practices.

Similar to all major leadership challenges, the governance of demographic change is fundamentally a balancing act on multiple levels. Such governance must provide clear orientation at a high level of purpose and principles without unduly restricting freedom at a lower, local level of adaptation and technocratic implementation. The architecture of this governance needs to be consistent yet open. If we master the art of effective governance there will be no need to fear the consequences of demographic change.

Subject Index

A

Accrued-to-date liabilities (ADL) 116, 118
Active labor market policies (ALMP) 111
Active life span 31
Age
  composition 19, 30, 86, 137, 143, 146, 159
  effect 67
Age-cost profile 137–138, 140, 141–150, 159
Age-cost profiles 130
Age-expenditure share 149, 151
Age-expenditure shares 150
Ageing Working Group (AWG) *see* EU Commission
Aging 9, 35–36, 38, 40, 47, 49, 122, 129, 137, 151, 190–191, 195, 201
Asset 47, 66, 72
  meltdown hypothesis 65, 68, 81, 85
  profile 68
Australia 49

B

Baby boom 11
Baby boomers 19, 30–31, 101, 197
Benefit 99
  average 101
  duration 112
  entitlement 98, 112, 116–117
  expenditure 103, 118
  indexation 100
  level 101, 103, 123
Bertelsmann Foundation 200, 202
Birth 13, 167
  cohort *see* Cohort
  rate 165, *see also* Fertility rate
  risk 171, 176, 178, 180, *see also* Transition rate
Bismarckian system 98
Budget *see* Fiscal consolidation, Government budget

C

Canada 49, 67, 129, 152
Capital 49, 50, 65, 72
  deepening 41, 44, 46–48, 52, 59
  export 79
  flow 72, 79
  formation 73
  intensity 44
  market 86, *see also* International capital market
  mobility 72–73, 79, 86
  movements 69, 72, 79
  productivity 71
  return on 76–77, 78
  stock 46, 71
  supply of 76
CESifo Pension Model 91
Child care 136, 143–144, 148, 155, 157
  availability 168
Childlessness 165, 169, 176, 182
Civil servants 104, *see also* Public servants
Cobb-Douglas production function 71
Cohesion 189, 196
Cohort 166, 173–174, 176

effect 67–68, 81, 84
fertility *see* Fertility
method 56
Cohort-size effect 138–139
Compulsory membership 97
Consumption
over the life cycle 81
Contribution 74, 98, 104, 106, 114, 117–118, 140
lump sum 106
rate 52, 57, 61, 73, 75, 77, 90, 92, 99, 104–105, 110, 112–113
Co-payment 105, 124
Counter-urbanization *see* Urbanization
Cross-payment 113, 118

D

Debt 134, 157, 197
explicit 116, 198
implicit 116, 118, 198
ratio 93, 114, 116, 118, 142
Debt monitor 200
De-familiarization 167
Deficit 114, 116, 157
ratio 93, 114, 116
Demographic
imbalances 26
sustainability 31
trends 9, 55–56, 189
Denmark 201
Dependency ratio 19–21, 48, 190
Dignity 191
Directorate General for Economic and Financial Affairs (DG ECFIN) *see* EU Commission
Disability pension 98–99
Discount rate 70
Displacement effect 73

E

Earnings
profile 101
threshold 97–98, 103
Earnings-related 104
East Germany 10, 12, 14–16, 23, 25–28, 84, 135, 139, 156, 158, 166
East-West divide 23–24, 29
Economy
closed 72
open 72
Education 134, 136, 139, 148, 166–168, 178
female 174
Educational
attainment 173
level 168, 171–173, 176, 182
participation 168, 172, 176
system 45
Efficiency 44, 61, 124
reserves 124
Employment 61, 85–86, 190–191
female 165
growth 56
rate 42
Entitlement period *see* Benefit duration
Equalization scheme 104
Equity investment 68
EU Commission 55–56, 60, 94
EU Economic Policy Committee (EPC) 120
EU-15 *see* European Union
EU-25 *see* European Union
Euro area *see* European Union
European Union 50–51, 56–57, 59
Eurostat 56
Event-history technique 171
Excess burden 122
Expenditure 92, 120
for families 169
ratio 90, 93
social insurance 114
Exports 49, 87

F

Factor prices 47
Family 192
formation 168

model 167, 169–170, 183
policy 167
size 167, 175
Federal Labor Agency 111
Fertility 9–11, 15, 17–18, 21, 23–24, 31, 124, 144, 166–169, 174, 176, 179, 183
behavior 166, 171, 174, 178, 182
biological limit of 168, 178, *see also* Time squeeze effect, Transition rate
choice 166, 168, 176, 182
decline 11–12, 19–20, 28, 167, 169, 189
differences 13, 176, 180, 182
gap 15, 174
indicator 172–173
level 9, 12, 23, 166, 169
postponement 176, *see also* Transition rate
rate 12–13, 17, 19, 20, 23, 31, 56, 165, 169, 190
replacement level 9, 11, 174
Financial system 196
Financial viability 124
Finland 57
Fiscal
adjustment 116, 122
balance 117
consolidation 116, 121, 197–199
policy 48, 50–51, 62, 94, 120, 122, 129, 200
sustainability 48, 62, 96, 109, 113–114, 121
target 120
Fiscal equalization 131, 136
Fiscal federalism 130, 148
Foreign direct investment (FDI) 49, 86
Funded system 60, 123

G

Gains 50
Gender composition 172
Gender equality 165–167, 183
General equilibrium model 52
Generation 35
German Socio-Economic Panel (SOEP) 171
German unification 38, 166
Globalization 49, 78–79
Governance 190, 195–196, 199–200, 202–203
Government
budget 116, 122, 141–143, 157
expenditure 114, 122, 124, 130–132, 137, 141, 143–145, 148–150, 152, 158
federal 129, 136, 150–151, 154, 157
functions of 132, 137, 144, 146
levels of 129, 131, 135–136, 144, 145, 148–153, 157–158, 162
local 129–130, 136, 148–151, 154, 157
revenue 114, 122, 130, 135, 141, 145, 153, 156, 158
saving 48
state-level 129–130, 136, 148–151, 154, 157
Gross domestic product (GDP)
aggregate 93, 96, *see also* Growth of GDP
per capita 50–51, 55, 61–62, 131, 136, *see also* Growth of GDP per capita
Gross national income (GNP) 61
Growth 145, 195
economic 40–41
GDP 41, 43, 51 , 55, 96, 142, 153, 156
GDP per capita 37, 40–41, 43, 51, 55, 60
output 40
rate 114
scenario 36

H

Health
benefit 105

budget 105
care 50, 106, 138, 152
cost profile 107
expenditure 105–106, 108, 125
fund 104–105, 109
insurance 90, 97, 103, 122, 125, 134, *see also* Long-term care insurance
insurance, private 106
risk, structure of 104
Heterogeneity 190, 192, 194, 201
Household survey *see* German Socio-Economic Panel (SOEP)
Housing 50, 80, 83, 134
demand 66, 83–84, 85
market 31, 85
Human capital 41, 44–45, 50, 166

I

Immigration 14–15, 21, 155, *see also* Migration
Implicit public debt *see* Debt
Incentive 202
Income gap 38, 62
Income-related effects 67
Indexation
mechanism 99
rules 107
Industrialized countries 38
Inflation 138, 145, 150
rate 96
Information system 203
Infrastructure 135, 139
Inheritance motive 68
Innovation 49, 55, 57, 106–108, 110, 124
Integration 197
Interest
payments 96, 134, 142, 151, 156
rate 46, 60, 70–71, 141, 156–157
Interest-bearing securities 68
Intergenerational justice 197
International
capital market 78–79, 85, *see also* Capital market
diversification 76–78
Investment 72
Ireland 49, 57
Israel 200
Italy 86

J

Japan 50, 79, 86
Joint taxation 170

K

Knowledge society 45

L

Labor 49–50, 76
costs 100
force 45, 96–97, 153, 156
market 96
market flexibility 125
market reform 57, 111
potential 41–42, 52, 125
productivity 37–38, 41–42, 46, 71, 86
supply 31, 36, 40–43, 45, 55
Life expectancy 13, 17, 24–25, 107, 189
Life-long learning 45, 191
Living
space, demand for 81
standard 35, 43, 50
Longevity *see* Life expectancy
Long-term care insurance 90, 97, 103, 109, 134
benefits 109

M

Marital status 168
MEA-OLGA model 69, 72
Median age 16, 18, 28, 169
Median voter 197
Membership rules 103
Migration 15–17, 25, 28–29, *see also* Immigration
flow 21

gains 20
internal 22, 25–27
replacement 21–22
selective 24–25
Mismatch 96
Mobility 26
Morbidity 107
Mortality 10–11, 17–18, 23–24
Multifactor productivity *see* Innovation

N

Natural growth 15
Netherlands 200
New Zealand 49
Non-informative censoring 173
Nordic countries 49, 57
North-South gradient 24
Notional individual accounts 98

O

OECD 51–52, 94
countries 49, 76, 79, 105
Open-system net liabilities (OSNL) 117–118, 120
Opportunity costs 167

P

Panel mortality 172
Parental leave
benefit 170
reform of 183
regulations 170, 183
Participation 194
in expenditure programs 138, 140–143, 150, 154
in society 192
labor force 19, 56, 94
rate 42, 55, 94, 125
Patchwork family 192, *see also* Family model
Pay-as-you-go system 60, 70, 73, 74, 86, 98, 104, 109, 191
Pension 47, 60
benefit 123
level 61
points 98
reform 48, 75, 77
scheme *see* Statutory pension scheme
system 35, 47, 57, 73, 90
Physical capital 46, 71, 76, 85
PISA exercise 45
Population 10, 18–19, 42, 196
decline, shrinkage 15, 20, 27–29, 81, 96, 190, 195
dynamics 22, 27
growth 35
projection 17, 42, 56, 61, 89, 94, 138, 156
Power
political 35
Prevalence rate 110
Price effect 138–139
Primary deficit ratio *see* Deficit ratio
Prison 146
Private insurance 125, *see also* Health insurance, private
Productive capital *see* Physical capital
Productivity 44, 45, 76
gap 38, 44
growth 38, 43, 51, 55, 61–62, 138. 141–142, 150, 153, 156
level 71
profile 45
Public finances *see* Fiscal policy
Public health insurance *see* Health insurance
Public long-term care insurance *see* Long-term care insurance
Public servants 134, 136, 139, 149, 154, 156, 158, *see also* Civil servants

R

Real estate assets 66–67, 81
Redistribution 47, 49, 98

inter-generational 123
Reform 52, 62, 99, 103, 105, 110, 122, *see also* Labor market reform
proposal 106
Region, regional 22, 27, 29
disparities, differences 22–26, 192
dispersion 25
level 23, 31
rural 26, 29
Replacement rate 20, 52, 60–62
Reserves
financial 98
stock of 109
Residential property 80, *see also* Real estate assets
consumption 81
demand for 66–67
market 66, 80
price 83
sector 83
Retirement 47, 52, 190
age 31, 61–62, 100, 123
Reunification *see* German unification
Riester reform 70, 73
Right-censoring 173
Risk
capital 49
of birth *see* Birth risk

S

Sample 171, 173
Saving 70
descision 70
domestic 48
life-cycle hypothesis of 46–47, 70
life-cycle profile of 68
rate 73–75
supplementary private 99, 123
Schooling 139, 148
Selection effect 179
Sensitivity analysis 93
Service sector 46, 50
Shrinkage *see* Population decline, shrinkage
Simulation 96, 100, 110, 113
Single parents 192, *see also* Family model
Skills *see* Human capital
Social
benefits 57
insurance 91, 93, 103
policy 166, 196
security 89, 129–130, 134, 136, 197, *see also* Health insurance
security contribution *see* Contributions
system 35, 196
Solidarity 191
Solow residual 37
Spatial disparities 29, *see also* Region, regional disparities, differences
Spillovers 59
Stability and Growth Pact (SGP) 114, 121
Statutory pension scheme 89, 97–98, 100, 122, 134, 136, 149, 155, 157
Structural imbalances 30
Subsidiarity principle 194
Subsidy 98, 100
Suburbanization *see* Urbanization
Survivor benefits 98
Sustainability 116, 130, 141–144
factor 99–100
gap 93, 120–124
indicator 113
risk 122
Sweden 57, 199, 201
Switzerland 105

T

Tax 131, 140, 144
legislation 130
revenue 131, 137, 152
schedule 170

sharing 130, 136, 152
system 170
Technical progress *see* Innovation
Tertiary education 148, 154, 156, 158, 173, *see also* Education
Time path 93, 101, 107
Time squeeze effect 168, 178, *see also* Transition rate
Time trend 180
Timing effect 11, 13
Total deficit *see* Deficit
Total factor productivity *see* Innovation, Multifactor productivity
Total fertility rate (TFR) *see* Fertility rate
Total period fertility rate *see* Fertility rate
Trade 59
Trade union 131
Transfer
interjurisdictional 130, 132, 134–136, 149, 156–157
system 170
Transition rate 168, 178–180, 182, *see also* Fertility, biological limit of
Transparency 202
Two-child family 175, *see also* Family model

U

Unemployment 57
insurance 89, 112, 118
rate 56, 96, 153, 155, 158
structural 51, 56
United States 49–50, 52, 57, 59, 62, 66, 68, 76, 79, 105
Universal coverage 106
University degree *see* Tertiary Education
Urbanization 27–28

V

Vocational degree 171–172
Voting 140, 195, *see also* Median voter

W

Wage 42, 46, 71
indexation 99
public-sector 131
system 45
Wage-replacement benefit 104
Welfare
spending 134, 155
system 48, 155
West Germany 10, 12, 14–16, 23, 25, 27, 139, 166

Name Index

A

Abel, Andrew B. 68, 87
Ahn, Namkee 166, 183
Akerlof, George A. 69
Alber, Jens 169, 183
Allison, Paul D. 171, 183
Andersson, Gunnar 166, 172, 183
Antolin, Pablo 50, 52, 63
Auerbach, Alan J. 69, 87
Axinn, William G. 167, 183

B

Bach, Stefan 137, 162
Bähr, Jürgen 26, 32
Barber, Jennifer S. 167, 183
Baum, Britta 139, 163
Baumann, Florian 104, 125
Bayoumi, Tamim 48, 63
Becker, Gary S. 165, 167, 183
Birg, Herwig 20, 32
Blanchard, Olivier J. 57, 63, 93, 113, 120, 125–126, 142, 144, 162
Blau, Harald 93, 128
Blossfeld, Hans-Peter 168, 171, 173, 183
Bomsdorf, Eckart 31, 32
Bork, Christhart 162
Börsch-Supan, Axel 57, 63, 69, 71, 76, 81, 87, 129, 162
Bracher, Michael 168, 186
Braun, Michael 170, 187
Brewster, Karin L. 166, 184
Breyer, Friedrich 108, 122, 126
Brockmann, Hilke 172, 184
Bucher, Hansjörg 23, 27–28, 32
Burniaux, Jean-Marc 52, 54, 63

C

Caselli, Graziella 33
Castles, Francis G. 166–167, 184
Castro Martin, Teresa 167, 184
Cette, Gilbert 44, 63
Chouraqui, Jean-Claude 93, 113, 126, 162
Cigno, Alessandro 124, 126
Cischinsky, Holger 25, 32
Corijn, Martine 168, 186
Cutler, David M. 69, 87

D

Daveri, Francesco 57, 63
De la Maisonneuve, Christine 50, 52, 63
De Wit, Margaret L. 168, 184
Del Boca, Daniela 168, 184
Diamond, Peter A. 69, 87
Dingeldey, Irene 170, 184
Disney, Richard 129, 162
Dorbritz, Jürgen 12–13, 32, 165, 184
Duval, Romain 52, 54, 63

E

Edwards, Ryan 129, 138, 140, 163
Elder, Glen H. 168, 184
Engelhardt, Gary V. 67, 87
Esping-Andersen, Gosta 165, 167, 170, 184

F

Felder, Stefan 128
Fenge, Robert 126

Fernandez, Raquel 139, 162
Fleischhacker, Jochen 13, 32
Flöthmann, Jürgen E. 20, 32
Fore, Douglas 113, 127
Franco, Daniele 107, 116, 126, 138, 162
Frein, Thomas 20, 32
Fuchs, Johann 19, 32, 95, 126
Fuentes, Andres 49, 63

G

Gans, Paul 23, 32
Gauthier, Anne H. 165, 169, 184
Gonand, Frédéric 50, 52, 63
Gornick, Janet C. 165, 169, 184
Gradstein, Mark 140, 162
Grob, Ueli 139, 163
Gruber, Jonathan 139, 163

H

Hagemann, Robert P. 93, 113, 126, 129, 162–163
Hamilton, Bruce W. 67, 87
Hamm, Ingrid 163
Hank, Karsten 183–184
Heiss, Florian 87
Hendershott, Patric H. 67, 87
Heppke-Falk, Kirsten 48, 63
Herd, Richard 116, 128
Hirschman, Charles 165, 184
Hoem, Britta 168, 184
Hoem, Jan M. 168, 184
Höhn, Charlotte 32, 89, 94, 127
Holzmann, Robert 116, 127
Holzner, Christian 112, 128
Hüfner, Felix 48, 63
Huinink, Johannes 166, 168, 170, 183, 185
Hullen, Gert 169, 185

I

Inklaar, Robert 63

J

Jaumotte, Florence 52, 54, 63
Joshi, Heather 165, 185

K

Kaganovich, Michael 140, 162
Kaltschütz, Anita 93, 121, 128, 155, 163
Kaufmann, Franz Xaver 169, 185
Kemper, Franz-Josef 23, 26–27, 33
Kempkes, Gerhard 129–130, 139, 146–147, 154, 163
Klein, Thomas 168, 185
Konietzka, Dirk 165, 171, 184–186
Köppen, Katja 168, 185
Kotlikoff, Laurence J. 69, 87
Kravdal, Øystein 167–168, 180, 185
Kreyenfeld, Michaela 165–166, 168–170, 180, 184–186
Krimmer, Pascal 162
Kurz, Claudia 155, 163

L

Lackmann, Georg 27–28, 32
Lappegård, Trude 168, 186
Laubach, Thomas 48, 63
Lauterbach, Wolfgang 168, 185
Lee, Ronald 129, 138, 140, 163
Leibfritz, Willi 90, 94, 96, 113, 127
Lesthaeghe, Ron 167, 186
Lewin-Epstein, Noah 170, 187
Liefbroer, Aart C. 168, 186
Little, Jane Sneddon 163
Ludwig, Alexander 65, 69, 71, 87
Luy, Marc 23–25, 33

M

Mai, Ralf 16, 23, 25–26, 33, 89, 94, 127
Mankiw, Gregory N. 66–68, 85, 88
Marini, Margaret M. 168, 186
Martin, Steven P. 168, 186
Martins, Joaquim O. 50, 52, 63

Masson, Paul R. 48, 63
Mc Morrow, Kieran 60, 63
McDonald, Peter 166–167, 186
McFadden, Daniel 68, 88
Meier, Markus 128
Meier, Volker 104, 125
Meister, Wolfgang 112, 128
Meyers, Marcia K. 165, 169, 184
Micheel, Frank 89, 94, 127
Miles, David 46, 63
Mira, Pedro 166, 183
Morgan, Margaret 49, 63
Morgan, S. Philip 168, 186
Munzi, Teresa 138, 162

N

Neyer, Gerda R. 167–168, 184, 186
Nicoletti, Giuseppe 129, 163

O

O'Mahony, Mary 63
Ochel, Wolfgang 112, 128
Offutt, Kate 168, 186
Oláh, Livia 168, 186

P

Palacios, Robert 116, 127
Poterba, James M. 67–69, 87–88, 139–140, 163
Prskawetz, Alexia 168, 184

R

Raffelhüschen, Bernd 162
Ravanera, Zenaida R. 168, 184
Razin, Assaf 129, 163
Reisen, Helmut 69, 88
Rindfuss, Ronald R. 166, 168, 184, 186
Roeger, Werner 60, 63, 90, 94, 96, 127
Rogerson, Richard 139, 162
Rohwer, Götz 171, 183
Rønsen, Marit 168, 183, 186
Roseveare, Deborah 113, 127
Ross, Katherin E. 165, 169, 184
Rowland, Donald T. 11, 33
Ruckdeschel, Kerstin 165, 184

S

Sadka, Efraim 163
Sainsbury, Diane 170, 186
Samiei, Hossein 48, 63
Samuelson, Paul A. 69, 88
Santow, Gigi 168, 186
Sartor, Nicola 93, 113, 126, 162
Scharein, Manfred 16
Schlömer, Claus 27–28, 32
Schultz, T. Paul 167, 186
Schulz, Erika 162
Schwarz, Karl 12, 32
Scott, Kirk 166, 183
Seitz, Helmut 114, 127, 129– 131, 135, 139, 146–147, 154–155, 163
Sheiner, Louise M. 69, 87
Sinn, Hans-Werner 112, 122–124, 127–128
Skinner, Jonathan 68, 88
Söhnlein, Doris 19, 32, 126
Solga, Heike 186
Sommer, Mathias 65, 71, 87
Spieß, Katharina 186
Stier, Haya 170, 187
Ströker, Kerstin 20, 32
Summers, Lawrence H. 69, 87
Swagel, Phillip 163
Swan, Craig 67, 88
Swicegood, Gray 168, 186

T

Tabellini, Guido 57, 63
Thieme, Günter 23, 33
Thon, Manfred 95, 126
Timmer, Marcel 63
Treas, Judith 170, 187
Triest, Robert K. 163

U

Ulrich, Volker 108, 126

V

Van den Noord, Paul 116, 128
Van der Veen, Wiltem J. 23, 33
Venti, Steven F. 68, 88
Vikat, Andres 183

W

Wagner, Gert 186
Weil, David N. 66–68, 85, 88
Werding, Martin 93, 104, 112, 124–125, 127–130, 134, 155, 161, 163
Widmer, Eric D. 170, 187
Wilke, Christina B. 57, 63
Wingen, Max 169, 187
Winter, Joachim K. 69, 87
Wise, David A. 68, 88, 139, 163
Wolfers, Justine 57, 63
Wolter, Stefan C. 139, 163
Woodward, Susan E. 67, 88
Wurzel, Eckhard 49, 63, 113, 127

Y

Yamaguchi, Kazuo 171, 187
Yoo, Kwang-Yeol 50, 52, 63

Z

Zviniene, Asta 93, 116, 127
Zweifel, Peter 128