ESSAYS ON THE IMPACT OF DEMOGRAPHIC CHANGE ON CAPITAL, GOODS AND LABOR MARKETS

Inauguraldissertation
zur Erlangung des akademischen Grades
eines Doktors der Wirtschaftswissenschaften
der Universität Mannheim

vorgelegt von
Melanie Lührmann

im Wintersemester 2005/2006

Referent:	Prof. Axel Börsch-Supan, Ph.D.
Koreferent:	Prof. Dr. Klaus Conrad
Dekan:	Prof. Konrad Stahl, Ph.D.
Sprecher der Abteilung:	Prof. Konrad Stahl, Ph.D.
Tag der mündlichen Prüfung:	24. Januar 2006

Acknowledgments

I am grateful to many people for their encouragement and support while I was writing this thesis. First of all, I would like to thank my supervisor Axel Börsch-Supan. He has encouraged the development of my economic skills from the beginning of my studies. During the writing of this thesis, he has been an invaluable source of inspiration, and a supportive advisor. In addition, he has provided an excellent work infrastructure and a pleasant and personal working atmosphere.

Second, I would like to thank my coauthor and friend Matthias Weiss for his lively interest in and tireless willingness to discuss the smaller and larger economic problems and issues emerging during the preparation of my thesis. I very much enjoyed our cooperation and hope that it continues.

My friend Simone Kohnz has been a very supportive accomplice in coping with the ups and downs emerging during the preparation of a thesis. She has also been an engaged critic and a picky one, too, where economic theory was concerned. I would like to thank her very much for her support and friendship during the last years.

Florian Heiss has been a very reliable and inventive source of advice in econometric issues. I would like to thank him for his advice and for his relaxed and patient way of troubleshooting in the case of urgent computer problems.

I am deeply indebted to Joachim Winter who always had an open ear for me, and who continuously motivated me, be it with chocolate infusions or sound economic advice. He has also been a constant source of advice on career matters.

I would also like to particularly thank Alexander Ludwig, Karsten Hank and Alfred Garloff for detailed discussion, comments and suggestions—and for their friendship and personal support. Thanks also go to all current and former colleagues and friends at the Mannheim Research Institute for the Economics of Aging (MEA). They all contributed to the uniquely agreeable and familial atmosphere at MEA. They all made this thesis enjoyable and certainly improved its quality. Special thanks go to Isabella Nohe and her warm and caring manner. She has helped me deal with the bureaucratic issues of university life innumerable times.

I very much appreciate the feedback of other researchers at conferences, workshops and visits —especially from Martin Browning and James Banks. Furthermore, I would like to thank my second advisor, Klaus Conrad, for helpful comments. I gratefully acknowledge financial support from the Land Baden-Württemberg, the Gesamtverband der Deutschen Versicherungswirtschaft (GDV), the Volkswagen Stiftung, and the EU Research Training Network on the Economics of Aging.

Last but not least, I would like to thank my parents for their support and love and their unconditional belief in me.

Contents

List of Tables

List of Figures

1 Introduction

The past several decades have witnessed an unprecedented demographic change in almost all developed countries. The speed and intensity of this demographic process differ considerably across countries. For example, Europe and Japan already have much older populations than the US, and South Korea is currently the fastest aging country in the world. Even within Europe, demographic heterogeneity is large: While Germany and Italy have a very advanced aging process, fertility rates are higher and the age structure is much younger in the Scandinavian countries and Ireland. However, there is one common factor: Populations in industrialized economies are aging substantially. This is manifested in ever-rising life expectancy and fertility rates below replacement level. Both factors lead to a dramatic shift in the age structure of the population that will affect economic processes considerably in the next decades.

The purpose of this dissertation is to better understand the impact of population aging and accompanying changes in demographics on capital, goods and labor markets. Chapter 2 investigates the link between population aging and international capital markets, while Chapter 3 analyzes the macroeconomic implications of demographic change on the demand for goods and services. In Chapter 4, I take a closer look at the consumer behavior of households shortly before and after retirement from a microeconomic perspective. Finally, Chapter 5 shows how aging-related changes in market work can change consumer demand and labor supply. Each of these chapters is a self-contained paper with its own introduction that can be read independently. In the remainder of this introduction, I briefly describe the content and results of each chapter.

Chapter 2 deals with the role of population aging on international capital flows from a macroeconomic perspective. Using a large cross-country time-series data set of 121 countries for the time period from 1970 to 1997, I test the hypothesis that there are demographically-induced capital flows between countries.

The motivation for this chapter is the so-called asset melt-down hypothesis that predicts asset returns to drop dramatically in the future. The hypothesized drop is caused by the retirement entry of the baby boom generation upon which they will sell their assets for consumption in old-age. Due to their smaller size, the following generation of baby busters will have a lower capital demand, so that asset returns drop. This hypothesis is correct only under several restrictive assumptions. One of them is that international diversification of capital which could balance the demographic pressures, is not possible. If cross-border capital flows were limited due to home bias, trade restrictions or large transaction costs, capital-intensive countries with a shrinking workforce could face an asset meltdown (Abel 2001; Abel 2003; Brooks

2000a). However, in a financially integrated world, this is not likely to be the case (Börsch-Supan, Ludwig, and Winter 2005).

If capital is mobile to flow freely between countries, demographic cross-country differences create incentives to invest in younger economies characterized by higher capital demand and higher expected asset returns. Hence, relative demographic differences between countries should trigger international capital flows. High youth and old-age dependency ratios should bring about a current account deficit, because a relatively large population of dependent young and old has a relatively lower savings rate (Ando and Modigliani 1963). Furthermore, countries with a large fraction of young dependents tend to have a high investment demand, as shown by Higgins (1998).

While the link between current demography and cross-border capital flows has been analyzed by several researchers, the role of expectations has been neglected. However, according to the capital market theory, asset returns reflect anticipated future trends in the moment that new information occurs. Since the future demographic trends are well-known already today, and can be forecasted with relative certainty, future demographic pressures should trigger current international capital flows. This chapter puts an emphasis on analyzing whether these anticipation effects can be observed in current international capital flows.

Even in times of global financial integration, there is consensus that integration is not perfect. As discussed above, the occurrence of demographically induced capital flows hinges upon the magnitude of capital market imperfections which hamper international capital to flow freely. Hence, I use some indicators of capital market frictions to investigate whether they are seriously hampering the international diversification of demographic pressures on domestic capital markets.

The chapter provides empirical evidence of two substantial demographic effects on international capital flows: First, capital flows are induced by changes in *present* demography. Countries with a large working-age population tend to be net exporters of capital, relatively younger economies importers of capital and extremely aged countries with a major population share of elderly also tend to import capital. In particular, high youth dependency induces current account deficits. Second, the chapter provides evidence that *future* demographic changes are anticipated and affect current net capital flows, too. The direction of the effects is the same as for present demography. This result provides empirical support for the assumption of rational and forward-looking agents. This assumption is often made in overlapping generation models that simulate the evolution of asset returns in an aging population.

Furthermore, the results indicate that both demographic effects on international capital flows are reduced by capital controls and other capital market frictions.

The next chapter, Chapter 3, focuses on the role of demographic change on the markets for goods and services. I develop a micro-based tool for projecting macroeconomic changes in the structure of German demand for broad commodity groups that are caused by population aging. The basic intuition why population aging should affect aggregate consumer demand is the observation of age-specific consumption patterns. This variation in the composition of the demand for goods and services over the life cycle is likely to produce changes in the aggregate, when the whole age structure shifts due to population aging.

This chapter contributes to the field of aging economics by projecting the impact of demographic change on the demand for goods and services. Additionally, it makes a contribution to the demand literature as well, since it is the first micro-based projection of aggregate consumer demand.

In the first part of the empirical analysis, I estimate the microeconomic age-specific household demands for a set of eight composite goods based on the German budget survey *Einkommens- und Verbrauchsstichprobe* for 1978-1998 using a quadratic almost ideal demand model. In the second part, these age-specific demand patterns are aggregated in order to project the macroeconomic effect of population aging on the aggregate household demand for goods and services between 2000 and 2040. These projections are done in scenarios. They take into account (i) the direct effect of a shift of the age structure, (ii) accompanying changes in the level and distribution of total expenditures, and (iii) changes in household composition. The level of consumer expenditures changes due to population aging, because it affects savings and economic growth and thus also per capita incomes and consumption at the microeconomic level. Aging-related changes in the distribution of consumer expenditures are mainly caused by social security systems whose design influences the inter- and— through re-distributional features— the intra-generational distribution of incomes. I use the outcomes of OLG simulations by Börsch-Supan, Ludwig, and Winter (2005) as base for the projections in this scenario. Finally, population aging is caused by declines in fertility, increases in life expectancy and changes in the timing of family formation and fertility decisions. All these factors affect the composition of households. I use household projections originating from the FAMY-project provided by empirica to project the resulting demand effects.

The results point to significant increases in the expenditure shares of health and leisure goods and a decline in necessities like food and energy in all scenarios. While the pure effect of a shift in the population age structure does already trigger significant demand changes, the effects are magnified when moderate growth in total expenditures is assumed. However, changes in household composition -decreasing average household size, but a slow reduction in the number of households- do not affect demand substantially. The future design of the pension system has only a minor impact on the distribution of incomes and total expenditures and thus also a negligible impact on aggregate demand.

In chapter 4, I analyze consumer expenditures from a microeconomic perspective. I concentrate on the consumer behavior of households shortly before and after retirement and on the role of home production in explaining such changes.

For the US, the UK and Italy, a distinct drop in spending around retirement has been documented. This drop has been termed the retirement consumption puzzle because such a discontinuous drop is inconsistent with the standard life cycle theory according to which households smooth consumption over their lifetime. Various reasons have been put forward in the literature to solve this puzzle and to reconcile observed behavior with the life cycle framework. They range from unexpected health and income shocks around retirement to the cessation of work-related costs, non-separability between consumption and leisure, and the substitution of expenditures by increased home production. I analyze the patterns of home production and expenditures at retirement.

This chapter contributes to the literature by presenting evidence on the magnitude of the drop in expenditures in Germany. Additionally, I analyze the role of home production in solving this empirical puzzle and reconciling it with the life cycle model. Most studies investigate home production by looking at detailed expenditure categories like food at home which can be substituted by home production. Disproportionate expenditure drops in these categories have been interpreted as indirect evidence of increased home production activities. This interpretation cannot be separated from disproportionate expenditure cuts on some commodities that are *not* compensated by increases in home production. Combining the analysis of expenditure data with time use data, I can draw direct conclusions about the home production activities of retirees and non retirees, and whether they complement the observed drop in spending.

Using *Einkommens- und Verbrauchsstichprobe (EVS)* over the period 1978-1998, I find a significant one-off drop in nondurable consumer expenses at retirement which is comparable to those found for the US, Italy and the UK. After a descriptive analysis of cohorts, I investigate this drop in a multivariate regression analysis controlling for differences in household characteristics by retirement status, and by age and cohort using the Deaton-Paxson decomposition. The results point to a 17% drop in nondurable spending which varies across age groups. Furthermore, the analysis shows that the drop is discontinuous and levels off partially during retirement.

Additionally, I use two waves of the German time use survey (*Zeitbudgeterhebung*) from the years 1991/92 and 2001/02 to investigate whether this drop is compensated by increased home production. This explanation for the drop in expenditures bases on the notion that consumption does not equal expenditures. If households engage to a considerable degree in producing goods and services themselves, they can consume more than just their market purchased goods and services. The analysis of the time use patterns of retirees and non retirees shows that home production is with 75 additional minutes per day significantly higher in households with a retired head. Hence, the results are consistent with the idea of non-separability between consumption and leisure. They show that when the time and financial budgets of households change, they substitute between spending time to produce consumer goods and services themselves and spending money to buy those goods and services.

The idea, that households flexibly choose their engagement in home production according to their financial and time budget constraints, also plays a key role in Chapter 5. This chapter is based on joint work with Matthias Weiss. In a general equilibrium model with two goods, the effect of changes in working time on the unemployment of the unskilled is analyzed. The model links the market for goods and services with the labor market, and thus introduces a novel argument into the debate about the employment effects of a longer working time. This new mechanism works through consumer demand: If a household increases its working time—be it through a longer weekly working time, higher labor force participation (especially of women), or a longer working life— it has a higher income and less leisure time at its disposal. Households react to this change in resources by purchasing some formerly home produced goods and services in the market. This change in consumer behavior raises the demand for substitutes to home production that can to a large extent be done by unskilled workers. Hence, due to the outsourcing of domestic tasks to the market, consumer demand shifts toward unskill-intensive goods. In consequence, the relative demand for unskilled labor rises and unemployment among the unskilled decreases.

There is an additional link between Chapter 5 and the main theme of this dissertation apart from extending the idea of interactions between consumer expenditures and home production activities to labor market issues. Population aging has now long been discussed in the context of social security systems. It is well-known, at least in "old" economies like Germany, that aging puts a significant pressure on the financial sustainability of pension systems. An integral component of a system reform to make it financially balanced again is the prolongation of the work life by means of raising the official statutory retirement age (Bundesministerium für Gesundheit und Soziale Sicherung 2003). Chapter 5 analyzes the economic effects of a longer work life on consumer behavior and labor demand.

Furthermore, the German population of working age, i.e., between 15 and 65, will decrease in the future. This triggers a shrinkage of the workforce from about 36 millions in 2000 to between 26 and 34 million until 2040, depending on the assumption made about labor force participation rates and changes in statutory retirement age (Börsch-Supan 2003a). Policy measures geared at increasing labor force participation and working time to mitigate the shrinkage of the workforce might be warranted. Chapter 5 analyzes the economic consequences of such a policy and concludes that it would increase the demand for goods and services that substitute for home production and subsequently increase the demand for unskilled labor needed to produce these services.

The predictions of this theoretical model are tested in two ways: First, based on a microeconomic survey of time use in Germany conducted in 1991/92, the link between labor market participation, home production and the demand for household and similar services is analyzed. Second, cross-country time-series data on OECD countries between 1980 and 2003 is used to directly examine the link between labor force participation and the unemployment rate. The results corroborate the predictions from the theoretical model. They show once more that households engage significantly more (less) in home production activities, when they have more (less) leisure time at their disposal, i.e., work less (more). Hence, this result is consistent with the results found in Chapter 4 for the elderly. Furthermore, the macroeconomic part yields a significant reduction of unemployment in OECD countries with a higher labor force participation and longer working time.

2 Demographic change, foresight and international capital flows

2.1 Introduction

The next decades will bring about a pronounced aging process, in particular in industrialized countries. This demographic transition which is characterized by falling mortality rates and a subsequent decline in birth rates is much less advanced in developing countries.
There are large cross-region[1] and cross-country differences in the age structure of the population now and in the future (Fig.2.1).[2] Although the world regions share the common trend of a rising population share of the elderly and a declining share of the young, the differences in levels are large. In order to illustrate the demographic differences across the world, Fig. 2.2 depicts the total variation in youth and old-age dependency rates across the world using variation coefficients.[3] In particular, not only old age dependency but also its variance is strongly increasing over time until about 2020, and falls afterwards.

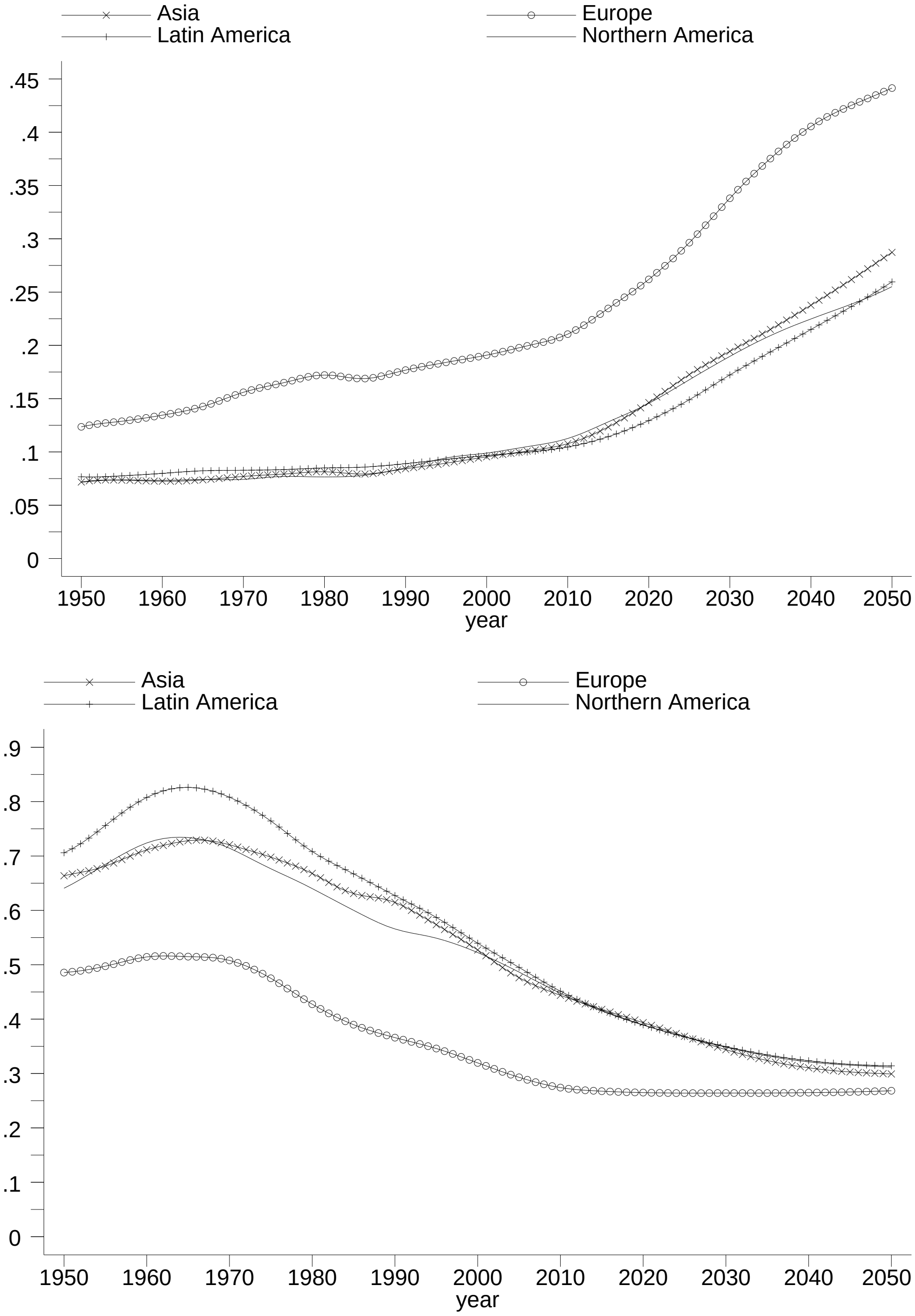
These demographic changes raise questions about their economic implications. There is an ongoing debate about the asset melt-down hypothesis which states that the soon retiring baby boomers will create a massive supply of assets that can be matched by the baby busters' meager demand only at low asset prices (Poterba 2001; Brooks 2000b). Thus returns to capital will decline. This discussion is closely related to the focus of this study: international capital flows provide a means of mitigating or even avoiding the expected decline in return rates, since they allow for capital to be placed on the world capital market which channels it to relatively younger countries with higher capital returns. This in turn will reduce the demographic pressure on the domestic rate of return (Börsch-Supan, Ludwig, and Winter 2005). Returns to capital also play a key role for the implications of designing partially funded pension systems, since they determine where the additionally accumulated capital will be invested. Understanding the factors driving international capital flows is thus important. This importance is underlined by the remarkable increase of the volume of international capital flows over the 1990s (World Bank 1997) and the observation that capital mar-

[1]The world is divided into 18 regions, defined according to the UN classification.

[2]For a detailed description of worldwide demographic differences, see United Nations Population Division (2000) for all world regions, Börsch-Supan (1996) for OECD countries, Bloom and Williamson (1998) for Asia, and Bloom and Sachs (1998) for Africa.

[3]Youth *(old age)* dependency being defined as ratio of the population between 0-14 *(65+)* to the working-age population between ages 15 and 65.

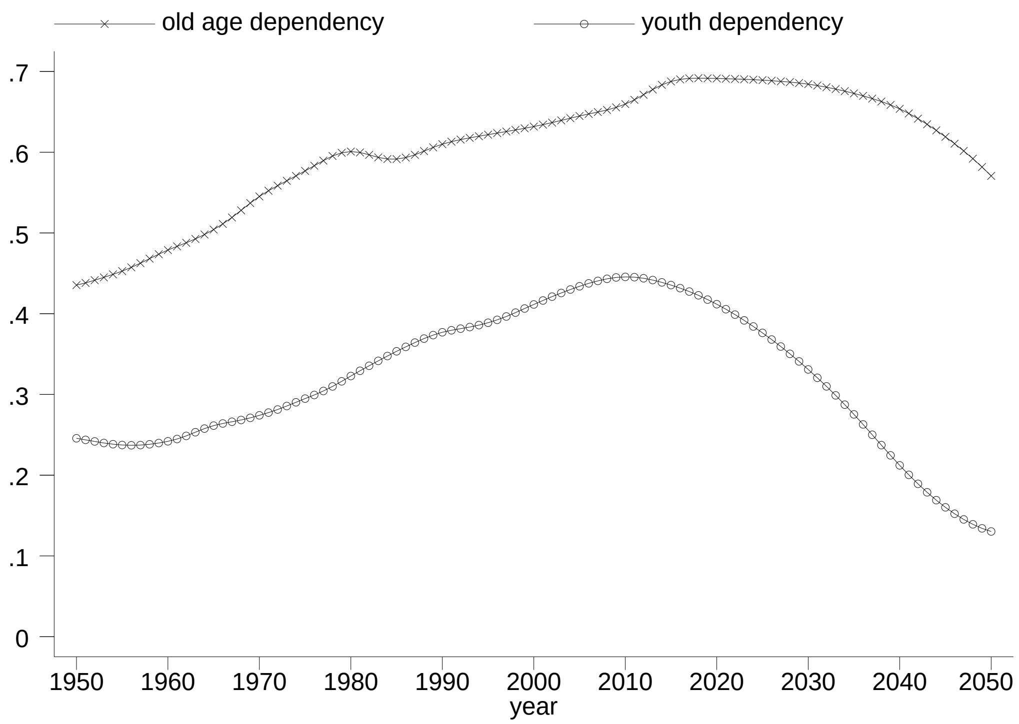
Figure 2.1: a) Old age and b) youth dependency for selected world regions: 1950-2050



Source: UN Population Prospects and own calculations
Youth (old age) dependency is defined as ratio of the population between 0-14 (65+) to the working-age population between ages 15 and 65.

kets become more and more integrated across national borders.
In this paper, I conduct a reduced-form empirical analysis using an unbalanced panel of 121 countries for the time period from 1970 to 1997. Demographic effects on international capital flows are analyzed taking into account capital market imperfections and limited capital mobility. The main contribution of this paper is the analysis of the role of anticipated demographic changes on international capital flows. Anticipation affects the timing of the link between demography and international capital flows. Furthermore, this paper relates the reduced-form analysis undertaken here to the growing literature using overlapping generations models which relies on the assumption of forward-looking agents. Forward looking behavior is informally tested here by researching into the relevance of anticipation effects.
The remainder of the paper is organized as follows: Section 2.2 reviews the theoretical foundations of demographic effects on international capital flows. The role of anticipation effects in this study is described in Section 2.3. Section 2.4 contains a description of the data, the regression specifications (2.4.1), the modeling of present (2.4.2) and future demography (2.4.3), and of the financial sector variables and indicators for capital mobility (2.4.4). Section 2.5 presents the results. Before I conclude, the demographic effects found in this paper are illustrated by stylized out-of-sample predictions for selected countries (Section 2.6).

Figure 2.2: Variation coefficients for youth and old age dependency: 1950-2050



Source: UN Population Prospects and own calculations

2.2 Literature review

2.2.1 The dependency debate and life-cycle savings

Whether and how demographic changes affect aggregate savings and growth outcomes is an old question leading back to Malthus (1798) and Coale and Hoover (1958). Coale and Hoover formulated the *dependency hypothesis* of a negative link between an increase in the young population and savings. It is due to the low savings capacity of children and young parents supporting children.
A second strand of studies has its theoretical foundation in the life cycle hypothesis by Ando, Modigliani and Brumberg (Modigliani and Brumberg 1954; Ando and Modigliani 1963). Empirical studies suggest age-specific savings decisions of individuals (Leff 1969; Fry and Mason 1982; Kelley 1988; Mason 1988; Collins 1991; Taylor and Williamson 1994). According to the theory, savings should be low at early stages of life due to low initial incomes and consumption-smoothing. In the course of rising income, savings increase. The age-specific individual savings patterns imply aggregate savings that depend on the national age structure. Thus, the application of the life-cycle model to the national context points to a negative link between youth dependency rates and savings. In contrast, savings are high at later stages of life and thus positively linked to the size of the work-force.
In an empirical analysis, Mason (1988) and Collins (1991) found a negative relationship between youth dependency rates and national savings rates. All these studies however lack a proper incorporation of the capital demand side. In other words: they do not explicitly consider the differences in savings and investment patterns of open versus closed economies. Neglecting the demand for capital leads to biases in the estimated demographic effects on savings. The demographic impact on savings is likely to be negative, but stronger than suggested by this literature. This underestimation is due to the omission of the investment side, so that the demographic coefficients also pick up demographic effects on investment. The nature of the link between savings and investment patterns and the resulting differences in these patterns between open and closed economies will be discussed in more detail in Section 2.2.3.

2.2.2 Analyzing savings and investment patterns jointly

In order to analyze the demographic effect on the focus variable net capital flows, and to avoid the biases described in Section 2.2.1, a joint approach towards savings and investment patterns is needed. In the 1990s, some effort was put into researching demographic effects on capital demand *and* supply by examining the demographic effect on the residual directly (Higgins and Williamson 1996; Higgins and Williamson 1997; Higgins 1998).
Higgins and Williamson (1996) study the demographic effect on savings, investment and net capital flows in a neoclassical overlapping generations framework with three periods of life. Demographic variation enters their model through cohorts of different size. Fertility and the rate of technological progress are exogenously given, production

has constant returns to scale and labor is inelastically supplied. The authors simulate the effect of a stylized demographic transition process. It consists of an increase in fertility over two periods that levels off over three periods afterwards and then falls to a lower steady-state value. The results are that investment is tightly connected with the growth of the labor force which needs to be equipped with capital. Furthermore, the simulations show that savings rates are high for a large work force and decline gradually, as the economy ages.
Countries with a large working population will thus tend to be net capital exporters in a globalized capital market while relatively young economies tend to import capital due to their high investment demand and low national savings. Finally, a country with a majority of retired citizens will tend to be net capital importing.
In an empirical analysis of a large cross section of countries taken from the Penn World Tables (Mark 5.6), Higgins (1998) finds evidence of the savings, investment and net capital flow patterns predicted in the simulation model of Higgins and Williamson (1996). Taylor (1998) also finds a negative link between youth dependency ratios and net capital outflows for Argentina and other Latin American countries in the 20th century (1885-1989).

2.2.3 Demographic effects and the role of capital mobility

The distinction between closed and open economies is crucial in the analysis of savings patterns, since savings are independent of the demand side in the capital market only under the assumption of perfect capital mobility. In this case, capital is traded at the world capital market which determines the rates of return at the domestic market. If capital is not entirely mobile internationally, domestic savings and investment are jointly determined and can thus not be analyzed separately. This linkage between the degree of capital mobility and savings and investment patterns in the domestic economy is formulated in the well-known Feldstein-Horioka theorem (Feldstein and Horioka 1980). Feldstein and Horioka as well as follow-up studies (Dooley, Frankel, and Mathieson 1987; Hussein 1998; Jansen 2000; Shibata and Shintani 1998) found a significantly positive, but decreasing correlation between domestic investment and savings outcomes over time, an indicator for a limited, but increasing degree of international capital mobility.
Studies based on the examination of interest rate parities are in line with these findings of limited capital mobility. Frankel (1992) and Obstfeld (1995) provide surveys on these tests for capital mobility and their (mostly negative) results. French and Poterba (1991) resume that there is considerable home bias in investment decisions and the results of Portes and Rey (2005) suggest that information asymmetries reduce international capital mobility. Thus, evidence that capital mobility is not perfect is numerous. However, it is equally true that capital controls have been abolished on a large scale during the last decades and that capital has become more mobile at least within the OECD area.
The consensus in the literature is best summarized by Obstfeld (1995): *As far as industrial countries are concerned, capital mobility appears substantial...though it is*

clear that much of the developing world still stands outside the nexus of industrial-country financial markets.
Higgins (1998) relates demographic effects and capital mobility, taking into account that incomplete capital mobility can hamper demographically-induced capital flows. Thus, demographic effects on capital flows should be weaker when capital controls or other obstacles to free capital flows are present. Higgins (1998) uses the Sachs and Warner openness measure as an index of financial openness (Sachs and Warner 1995) and obtains the expected results: the less open a country, the weaker the demographic effect on net capital flows. There is a certain flaw to the Sachs and Warner openness measure: it is usually considered as an index of trade and not financial openness. I extend this line of research by applying a broader concept of capital mobility determinants in the empirical analysis.

2.3 The role of future demography

2.3.1 How anticipation affects international capital flows

This study is a first step towards evaluating the role of expectations in the analysis of demographic effects on international capital markets. Previous studies found significant demographic effects on international capital flows and capital market returns (Higgins and Williamson 1996; Higgins and Williamson 1997; Taylor 1998; Taylor and Williamson 1994). This paper researches into the effects of *future* demographic developments on *current* international capital flows. This focus stems from the notion that actions taken on the capital market are highly driven by expected returns. Hence, it is not sufficient to look at the present demographic situation only when analyzing demographic effects on net capital flows. To my knowledge, this effect has been not been studied thoroughly in the empirical literature so far.
Poterba (2001) briefly discusses anticipation effects. He notes that forward-looking behavior by agents implies that savings and investment decisions are taken on the basis of present discounted values of the future earnings of investment goods and the value of savings. Poterba resumes that "forward-looking investors should anticipate the decreasing demand for capital and bid down shares prices and the prices for other durable assets before the baby boomers reach their saving years." He however does not incorporate forward-looking behavior into his empirical analysis of demographic effects on asset returns in the U.S. but instead confines to a steady-state focus.
To clarify how anticipation of demographic changes alters agents' behavior, consider the *closed economy case* in which there is no access to the world capital market: the only way in which individuals can react to the anticipation of a baby boom baby bust cycle is to intertemporally shift their savings: either they save more today in order to ensure a sufficient retirement income, or they start consuming their savings earlier if the substitution effect dominates. Obviously, an intertemporal shift towards earlier consumption would reduce capital returns in the present. However, anticipation can only smoothen the sharp decline of future returns, and it is not clear that individuals

really choose to shift their consumption towards earlier stages of their life. Intertemporal substitution does not solve the asset-melt down problem because the individuals' scope for using the information about the future is limited as there is no escape from the (shrinking) domestic financial market.[4]

This closed economy result is found in a study by Brooks (2000b). Brooks's stylized Baby Boom-Baby Bust cycle results in an abrupt drop in cohort size between two generations. It can be regarded as a contracted, stylized version of the long-term phenomenon of demographic change. The effect of this demographic shock is analyzed in a simulation model with rational, forward-looking agents. The simulations show that in spite of forward-looking behavior, the transition from baby boom to baby bust will lead to a sharp decline in asset returns. This result is not surprising: the model ignores the ability of investors to hold an internationally diversified portfolio and analyzes demographic effects in a closed economy setup only.

The virtues of integrated capital markets are modeled in Börsch-Supan et al. (2005): Their simulations show that the decline in capital returns induced by the aging process are much smaller when capital is mobile across the EU or OECD, and not bound to be invested in Germany only. The authors find no evidence of an asset melt down effect in an open economy setting. Thus, anticipation effects lead to a much higher extent of smoothing of the return curve over time in an open economy. The pivotal difference to the closed economy case is, that agents can make better use of their knowledge about domestic demographic pressures: they can access the world capital market in order to diversify domestic demographic risks. This mechanism of alleviating domestic demographic pressure generates net capital outflows from industrialized countries to emerging markets in the present. The size of these flows depends on the *relative difference* in the age structure between the home country and the rest of the world (Williamson 2001). Capital will flow between countries such that returns equalize across countries and these returns will depend on the world capital market only.

In consequence, population aging in the home economy does not necessarily lead to sharp declines in capital returns, since agents can react to demographic pressures by investing their capital in countries where aging is less pronounced.

However, if capital is perfectly mobile and can be reallocated at any point in time, net capital flows will depend on the change of the relative age structure in the next period only. Although individuals anticipate long-term changes in demography, they only need to redirect capital in each period such that the expected change in the relative age structure over the next period is balanced. Thus, one should *not* observe a linkage between net capital flows and *long-term* future demographic change, if capital is perfectly mobile.

In the realistic scenario of imperfect capital markets as supported by empirical evidence (see Section 2.2.3), however, international capital flows can be affected by expected demographic changes over a longer period as well. It might not be possible to redirect

[4]The effect of the increased volume of savings would further stabilize capital returns if it increased productivity (Börsch-Supan and Winter 2001). A higher capital stock can enhance corporate governance in the capital market and thus raise capital productivity.

capital flows at any point in time. Furthermore, the allocation of capital across countries might depend on the degree of imperfection of the destination country's domestic capital market. The most obvious deterrent to the redirection of capital in each period is the presence of transaction and information costs. They represent an incentive towards making longer term investment decisions.[5]
Thus, with incomplete capital markets and farsighted agents, present net capital flows should depend on expected relative differences in future demography between countries. The more incomplete the capital markets, the smaller should be the effect of anticipation on international capital flows. Therefore, I construct demographic variables capturing anticipation only, and next, I also introduce interactive effects of these anticipation variables and indicators of capital market imperfections. The variables used in the empirical analysis are described in Section 2.4.3 and Appendix 2.8.1.

2.3.2 The formation of expectations

The studies described in the last section belong to the group of overlapping generations simulation models (see also Börsch-Supan and Winter 2001; Börsch-Supan et al. 2003; Miles 1999; Pemberton 1999; INGENUE Team 2001). They base on the assumption of rational, forward-looking behavior. This paper means to be the flip side of the coin, since it provides an informal test whether this assumption is warranted, as anticipation effects represent an indicator for forward-looking behavior. By including anticipation effects in the analysis, I test a joint hypothesis: (i) the availability of credible demographic information and (ii) the farsightedness of agents. These two hypotheses cannot be separated in the empirical analysis of this paper.
There is evidence that individuals are aware of the demographic changes ahead, i.e. that they are in possession of reliable and credible demographic information. This awareness is due to the drastic dimension of the aging process in industrialized nations and the resulting widespread problems with financing social security systems in the future (Boeri et al. 2002).
Demographic forecasts like the United Nations projections usually extend over a timespan of 50 years and are considered as relatively reliable, in spite of implausible fertility assumptions used in the past (Birg 2001). Reliability is enhanced by the fact that the elderly of tomorrow are already born today.
In this paper, I chose the UN projections as information source for projections of the aging process. I do so because it is a broadly cited international data source for demographic projections so that public information is mainly based on this data. Projection errors in this database produce errors in the expectations. This is unproblematic here since the goal of this paper is to show that expectations affect the link between demography and international capital flows, regardless of whether individuals have perfect information.
The various editions of UN projections over time differ from each other, mainly due

[5] Another example for capital flows that cannot be redirected each period is foreign direct investment (FDI). FDI often yields positive returns only after a couple of years and is not easy to reverse - if at all.

to the rapid spreading of the HIV-virus and revisions of the fertility assumptions. In consequence, every official update produces "news" and thus a change in expectations. I use four UN projections, issued in 1980, 1988, 1992 and 1998, to exploit this variation. Expectations are revised each year on the basis of the latest official projection available. Since data based on forecasts before 1980 is not available, I assume that expectations about the demographic future built before 1980 were correct, i.e. matched the demographic reality. Further details about the construction of the anticipation variables are given in Section 2.4.3.

2.4 The econometric model

This paper uses a reduced-form approach to analyze the empirical link between current and future demography and international capital flows. A feasible generalized least squares panel estimator with region fixed-effects is applied to time-series cross-section data for about 120 countries from 1970 to 1997 and to demographic projections that reach out until 2050. The demographic data is provided by the United Nations World Population Prospects, while the economic data of this unbalanced panel is taken from the World Development Indicators by the World Bank. Additional data on capital controls is provided by the IMF (International Monetary Fund 1999). The dependent variable is capital outflows, constructed as the net value of gross domestic savings minus domestic investments as a percentage of GDP.
The next section describes the estimation strategy. Sections 2.4.2 to 2.4.4 deal with the explanatory variables used in the analysis and define how they are specified. They can be grouped into four categories: region fixed-effects, present demography, expected demographic changes, and last, financial sector variables and capital mobility factors. The regions amount to 18 groups, defined according to the UN classification. The measurement of the present and expected demography is explained in Section 2.4.2 respectively 2.4.3 as well as in appendix 2.8.1. The other covariates are described in detail in Section 2.4.4.

2.4.1 The empirical specification

For the moment, consider the regression specification with present demography only:

$$y_{it} = \alpha_{oi} + x_{it}^{'}\beta + \sum_{j}^{J-1} \alpha_j d_{jit} + u_{it} \tag{2.1}$$

where y_{it} are net capital outflows of country i at time t, α_{oi} represents region fixed effects, x_{it} are other explanatory variables capturing features of the financial sector and of capital mobility. d_{jit} are the population age shares for j age groups in country i at time t and u_{it} is the error term.
I extend the analysis of Higgins (1998) by allowing for heteroskedasticity and first order autocorrelation of the error terms. Heteroskedasticity is introduced into the model by

allowing for differences in variances by country, σ_i^2. Second, a first-order autoregressive process AR(1) with country-specific correlation coefficients ρ_i is specified. This leads to a variance-covariance matrix of the following form:

$$E[\epsilon\epsilon'] = \Omega = \begin{pmatrix} {\sigma_1}^2 V_1 & 0 & \dots & 0 \\ 0 & {\sigma_2}^2 V_2 & \dots & 0 \\ \vdots & \vdots & \ddots & \vdots \\ 0 & 0 & \dots & {\sigma_n}^2 V_n \end{pmatrix} \tag{2.2}$$

where

$$V_i = \begin{pmatrix} 1 & \rho_i & 0 & 0 & \dots & 0 \\ \rho_i & 1 & \rho_i & 0 & \dots & 0 \\ \vdots & \vdots & \ddots & \vdots & \vdots & \vdots \\ 0 & 0 & 0 & \dots & \rho_i & 1 \end{pmatrix} \tag{2.3}$$

Thus, the feasible generalized least squares estimator is given by:

$$\widehat{\beta}_{FGLS} = (X'\hat{\Omega}^{-1}X)^{-1}X'\hat{\Omega}^{-1}y \tag{2.4}$$

and the estimated variance by

$$\widehat{Var}(\hat{\beta}_{FGLS}) = (X'\hat{\Omega}^{-1}X)^{-1} \tag{2.5}$$

where the $\hat{\Omega}$ contains the weights given to each observation according to its country-specific variance and the autocorrelation coefficient.

2.4.2 Modeling the present age structure of the population

Most of the empirical studies of demographic effects use only two broad measures of the population structure: youth and old age dependency rates. The reason for these coarse measures lies in the high multicollinearity of age-specific population shares and the reduction of degrees of freedom when including population shares for detailed age groups.

This study tries to improve on this by modelling the current demographic situation according to the method proposed by Fair and Dominguez (1991). It allows to use the information on the *entire* age structure while avoiding the identification problem arising from multicollinearity.

Consider the specification introduced in equation (2.1) in the last section. Now, I constrain the age share coefficients α_j to lie on a fourth-order polynomial[6]:

$$\alpha_j = \sum_{s=0}^{4} \gamma_s j^s \tag{2.6}$$

[6] I also used higher and lower order polynomials; the results did not change much. For more information, refer to appendix 2.8.2.

where $s \in [0, S]$ and $S = 4$ is the order of the polynomial. A high order polynomial presents a flexible framework for analyzing demographic effects. This restriction is used to reformulate the regression specification by substituting in for the α_j:

$$y_{it} = \alpha_{i0} + x_{it}^{'}\beta + \sum_{s=0}^{4} \left(\gamma_s \sum_{j=1}^{J} j^s \cdot d_{jit} \right) + u_{it} \tag{2.7}$$

I further restrict the sum of the age share coefficients α_j to zero. This normalization allows for a straightforward interpretation of the age share coefficients as deviations from the average demographic effect on international capital flows.
This yields the following relationship of the γ:

$$\gamma_0 = -\frac{\gamma_1}{J} \sum_{j=1}^{J} j - \frac{\gamma_2}{J} \sum_{j=1}^{J} j^2 - \frac{\gamma_3}{J} \sum_{j=1}^{J} j^3 - \frac{\gamma_4}{J} \sum_{j=1}^{J} j^4 \tag{2.8}$$

The parameter γ_0 can be recovered from the four estimated coefficients $\gamma_1, ..., \gamma_4$. These coefficients do not have an intuitive interpretation, but they can be used to recover the original age share coefficients α_j in the next step. The transformed regression specification can be written as:

$$y_{it} = \alpha_{i0} + x_{it}^{'}\beta + \sum_{s=1}^{4} \gamma_s \left(\sum_{j=1}^{J} j^s \cdot d_{jit} - \frac{1}{J} \sum_{j=1}^{J} j^s \cdot \sum_{j=1}^{J} d_{jit} \right) + u_{it} \tag{2.9}$$

In brief:

$$y_{it} = \alpha_{i0} + x_{it}^{'}\beta + \sum_{s=1}^{4} \gamma_s Ds_{it} + u_{it} \tag{2.10}$$

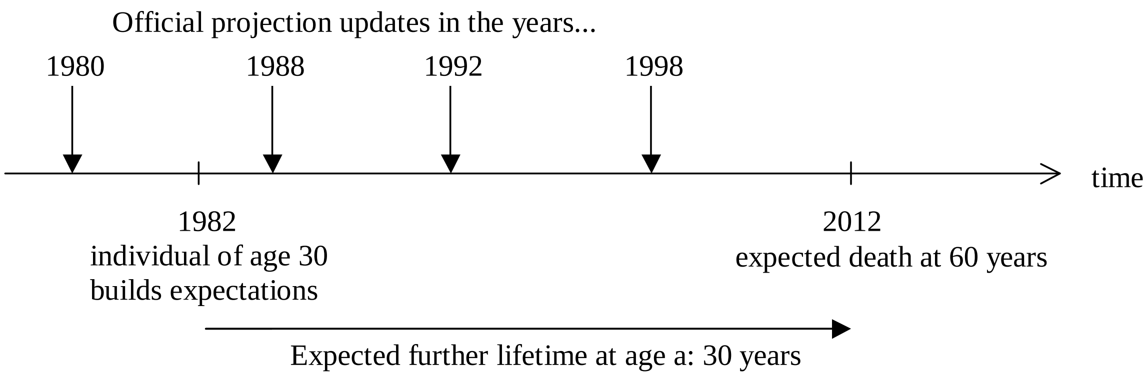
where $Ds = \sum_{j=1}^{J}(j^s \cdot d_{jit}) - \frac{1}{J}\sum_{j=1}^{J} j^s \cdot \sum_{j=1}^{J} d_{jit}$. The $\hat{\alpha}_j$ can be recovered from the $\hat{\gamma}_s$ according to (2.6).
I use population shares of 17 age groups (0-4,5-9,10-14,...75-79 and 80+) to construct the four demographic measures $D1..D4$. Before applying the method by Fair and Dominguez (1991), I transform the absolute age-specific population shares into shares relative to the rest of the world. It is well-known and often emphasized in the literature that it is *relative* demographic changes that will drive capital flows. However, in empirical studies, this insight is always neglected and only absolute changes are used as measures for demography. The transformation of the variables is described in appendix 2.8.1 and will be applied to the future demography variables in the next section as well.

2.4.3 Modeling future demographic trends

To analyze expected future demographic changes as a determinant of international capital flows, I develop anticipation measures that reflect expected demographic changes

over time (i) relative to the *rest of the world*, (ii) at each point in time and (iii) differing by the age structure of the population.
The effect of future demographic changes on current behavior hinges upon the foresight period over which individuals anticipate demographic changes. Based on the life cycle theory, I assume that individuals plan over their expected further lifetime. Since further lifetime differs by age, the anticipation measures are computed for each age group individually and are then aggregated over age groups to obtain the macroeconomic anticipation measure for each country.
Figure 2.3 gives an example how the anticipated demographic changes are computed for the 30 year olds in 1982: I determine the expected further life expectancy of the 30 year olds, here 30 years, and calculate the projected demographic changes over their expected further lifetime on the basis of the relevant information, the 1980 projection. The expected demographic change is the difference in the old age respectively youth dependency ratio between 1982 and 30 years later, in 2012. This procedure is performed for each age group. Finally, I obtain the country's composite anticipation measure by aggregating these age-specific anticipated changes over age groups, weighting each age groups' information with its cohort size.

Figure 2.3: Example of the anticipation effects



One element of the computation is the expected further lifetime of each age group. It is measurable by age-specific data on further life expectancy. However, due to the bad coverage of data on this variable, the results are most likely to be biased, since many developing countries would be excluded from the sample. Hence, I use the difference between life expectancy at birth and the age at time t instead which both vary over time and by country. This underestimates further life expectancy, especially for elder cohorts who might have a negative further life expectancy in this specification. Their planning horizon will be too short. However, robustness checks reveal that the results are not substantially different from those on the basis of age-specific life expectancies. This specification will be labeled Specification 2 in the following. Specification 1 restricts anticipation effects to zero.
In order to investigate whether anticipation has a long or only a short-term effect on

international capital flows, I use an additional specification for the future demography variables, labeled Specification 3: I determine the further lifetime of each age group. Then, I split the age groups into four categories according to their planning horizon: 0 to 10 years, 10 to 20 years, 20 to 30 years and 30 to 50 years. Next, I compute the population shares of these four groups. Finally, I calculate the demographic changes in the short run, i.e. t and $t+10$, in the medium run for $t+20$, and so forth, and weight them by the population shares of the four groups. By doing so, I can identify whether short- or long-term demographic changes have an effect on international capital flows.
I construct these measures for demographic changes in youth and old-age dependency rates seperately. These ratios summarize the broad dimensions of the demographic changes ahead. As in the last section, I transform these ratios into relative dependency ratios. The resulting explanatory variables in Specification 2 are labeled YNG and OLD. Specification 3 contains four variables on the basis of changes in relative youth dependency, $YNG10, 20, 30$ and 50, and four based on old-age dependency ratios, $OLD10, 20, 30$ and 50.

2.4.4 Capital mobility factors and financial sector influences

Apart from demographic changes, capital flows crucially depend on the degree of capital mobility in a globalized capital market (see Section 2.2.3). Hence, I include a set of variables that capture some determinants of capital mobility.
The openness of a country towards foreign capital is most directly determined by the existence of capital controls.[7] These controls can prevent capital from flowing between countries. Therefore, I include the dummy variable ($CONTROL$) that takes the value one if restrictions on the current or capital account are in place or if there exist regulations for the surrender of export proceeds.
A second factor are capital gains taxes (TAX). Foreign investors may fear high taxation of their investment returns so that high taxes will discourage foreign investors if taxes have to be paid in the country where the funds are placed. At the same time, high capital gains taxes also discourage investment in the home country by domestic investors. Only a crude measure is available here: taxes on income *and* capital gains. However, income taxes will also affect international capital flows via their depressing effect on savings.
Another tax measure is taxes on international trade ($TRADETAX$). Since capital flows and trade are closely linked through national accounts, I expect that high taxes on international trade will be a disincentive towards capital outflows.
To capture additional non-demographic effects driving capital flows, several variables describing the financial sector in the home country are included. They are the so-called 'pull factors' that capture accessibility, development status and effectiveness of

[7] A detailed description of capital controls is provided in Cooper (1999) and Montiel and Reinhart (1999).

domestic financial markets. The size of the financial sector ($SIZE$) is widely used as a measure of how accessible the capital market is (Levine and Zervos 1993). It is defined as ratio of liquid liabilities to GDP. Next, $PRIVATE$ is private credits as percentage of GDP. Due to limited data coverage, the ratio of private to total domestic credit ratio is not available. Therefore, I use $PRIVATE$ as a proxy for the involvement of private agents in the financial sector.
Next, I include the variable $CIVIL$ from House (2002) capturing the rule of law and the security of property rights. $CIVIL$ is constructed from survey results in the form of a checklist and takes values from 1 to 7 where 1 represents the highest degree of civil liberties. Recent studies show that especially the security of ownership rights, but also the enforceability of legal claims are vital growth enhancing factors (Knack and Keefer 1995; Barro and Sala-I-Martin 1995). If the rule of law and the security of property rights are weak, then this also comprises capital transactions. Investors planning a new site or production location in a foreign country will certainly be interested in securing their investments. The worse the infrastructure and security to do so, the less they will be prepared to invest in that country. The same argument holds for other types of investment.
Yet another variable from the Freedom House Indicators, $RIGHTS$, is included in the analysis. It reflects the status of political rights and freedom and the voting rights of the public. This variable is taken as a proxy for the political risk that investors face.
Finally, I recognize the role of education in explaining capital flow patterns. The variable $SCHOOL$ captures gross school enrollment in secondary education. It is often argued that omitting human capital when researching the link between demography and international capital flows leads to biased results. This bias would be present, if aging induces a scarcity of labor associated with increased investments in education that will make the scarce factor more productive. Furthermore, schooling might have an effect on net capital flows since increases in schooling trigger a higher labor productivity, raising incomes and thereby savings rates. Higher savings rates will increase net capital outflows. Hence, the demographic effects can be separated from human capital effects. Since the schooling variable is often reported in 5-year-intervals only, I linearly interpolate $SCHOOL$.

2.5 Results

This section presents the results of the empirical model developed in Section 2.4.1. Three specifications are estimated. The simple Specification 1 in the second column of table 2.2 does not account for future demographic changes as a potential determinant of international capital flows, but confines to present demography only. In Specifications 2a and b, I add the future trends in youth and old-age dependency rates, as described in detail in Section 2.4.3. The future demography variables enter in a continuous way. They contain aggregated information on the demographic changes in relative youth and old-age dependency over the individual planning horizon of each cohort. In order to learn more about the relation between short- and long-term anticipation effects, Specifications 3a and b (table 2.3) contain the aggregated future demography changes splitted into four variables each for the two dependency ratios. These four variables are lead variables that cover expectations over different time horizons - short-term, medium-term and long-term. Specification b differs from a by the additional interactive term of capital market imperfections, i.e. the size of the domestic financial sector, and the anticipation measures. These variables are supposed to test the hypothesis that anticipative behavior has a larger effect when capital market imperfectionsThe interacted variables are labeled $OLD..i$ and $YNG..i$. Table 2.1 contains the list of variables.

Table 2.1: List of variables

Dependent variable	
NET CAPITAL OUTFLOWS	gross domestic savings - gross domestic investment (percent of GDP)
Present demography variables (see section 4.2)	
D1..D4	Transformed present demographic variables that identify the polynomial
Future demography variables (see section 4.3)	
OLD(YNG)	Change in relative old-age (youth) dependency over the expected further lifetime of each age group, aggregated for each country i at time t
OLD(YNG) 10..50	Change in relative old-age (youth) dependency over the expected further lifetime of each age group, classified into four foresight periods and aggregated for each country i at time t
$OLD(YNG)i$	interactive terms: anticipation measures OLD(YNG)*SIZE
$OLD(YNG)10..50i$	interactive terms: anticipation measures OLD(YNG)10..50*SIZE
Other explanatory variables (see section 4.4)	
SIZE	Liquid liabilities as percentage of GDP
PRIVATE	Private credit as percentage of GDP
TAX	Taxes on income and capital gains in percent of current revenue
TRADETAX	Taxes on international trade in % of current revenue (incl. import duties, profits of ex- or import monopolies, exchange profits, and exchange taxes)
SCHOOL	Gross school enrollment in secondary education
GROWTH	GDP growth rate, lagged
CONTROL	Dummy variable: 1 if capital controls present, otherwise 0 (see *IMF(1999)* for further details)
CIVIL	Indicator capturing the rule of law, security of property rights, human and organizational rights, freedom of expression and belief (ranging from 1 to 7: 1 = highest degree of civil liberties, 7 = lowest)
RIGHTS	Political rights indicator (ranging from 1 to 7: 1 = highest degree of political rights, 7 = lowest)

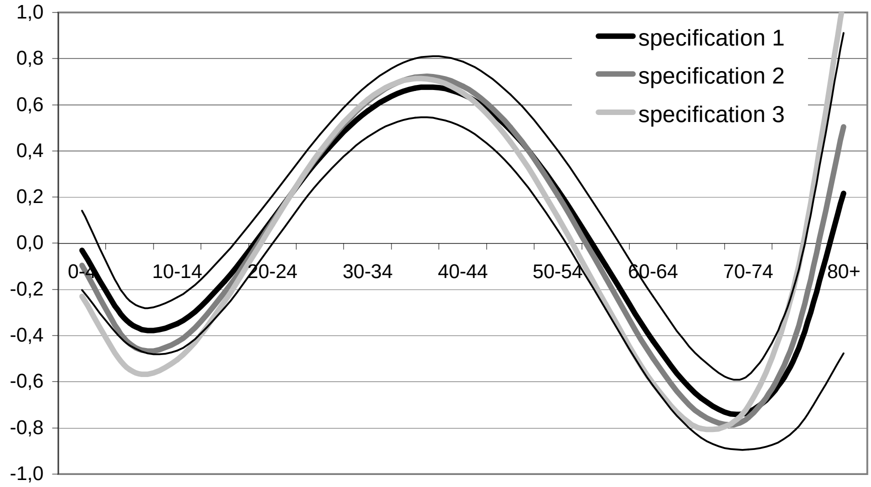
Sources: World Development Indicators (WDI) 2000, UN Population Projections (UN)1998, Freedomhouse Indicators, and own calculations

In the following, I discuss the results of the different specifications, as shown in Figure 2.2. The discussion is organized along the three groups of explanatory variables: present and future demography and other covariates.

2.5.1 Present demography

Since the four variables capturing present demography have no direct interpretation, the bold lines in Figure 2.4 show the implied age share coefficients for Specification 1, surrounded by a 95% confidence interval, and the other two specifications.

Figure 2.4: Age share coefficients by age group for current demography: specifications 1-3



Annotation:
specification 1: present demography effects only
specification 2a: present and future demography, aggregated over age groups
specification 3a: present and future demography, classified into four foresight periods

In Specification 1 where future demography is not considered, the age share coefficients are significantly negative for ages 5 to 15. Hence, a high youth share tends to draw the economy into a current account deficit. This finding is in line with the theoretical argument that "young" economies have a high investment demand while generating few savings domestically. Even stronger demographic effects are present in the middle of the age distribution: a large working age population in its twenties to mid-fifties generates large net capital outflows. A one percent rise in the relative population share of those between 35 and 40 years induces an increase in net capital outflows of about 0.7 percent. These population groups are in their high savings years. Finally, the results show a reverse effect for the elderly. A high relative share of those aged 65+ is associated with a tendency towards capital inflows. This effect can be explained by declines in savings and the repatriation of capital for consumption in

old age. The coefficients for those of age 70 and older cannot be trusted much, since the confidence intervals become very large at the ends of the age distribution.
These results do not change substantially when expected future demographic change is included in the analysis in Specifications 2 and 3. The shape of the present demographic effect is very similar, as can be seen in Figure 2.4. The amplitude increases, but the point estimates lie within the confidence interval of the estimated coefficients from Specification 1 except for very young ages. Hence, the estimation results for the present demography variables are robust. I also tried various other specifications of the future demography variables based on further life expectancy instead of life expectancy at birth. Furthermore, I estimated the three specifications without the interpolation of the schooling variable, reducing the sample size by about 30%, and third, I averaged the data in 5 year intervals to see whether autocorrelation effects like business cycles drove the effects. Finally, I included lagged GDP growth in the regressions in order to capture country-specific heterogeneity resulting from different growth patterns (see appendix 2.8.3). The results do not change much over all these variations of the regression specification.

2.5.2 Future demography and its interactions with capital market imperfections

The results provide evidence that anticipation of *future* demographic changes does affect international capital flows *today*.
The results for the future demography variables YNG... in Specifications 2 and 3 point to a significant impact of anticipated demographic changes on current net capital flows. A rising youth dependency rate over the further lifetime of the population affects capital outflows negatively. This is in line with the argument from Section 2.3 that a high expected youth share will induce additional investment in the domestic economy due to the rising labor force in the future. Specification 3 shows that the anticipation effects concerning future youth dependency are stronger for shorter planning horizons. There are a couple of reasons for this: First, capital market frictions are more important for the short and medium-run and will be less important in the long-run. Second, this result might be an indication that individuals do not plan over very long horizons. And third, individuals might have a large discount factor such that in spite of anticipation, long-term demographic changes do not strongly influence their behavior.
An anticipated increase in relative youth dependency signifies that the age structure in the domestic economy will become younger relative to other countries in the future; this leads to rising demand for capital and thus attracts additional capital and keeps domestic capital within the domestic market.
I do not find evidence of anticipation effects in old-age dependency. This is most likely due to little variation in old age dependency over the projections and due to a problem of multicollinearity: if a high share of elderly people is expected for the future, then

Table 2.2: Regression results for specifications 1 and 2

Dependent variable: NET CAPITAL OUTFLOWS			
	SPEC 1	SPEC 2a	SPEC 3a
Present demography			
D1	-1.057 (5.73)***	-1.171 (6.51)***	-1.193 (5.87)***
D2	0.312 (7.02)***	0.350 (7.95)***	0.372 (7.35)***
D3	-0.030 (7.32)***	-0.034 (8.26)***	-0.037 (7.89)***
D4	0.001 (7.07)***	0.001 (7.99)***	0.001 (7.95)***
Expected future demography			
OLD		-0.010 (0.52)	
YNG		-0.089 (4.75)***	
OLD10			-0.083 (0.88)
OLD20			0.017 (0.11)
OLD30			0.140 (0.98)
OLD50			-0.079 (1.52)
YNG10			-0.240 (4.34)***
YNG20			0.314 (3.47)***
YNG30			-0.208 (2.04)**
YNG50			-0.089 (1.71)*
Other covariates			
SIZE	-0.023 (2.05)**	-0.0248 (2.27)**	-0.0234 (2.08)**
TAX	0.028 (2.35)**	0.0216 (1.88)*	0.0444 (3.71)***
TRADETAX	-0.126 (8.36)***	-0.1198 (8.06)***	-0.1052 (6.66)***
PRIVATE	-0.034 (4.00)***	-0.0317 (3.80)***	-0.0405 (4.93)***
CONTROL	-0.015 (4.34)***	-0.0162 (4.70)***	-0.0152 (4.36)***
RIGHTS	-0.003 (3.53)***	-0.0025 (3.35)***	-0.0020 (2.55)**
CIVIL	0.002 (1.43)	0.0014 (1.42)	0.0022 (2.15)**
SCHOOL	0.036 (3.21)***	0.0332 (3.01)***	0.0271 (2.38)**
CONSTANT	0.031 (2.35)**	0.0415 (3.37)***	0.0439 (2.91)***
Observations	1823	1823	1802

Absolute value of z statistics in parentheses
** significant at 10%; ** significant at 5%; *** significant at 1%*
FGLS estimation with country-specific AR(1)-process and heteroskedasticity.
17 region dummies included.

Table 2.3: Regression results with interactions of expected future demography*CMI

Dependent variable: NET CAPITAL OUTFLOWS			
	SPEC 2b CMI=SIZE	SPEC 2c CMI=CONTROL	SPEC 3c CMI=SIZE
Present demography			
D1	-1.006 (5.47)***	-1.088 (6.22)***	-1.280 (5.92)***
D2	0.308 (6.79)***	0.334 (7.75)***	0.389 (7.25)***
D3	-0.030 (7.06)***	-0.033 (8.11)***	-0.038 (7.69)***
D4	0.001 (6.80)***	0.001 (7.89)***	0.001 (7.69)***
Expected future demography			
OLD	0.025 (0.47)	-0.057 (2.38)**	
YNG	-0.196 (5.67)***	-0.149 (4.35)***	
OLD10			-0.094 (0.40)
OLD20			-0.231 (0.65)
OLD30			0.284 (0.88)
OLD50			0.0004 (0.00)
YNG10			-0.164 (1.51)
YNG20			0.515 (2.96)***
YNG30			-0.526 (2.64)***
YNG50			0.025 (0.26)
Expected future demography (interacted with CMI)			
OLDi	-0.065 (0.77)	0.080 (2.47)**	
YNGi	0.307 (4.12)***	0.073 (2.16)**	
OLD10i			-0.058 (0.16)
OLD20i			0.745 (1.23)
OLD30i			-0.488 (0.92)
OLD50i			-0.128 (0.71)
YNG10i			-0.088 (0.38)
YNG20i			-0.682 (1.79)*
YNG30i			0.948 (2.03)**
YNG50i			-0.289 (1.38)
Observations	1823	1802	1802

Absolute value of z statistics in parentheses.
** significant at 10%; ** significant at 5%; *** significant at 1%*
FGLS estimation with country-specific AR(1)-process and heteroskedasticity.
17 region dummies, SIZE, TAX, TRADETAX, PRIVATE, CONTROL, RIGHTS, CIVIL, and SCHOOL included (not reported).

one observes a high youth dependency ratio in this country now. Therefore, it is likely that the OLD... variables are highly correlated with the present demography variables. Furthermore, since tomorrow's elderly are already born today, there will not be much news in the projections about their numbers in 30 or 40 years. Variation will mainly stem from improvements in longevity. Thus, it is not surprising that significant effects can be found only for expected changes in relative youth dependency in this study.
In Specifications 2b and 3b, I include the interactive terms of capital market imperfections and anticipation measures in the regressions. I also estimate Specification 2 using the capital control variable in the interactive term (Specification 2c). Fig 2.3 shows the results: The existence and nature of the capital market imperfections determines how anticipation alters international capital flows. If there are capital controls in place, then the simple anticipation effect is reversed, as can be seen from the reverse sign of YNG and $YNGi$ in Specification 2b. The reason is the argument raised in section 2.3.1: If the capital market is closed, then anticipation does not help much, since capital cannot be invested abroad. Thus, the $CONTROL$ variable is a discrete indicator, of whether capital markets are open or not.
On the other hand, the size of the domestic variable measures, how well developed the domestic capital market is and *how* open the domestic capital market is. The more developed the market is, the more it will attract foreign, and domestic capital and net capital outflows will decline. At the same time, if the capital market is very well developed and open to foreign investors, then anticipation does not play a large role. If capital were perfectly mobile, then we should not observe anticipation effects, since capital could be reallocated at any point in time. Therefore, anticipation effects become weaker, the more integrated the capital market is. The results for $YNGi$... in Specifications 2b and 3b show that there is evidence supporting this hypothesis in the data, and again, the effects are significant for (interacted) anticipated changes in youth dependency only.
On the basis of these results, the inclusion of anticipation effects in analyzing the link between demographic change and international capital flows appears to be crucial. The anticipation effects found in this paper are non-negligible and depend upon the degree of capital market imperfections. Even more, the results for present demography become more precise, when anticipation effects are included. Accounting for anticipation effects is necessary to understand the timing of the effects of demographic change. The timing will affect capital returns as well as other economic developments in a complex way.
This analysis provides evidence that savings and investment patterns today adapt not only to present but also to expected future demographic changes. Especially economic forecasts should therefore incorporate these effects into their simulation models, and model capital mobility carefully since it does not only affect international capital flows directly, but also indirectly via its interrelation with anticipative behavior.

2.5.3 Financial sector and other explanatory variables

An increase in the size of the financial sector leads to a small decrease in net capital outflows which is significant in all specifications. Since *SIZE* is a measure of how developed the financial sector of a country is, a larger size renders the domestic financial market place more attractive for foreign investors and may also absorb a higher share of national capital.
On contrary, high taxes on income and capital gains (relative to total revenues), measured by the TAX variable, make capital outflows more likely. Capital outflows become more attractive since lower taxes are levied upon the returns abroad. The opposite holds for taxes on international trade ($TRADETAX$) which are highly statistically significant: They include import duties, profits of export or import monopolies, exchange profits, and exchange taxes. All these components hamper not only goods, but also capital mobility. The results clearly show that their effect is asymmetric and hampers capital outflows more than inflows.
The same result holds for the capital control variable ($CONTROL$). Explicit restrictions and regulations of capital flows decrease the volume of capital invested abroad.
A final indicator of the intensity of national capital market activities is the variable $PRIVATE$, a proxy for the role of private investors in the national capital market. The hypothesis, that an active involvement of private players in the capital market goes along with less market regulation and more competition and thus more capital imports, is supported by the results, that show a clearly significant negative effect on capital exports.
The two variables $CIVIL$ and $RIGHTS$ coarsely capture general political risk, and the security of property rights as well as the rule of law. The results for $RIGHTS$ confirms the conjectures from section 2.4.4. The significant negative coefficient for $RIGHTS$ in all specifications implies that the stronger political rights, the higher is the tendency towards being a capital importer. I cannot find robust evidence of a significant relationship between civil rights and net capital flows.
At last, I include $SCHOOL$ in the empirical model. The results show that the demographic effect still exists, even when controlling for changes in human capital, or labor productivity. Furthermore, the better the evolution of human capital, the more capital outflows occur. This effect stems from the labor productivity increasing effect of schooling which translates into higher savings rates and higher net capital outflows.

2.6 The demographic effect in selected countries

This section is designated to further illustrate the importance of demographic effects on international capital flows. For that purpose, I present in and out of sample projections of the effect of the demographic variables on net capital outflows. The purpose of this section is not to present a forecast of future net capital flows. I simply calculate the predicted net capital outflows induced by demography only. Thus, all explanatory factors other than present and future demography are neglected for a moment, i.e.

all other covariates are set to zero. Thus, this section should be viewed as a thought experiment to illustrate the demographic effects for some selected countries.
Figure 2.5 illustrates the relative differences in youth and old age dependency rates between 1960 and 2000. The results are surprising: cross country differences in old age dependency were not very large before 2000, but are projected to become substantial afterwards - in some countries, old age dependency will more than double. The differences in the relative age structure before 2000 are mainly driven by large differences in youth dependency. Even after 2000, fertility is projected to play an important role in defining the differences in age structure across countries.
Figure 2.6 shows the projected demographically induced net capital outflows resulting from Specification 1 with present demography only, and Specification 3a which includes present demography as well as anticipation effects. The comparison of the relative dependency ratios and the predicted net capital outflows illustrates the regression results from Section 2.5. The cross-country comparison of the levels of demographically induced capital flows shows that in 1960, age differences resulted mainly from differences in youth dependency. Countries with a low relative population share of young people like Canada, Sweden, Argentina and Japan, for example, display demographically induced capital outflows. In 2020, countries with a relatively high share of young people like the US and Sweden will tend to be capital importers.
The demographic effects on capital flows can be illustrated very well over time, too. For example, Argentina's old age dependency will change little relative to the rest of the world, while its relative youth dependency will increase substantially. Hence, Argentina becomes younger in relative terms and will import more and more capital flows over time. The projected demographically induced capital flows in Figure 2.6 shows exactly this pattern. Brazil's relative youth dependency on contrary will decrease and its old age dependency is roughly flat over time, such that it tends to turn from a net capital importer to an exporter.
In general, the decline in youth dependency in European and other OECD countries like Japan is relatively moderate compared to the decline in less industrialized countries like Brazil, China and India. Hence, in terms of youth dependency the former are aging less than the latter. This demographic counter-movement of the two groups becomes more and more pronounced after 2000, so that capital exports of the European countries tend to shrink since the differences in youth dependency dominate the differences in relative old age.

Figure 2.5: Relative youth and old age dependency rates, selected countries, 1960-2050

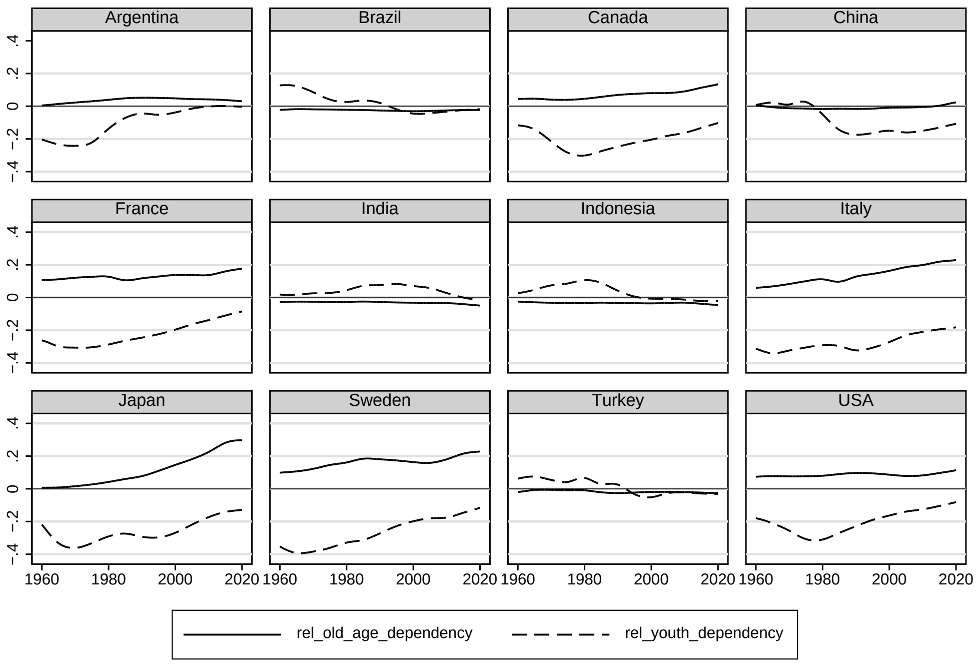
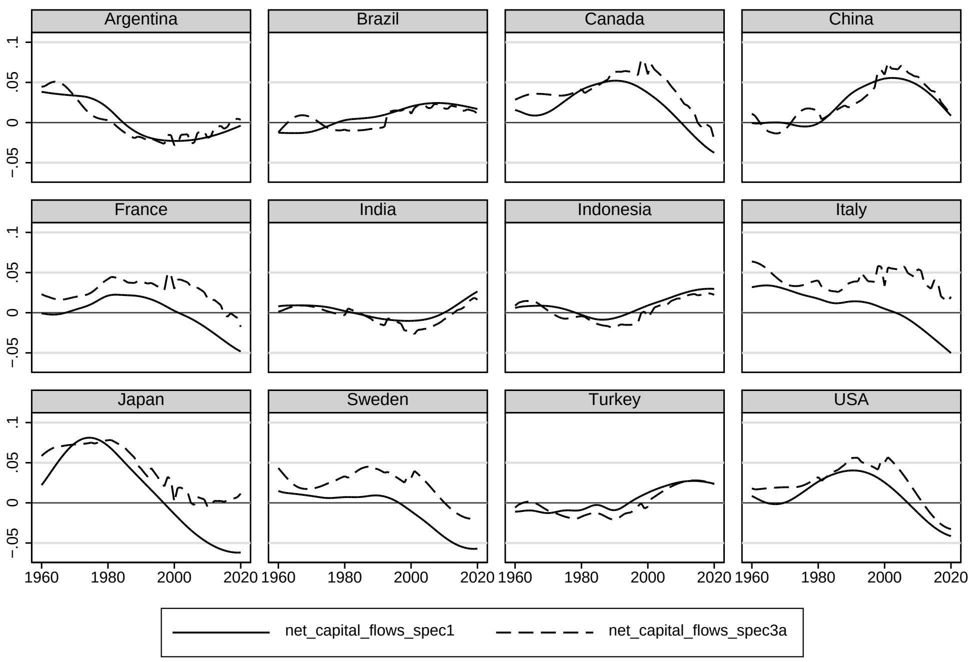


Figure 2.6: Demographic effects on net capital outflows, predictions of the pure demographic effects, 1960-2020



The effects of future demography are also visible: First, they become obvious when comparing the results of the two different specifications in Figure 2.6. Second, while relative youth dependency is increasing steadily after 1980, the increase in relative old-age dependency will begin only around 2010. This increase is anticipated and thus, capital exports are already starting to decline around the year 2000, i.e. before 2010.

Table 2.4 illustrates the quantitative importance of demographic effects. Following the representation of Higgins (1998), I calculate the 'demographic swings': For a given period, the demographic effect on a country's net capital outflows can be calculated as the demographically-induced deviations from the average net capital outflows over this period [8]. The difference between these demographic effects at two points in time is the demographic swing - the demographically induced change in net capital outflows. I calculate the swings between 1996 and 1970 for two specifications: specification 1 which contains present demography only, and specification 2a, which also incorporates anticipation effects.

Table 2.4: Demographic effects with and without anticipation effects, 1970 vs. 1996, selected countries

	with anticipation specification 2a	without anticipation specification 1
Argentina	-1.63%	-1.87%
Brazil	7.27%	6.17%
Canada	8.60%	7.00%
China	9.07%	7.64%
France	5.52%	4.39%
India	2.60%	2.07%
Indonesia	3.79%	3.04%
Italy	3.16%	1.80%
Japan	-2.47%	-3.33%
Sweden	4.14%	2.87%
Turkey	6.32%	5.30%
USA	8,36%	6,96%

The results show that the effects are quantitatively non-negligible, and that the demographically induced capital flows are larger in many of the selected countries when anticipation is taken into account. As an extreme case, the USA experienced a marked increase of net capital outflows, amounting to 6.96 per cent of GDP in 1996 compared to 1970. When anticipation effects are also accounted for, the demographically induced changes in net capital outflows total to 8.36 per cent of GDP. However, even in other

[8] This is the sum of the product of (i) the deviations of the age shares from their country-specific means, and (ii) the corresponding age share coefficients from the regression.

countries, the difference of the demographic swings between the two specifications is around 1 percentage point.

2.7 Conclusions

Demographic change has a profound impact on international capital flows. Economies with a relatively young age profile attract foreign capital from the aging countries due to the widening demographic gap. The strongest effect is found for the working age population.

The contribution of this paper is to provide empirical evidence of demographic anticipation effects on international capital flows. Future demographic changes are reflected in capital accumulation and investment outcomes today. In particular, future declines in youth dependency rates are associated with anticipative capital outflows. Additionally, the paper shows that these anticipation effects hinge upon the degree of international capital mobility and the development state of the domestic market. These findings emphasize the dynamic nature of the link between demographic changes and economic outcomes.

Demographic effects are quantitatively non-negligible and will become increasingly important during the next decades due to the unprecedented aging process in the developed world and the large demographic heterogeneity across world regions. It is important to identify demographic and non-demographic determinants of capital flows at times of global capital market integration and an upswing of cross-border transactions. Knowledge about the factors driving these capital flows is also crucial in policy-making. As an example, these factors play a key role in the perspectives of partially funded pension systems, since their design determines where the additionally accumulated capital will be invested. International capital flows also provide a mechanism to dissolve demographic pressure on domestic capital returns in aging economies that shift to a partially funded pension system.

An even more intuitive political field for application are the development and design of capital market structures and the role of institutional investors that can help channel domestic savings to foreign capital markets while providing for diversification of country-specific risks.

This paper shows that international capital flows are able to mitigate the negative economic consequences of the population age mismatch in the developed world by reducing the demographic pressure on capital returns in domestic markets. This mechanism has beneficial impacts on young developing countries as well since it provides them with the additional capital supply that is urgently needed.

In terms of policy implications, this mutual benefit can be strengthened by improvements in the international financial infrastructure, and thus enhancements in international capital mobility.

2.8 Appendix

2.8.1 The construction of the demographic variables

This section describes how the demographic variables are transformed. The basic idea is that demography matters only in terms of relative differences to other countries. This should be reflected in the demographic variables.

First, I calculate the weighted sum of population age shares in the *rest of the world*. The weights are the average population sizes $POPAVG$ between 1960 and 1997 of each country.

In the next step, I calculate the population shares of each age group j in the *rest of the world* from the perspective of country i at time t, $FORPOP_{ijt}$:

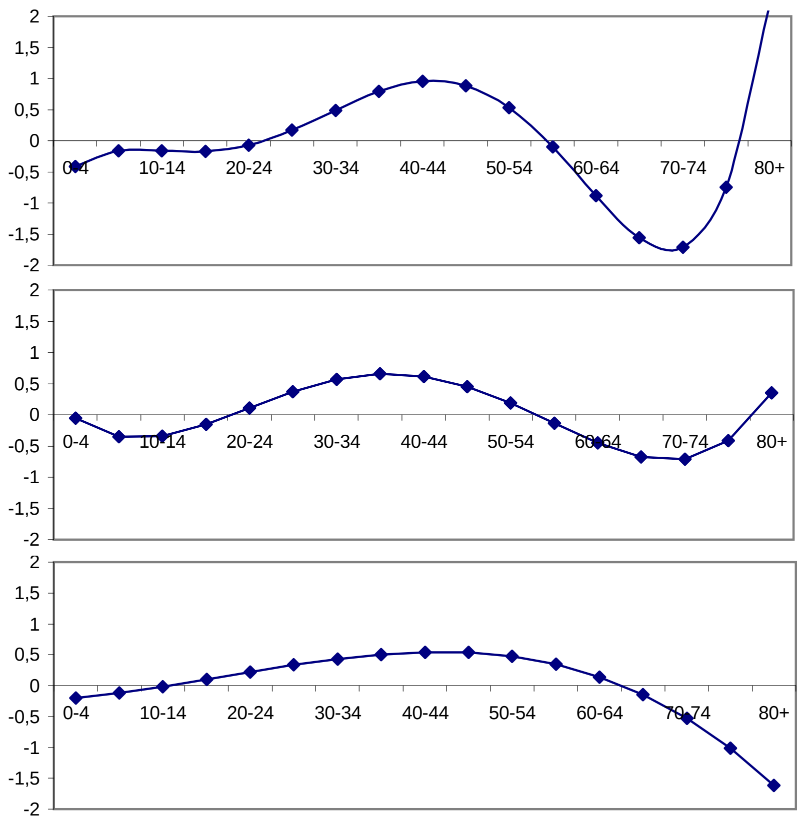
$$FORPOP_{ijt} = \frac{\sum_{k \neq i}^{K} d_{kjt} * POPAVG_{kj} - d_{ijt} * POPAVG_{ij}}{\sum_{k \neq i}^{K} POPAVG_{kj} - POPAVG_{ij}},$$

where d_{ijt} is the share of age group j in the population of country i at time t. The final step consists of taking the difference between the demographic variable in country i and in the rest of the world ($FORPOP_{ijt}$). The resulting variable $RELPOP_{ijt}$ represents the relative difference in the share of age group j between country i and the *rest of the world* at time t. The same procedure is applied to the dependency rates.

2.8.2 Robustness checks concerning the order of the polynomial

In order to check whether the polynomial of the present demography, described in section 2.4.2, is properly specified, I also estimate polynomials of third and fifth order. However, generally, choosing a high-order polynomial is unproblematic, because all lower order polynomials are nested in this specification. As can be seen in Figure 2.7, the third order polynomial is obviously too inflexible and does not model the demographic effects properly. The fifth-order polynomial displays a high sensitivity at the ends of the polynomial function. Thus, the fourth-order specification seems to be most suitable for analyzing demographic effects.

Figure 2.7: Estimated current age share coefficients: specification using a) a fifth order, b) a fourth order, and c) a third order polynomial structure



2.8.3 Sensitivity analysis: Including lagged GDP growth in the regressions

Table 2.5: Regression results for specifications 1 and 2

Dependent variable: NET CAPITAL OUTFLOWS			
	SPEC 1	SPEC 2a	SPEC 2b
Present demography			
D1	-1.026 (5.52)***	-1.173 (6.38)***	-0.999 (5.39)***
D2	0.307 (6.81)***	0.355 (7.80)***	0.312 (6.75)***
D3	-0.029 (7.14)***	-0.034 (8.08)***	-0.030 (7.06)***
D4	0.001 (6.95)***	0.001 (7.82)***	0.001 (6.84)***
Expected future demography			
OLD		-0.009 (0.51)	0.035 (0.65)
YNG		-0.104 (5.26)***	-0.219 (6.65)***
OLD*SIZE			-0.081 (0.99)
YNG*SIZE			0.333 (4.72)***
Other covariates			
SIZE	-0.025 (2.26)**	-0.025 (2.30)**	-0.035 (3.20)***
TAX	0.032 (2.64)***	0.028 (2.35)**	0.024 (2.06)**
TRADETAX	-0.115 (7.26)***	-0.119 (8.06)***	-0.114 (7.29)***
PRIVATE	-0.030 (3.62)***	-0.030 (3.80)***	-0.027 (3.49)***
CONTROL	-0.014 (3.89)***	-0.015 (4.36)***	-0.014 (4.14)***
RIGHTS	-0.003 (3.38)***	-0.003 (3.30)***	-0.002 (2.94)***
CIVIL	0.001 (1.09)	0.001 (0.83)	0.002 (1.53)
SCHOOL	0.035 (3.12)***	0.031 (2.73)***	0.034 (3.06)***
GROWTH(t-1)	-0.053 (3.12)***	-0.056 (4.41)***	-0.056 (4.67)***
CONSTANT	0.026 (1.87)*	0.039 (2.84)***	0.035 (2.48)**
Observations	1804	1804	1804

Absolute value of z statistics in parentheses
** significant at 10%; ** significant at 5%; *** significant at 1%*
FGLS estimation with country-specific AR(1)-process and heteroskedasticity.
17 region dummies included.

3 Population aging and the demand for goods & services

3.1 Introduction

This chapter analyzes how population aging can affect the aggregate national structure of the demand for goods and services. Individual consumer spending for different goods change markedly over the life cycle. In an aging economy like Germany, these individual profiles translate into changes in the aggregate composition of goods demand.

The consumption and savings literature has become increasingly aware of the necessity to study the consumer behavior of households around retirement (Banks, Blundell, and Tanner 1998; Gustman and Steinmeier 1999; Hurd and Rohwedder 2003; Hamermesh 1984; Lundberg, Startz, and Stillman 2001; Miniaci, Monfardini, and Weber 2003). The behavior of retirees might differ substantially from that of working citizens, if one considers their time budget for leisure activities, their health status and the changes in income at retirement. In the course of the aging process, these households play an increasing role in the economy.

However, not only the behavior of the elderly attracts more interest in the course of an unprecedented aging process. What will be the macroeconomic changes? Will the differences in consumer demand over the life cycle change the national demand structure? If, for example, the share of health in overall expenditures rises significantly due to the needs of the elderly, this will affect the production of health goods in the future. More generally, changes in the age structure of the population are likely to trigger substantial sectoral shifts. Thus, predicting long-term demographic trends on demand is important for the planning of long-term investments. Such demand changes will also affect other areas of the economy. The effect on national production depends on the trade activities, which might react to demand changes as well. In addition, sectoral employment is closely linked to sectoral production. If sectoral mobility of employees is low, adjusting the sectoral production to changes in demand might be difficult, which increases the value of long-term predictions. Thus, this chapter is part of a broader research agenda investigating the effects of demographic change on capital, labor and goods markets at the macroeconomic level and the above mentioned interactions between these effects.

A shift-share analysis by Börsch-Supan (2003a) gives a coarse first investigation of the aggregate aging effects on the composition of consumer expenditures. Projected expenditures for health in Germany are found to be increasing with population aging, while transportation expenditures decrease markedly.

The chapter contributes to the aging literature by extending this analysis, and to the demand literature by providing macroeconomic projections of the demand for various goods based on a micro-level analysis of age-specific household behavior. The analysis is conducted for West German households between 1978 and 1998. I apply the quadratic extension of the classical Almost Ideal Demand System model (QUAIDS) by Banks, Blundell, and Lewbel (1997) to household data from five waves of the EVS (Einkommens- und Verbrauchsstichprobe), a German household budget survey.

Micro- and macroeconomic estimates of consumer demand are often difficult to reconcile. Blundell, Pashardes, and Weber (1993) find that micro-level forecasts of consumer demand do not necessarily outperform macro-level ones. In order to avoid aggregation bias, some basic distributional weights have to be included in macroeconomic forecasts. The stability of the macro-level results hinges upon low variation of these aggregation weights respectively their predictable evolution. I argue in this chapter, that the aging process does not only alter the population age structure, but also other household characteristics. Hence, an aggregation of micro-level demands seems preferable given the expected instability of the aggregation weights over time.

I aim at disentangling various effects of population aging on demand. Thus, I construct four scenarios: First, I investigate the isolated effect of a change in the population age structure on demand. Second, I take economic growth into account, which leads to increasing household incomes and increasing total expenditures. Next, I analyze two indirect effects of population aging: The first is associated with the social security system. Demographic pressures in financing old-age pensions have to be borne either by higher contributions or lower benefits in a pay-as-you-go system. Depending on how the system is designed, the intergenerational distribution of this burden is in favor of the young or the old, creating different income distributions and consumer budgets. I analyze this change in the intergenerational distribution of economic resources by computing aggregate demand under two extreme pension schemes, that have been discussed in Germany. Second, aging goes along with changes in household composition. These are caused by lower fertility since the baby bust, the increasing number of single households and childless two-person households and the high number of elderly single households. This scenario technique helps understanding the various mechanisms through which population aging affects the aggregate demand for certain goods and services.

In the microeconomic analysis, I find strong age-specific differences in the demand of households for the eight composite goods considered. In the course of the life cycle, goods and services in the categories health and education & leisure become more important components of total nondurable expenditures. In an aging economy like Germany, these age effects translate into demand changes over time on the macroeconomic level. I show that these changes are substantial. Especially furniture, clothing, transport and education & leisure expenditures become less important factors in total spending - their share in total expenditures decreases by up to 20 percent. On contrary, the share of health in aggregate spending increases by 6 to 9 percent and Other goods sizeably gain in weight as well.

Analyzing the direct and indirect effects of aging, I find the following: While the pure effect of a shift in the population age structure does already trigger significant demand changes, the effects are magnified when moderate growth in total expenditures is assumed. Furthermore, different intergenerational distributions of total expenditures -as modelled by the two pension schemes- do not result in large differences in the projected evolution of aggregate demand composition. This is due to the small distributional changes that are assumed, although two extreme pension schemes are modelled. Hence, even under extreme reform proposals, the effect of expenditure growth is much stronger than the indirect effect resulting from a pension reform and its effect on the spending power of households.
Finally, accounting for changes in family formation which lead to a rapidly decreasing household size, but a slow decrease in the number of households, does not alter the results substantially either. The effect of population aging becomes slightly smaller, but the qualitative results are the same.
In summary, the results indicate that future trends in consumer demand caused by population aging. However, these changes are not caused solely by age-specific tastes, but also to a large extent by the different spending power of the age groups.

The remainder of the chapter is organized as follows: Section 3.2 contains the estimation of the age-specific demand patterns of households. Section 3.3 uses these estimates and projects the macroeconomic effects of population aging on demand. First, the aggregation procedure is developed (Section 3.3.1). Second, I describe the scenarios (Section 3.3.3) and subsequently present the results of the demand projections in the four scenarios (Section 3.3.4). Section 3.4 concludes.

3.2 The microeconomic analysis of the life cycle demand patterns of households

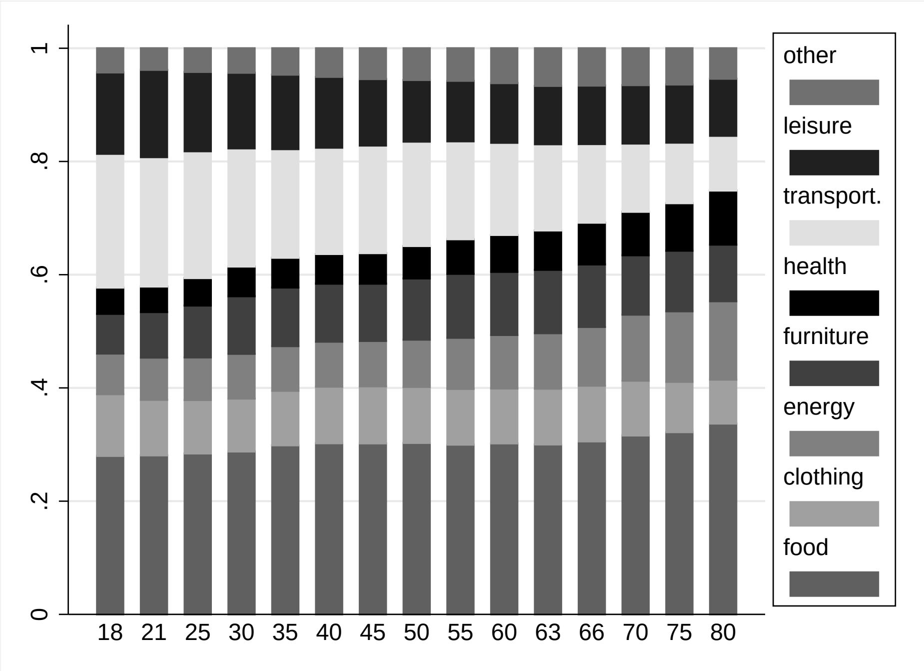
In this first part of the chapter, I investigate the effects of household characteristics, especially the age of the household head, on the allocation of household expenditures to consumer goods. I estimate a demand system of eight composite goods.

3.2.1 Data

The data are five cross-sections of budget survey data on West German households, the German Einkommens- und Verbrauchsstichprobe (EVS). Although many households are recorded in multiple waves, it is not possible to track households over time. Hence, I conduct the analysis on pooled data, and thus cannot account for unobserved heterogeneity.
The EVS slightly over-samples middle-income households. However, sampling weights have been supplied by the Federal Statistical Office (Statistisches Bundesamt) to control for this. These sampling weights stem from the comparison between (representative) German micro census information and the EVS.

The consumption module of the survey contains diary information on expenditures for several categories of goods and services. These categories are quite comprehensive, but it is obvious that they do not capture all expenditures. Missing expenditures are those not paid for by the household directly. An example are subsidies like studying at university, which is being paid for by all citizens, but consumed only by those who receive it. Also missing are expenditures for goods and services, that contain an insurance component, like health insurance or liability insurance. These might also be partly subsidized like German public health insurance.

Figure 3.1: Mean expenditure shares by age, averaged over the sample years 1978-1998



Total expenditures are not equivalent to total consumption for additional reasons. First, changes in relative prices trigger changes in expenditures which might even be reverse, depending on the income and substitution elasticities. In the empirical analysis, overall inflation does not affect the results because I investigate expenditures for certain goods as a share of total expenditures, so that such price trends cancel out. Additionally, I account for commodity-specific price trends by including a time trend as will be explained in more detail in section 3.2.3.

Second, consumption is the outcome of a home production function which uses both expenditures and time as inputs (Becker 1965). So, households produce some goods and services at home and can substitute between market-purchased goods and self-produced ones according to their preferences and in reaction to changes in relative prices. The role of home production is analyzed in Chapters 4 and 5. In this chapter, I do not take home production into account and I assume, that relative price changes between goods reflect respective quality changes between them.

I use expenditure data for eight composite categories of goods and services: Food, Clothing & Shoes, Energy, Furniture & Home Electronics, Health & Body Care, Transportation & Communication, Education & Leisure Goods, and Other Goods including jewelry, holiday expenditures and travel costs.[1] Housing expenditures are omitted for reasons explained later, so total spending is computed as non-housing expenditures. In addition, a set of socioeconomic variables is available. Price information is taken from an online time series compilation of the Statistisches Bundesamt.
Figure 3.1 depicts the allocation of total spending on the eight goods by age, averaged over the sample period. The share of food stays roughly constant for households between ages 35 and 66, and increases thereafter. Young households spend an increasing share of their expenditures on furniture and household goods up to age 30, then this expenditure share remains constant at about 8 per cent. Health and body care expenditures gain an increasing weight in total spending from age 45 onwards; their expenditure share roughly doubles between age 45 and 75. A very similar pattern can be seen for the Energy expenditure share. The expenditure share of Transportation & Communication, on contrary, is highest at young ages and strongly declines until age 35 and again after age 60. The hump shaped age profile for the category "Other Goods" including holiday expenses is consistent with a strong rise in travelling activities around retirement between ages 60 and 70. However, note that Figure 3.1 confounds age, year and cohort effects. The displayed trends also do not disentangle the accompanying effects of household composition, income differences between households and the influence of other household characteristics. Thus, it only serves as a descriptive starting point for the analysis.

3.2.2 The theoretical framework

Preferences over all available consumer goods are represented by the utility function of the household $U(q, z)$ where q is a vector of the quantities of the composite goods consumed by the household and z is a vector of household characteristics. Households maximize their utility subject to their budget constraint $x = p^T q$, where p^T is the transposed price vector and x is total consumer spending.[2]
One might ask where the savings decision enters in this framework and why I use non-housing expenditures as a measure of total expenditures. The decision problem is separated into a general consumption-savings decision and a subsequent decision about the allocation of total expenditures on different goods (Blundell 1988). By this separability assumption, I only need to model the decision at the second stage, where the household allocates its consumption budget to the different goods. This so-called two-stage budgeting is consistent with the intertemporal additive utility function of

[1] Appendix 3.5.1 describes how equivalent categories are created across the five waves of the survey. A detailed description of the goods and services contained in each composite group can be found in Appendix 3.5.1.
[2] Usually, x is referred to as income so that the budget constraint balances incomes and expenditures. I do not model the consumption-savings decision and use total expenditures instead of income as the disposable budget for consumption purposes.

the standard life cycle model (Blundell and Walker 1986). In addition, I assume separability between the durable good housing and the other, non-durable (or less durable) goods. In addition to the problems generally associated with infrequently purchased goods, housing expenditures represent to a large part an investment and thus part of the asset portfolio of households. Therefore, total spending is calculated excluding housing expenditures. In the same fashion, I assume weak separability between labor supply and consumer demand. This is done simply due to data constraints: the Einkommens- und Verbrauchsstichprobe (EVS) does not provide information on the employment status of the spouse and no information on hours worked for either member of the household.
The utility maximization problem of each period is transformed into a cost minimization problem at given prices p and given utility level u for the cost function of each good i in a system of I goods. Thus, the underlying assumption is that prices are exogenously given for the household. I choose the classical functional form of the Quadratic Almost Ideal demand system :

$$\ln c(u,p,z) = \ln a(p,z) + \frac{u \cdot b(p,z)}{1 - u \cdot g(p,z)} \tag{3.1}$$

where $a(.)$, $b(.)$ and $g(.)$ are functions of prices and household characteristics. For $a(.)$ and $b(.)$, I choose the translog respectively the Cobb-Douglas form, and for $g(.)$, I use the specification from Banks, Blundell, and Lewbel (1997):

$$\begin{aligned} \ln a(p,z) = \alpha_0 + \sum_k \zeta_{ik} z_k + \sum_i (\alpha_i + \sum_k \eta_{ik} z_k) \ln p_i \\ + \frac{1}{2} \sum_i \sum_j \gamma_{ij} \ln p_i \ln p_j \end{aligned} \tag{3.2}$$

$$b(p,z) = \prod_i p_i^{\beta_{i0} + \sum_k \beta_{ik} z_k} \tag{3.3}$$

$$\ln g(p,z) = \sum_i (\lambda_{i0} + \sum_k \lambda_{ik} z_k) \ln p_i \tag{3.4}$$

z_k denotes the household characteristic k, p_i is the price of good i and p_j is the price of good j. $\alpha_i, \beta_i, \gamma_i, \eta_i, \lambda_i$ and ζ_i are the structural parameters of interest in the model. The time subscript is omitted here for ease of notation.
Shephard's Lemma (Shephard 1953) gives the Hicksian demand for each good i, $h_i(u,p,z)$, here denoted as expenditure shares $w_i(u,p,z)$ due to the log specification of the cost function:

$$\begin{aligned} \frac{\partial c_i(u,p,z)}{\partial p_i} = h_i(u,p,z) = q_i \qquad \text{and} \\ \frac{\partial \ln c_i(u,p,z)}{\partial \ln p_i} = \frac{p_i q_i}{c(u,p,z)} = w_i(u,p,z) \end{aligned} \tag{3.5}$$

Using that $\ln c(u,p,z) = \ln x$, inverting and substituting gives the Marshallian demands in expenditure shares $w_i(x,p,z)$ as:

$$
\begin{aligned}
w_i(x,p,z) = \alpha_i + \sum_k \eta_{ik} z_k + \sum_j \gamma_{ij} \ln p_j + (\beta_{i0} + \sum_k \beta_{ik} z_k) \cdot \left[\ln \frac{x}{a(p,z)} \right] \\
+ \frac{\lambda_{i0} + \sum_k \lambda_{ik} z_k}{b(p,z)} \cdot \left[\ln \frac{x}{a(p,z)} \right]^2
\end{aligned}
\tag{3.6}
$$

where x is total expenditures on all goods in the demand system.
In order to estimate this system, several constraints derived from economic theory are imposed on the parameters (Deaton 1986). The adding-up property requires that:

$$
\begin{aligned}
&\sum_{i=1}^{n} \alpha_i = 1 \qquad \sum_{i=1}^{n} \eta_{ik} = 0 \quad \forall k \qquad \sum_{i=1}^{n} \gamma_{ij} = 0 \\
&\sum_{i=1}^{n} \beta_{i0} = 0 \qquad \sum_{i=1}^{n} \beta_{ik} = 0 \quad \forall k \\
&\sum_{i=1}^{n} \lambda_{i0} = 0 \qquad \sum_{i=1}^{n} \lambda_{ik} = 0 \quad \forall k
\end{aligned}
\tag{3.7}
$$

Homogeneity (of degree zero) of the indirect utility function in x and p adds further restrictions on the price parameters:

$$
\sum_j \gamma_{ij} = 0 \quad \forall i \qquad \text{and} \quad \gamma_{ij} = \gamma_{ji} \tag{3.8}
$$

Due to the adding-up condition, one equation can be left out and the remaining $(I-1)$ equations are estimated. The parameters of the left out equation can be recovered using the constraints.

3.2.3 Estimation

I estimate the system using an instrumental variables approach with demands of the general form of equation (6), but restricting the price coefficient γ_{ij} to zero:

$$
\begin{aligned}
w_i = \alpha_i + \sum_k \eta_{ik} z_k + \left(\beta_{i0} + \sum_k \beta_{ik} z_k \right) \cdot \left[\ln \frac{x}{a(p,z)} \right] \\
+ \left(\lambda_{i0} + \sum_k \lambda_{ik} z_k \right) \cdot \frac{1}{b(p,z)} \cdot \left[\ln \frac{x}{a(p,z)} \right]^2 + \epsilon_i
\end{aligned}
\tag{3.9}
$$

where ϵ_i is a randomly distributed error term.

The price restriction is imposed because of too little price variation in the data.[3] If there are any price trends, they will be absorbed by the time trends included in the estimation. Any other short-term price fluctuations like cyclical fluctuations can be neglected here, since the focus of this study is on long-run trends.
The key explanatory variables are the age and time effects. The next Section contains a discussion of the identification approach for these effects. In addition, I control for household characteristics like household size, the number of children, and the employment status of the household head. Last, I include total non-housing consumer expenditures and squared expenditures in order to capture income effects. The endogeneity of non-housing expenditures (henceforth: total expenditures) is taken into account by instrumenting the expenditure variable with disposable household income. I also control for owner-occupier status, i.e. whether the household is renting his home or owning it, and also interact this dummy variable with the other household characteristics in order to capture behavioral differences between the renter and owner households.
The quadratic model is used because Banks, Blundell, and Lewbel (1997) showed that Engel curves are nonlinear, but well approximated by a quadratic functional form. Furthermore, I interact the two expenditure terms with a second order polynomial of age in order to allow for different shapes of the Engel curves for different age groups. Total expenditures are calculated as nominal expenditures divided by the price index $a(p,z)$. Since each household consumes individually composed sets of goods aggregated into the eight composite goods, I calculate a Stone price index for each household h as an approximation to $a(\cdot)$.[4]

3.2.4 Identification of age, cohort and time effects

The identification of age, cohort and time effects is a crucial step in this analysis. The identification problem arises from the fact that the age of the household head can be inferred by subtracting the year in which the household is born, i.e. his cohort information, from the sample year. In consequence, identifying assumptions are needed which are inherently untestable. In the following, I will describe the chosen identification approach (Variant 1). Furthermore, I will carry out a sensitivity analysis using two alternative identifying assumptions (Variants 2 and 3), and show that the resulting estimated age effects do not differ substantially:

- Variant 1: I assume cohort effects to be zero. Thus, I model demands to be age- and time-variant only. I expect strong cohort effects in the consumption-savings decision, e.g. behavioral differences between the post-war generation and the generation growing up during the German economic miracle. However,

[3] I only have eight price observations for each of the five waves, one price for each commodity group. Due to overall price trends, there is additionally a high correlation between the time series of the commodity prices.

[4] The Stone price index is the weighted sum of the prices p_i and the expenditure shares w_{ih} of the composite goods i: $p_{ih} = \sum_i p_i w_{ih}$.

due to the two-stage budgeting approach, I am focusing on the decision how to allocate total expenditures to different goods, which I expect to be less prone to cohort effects. If the post-war generation is a high-saving one and the younger generations is more inclined to spend than to save, the former generation is likely to make its choice in a similar way as an individual of the latter one with a low income, given that their total expenditures will be similar.

- Variant 2: This identification strategy follows the approach by Deaton and Paxson (1994). Their decomposition attributes behavioral changes to cohort and age effects, and constrains the time effects to capture cyclical fluctuations or business-cycle effects that average to zero in the long-run. A more detailed description can be found in Appendix 3.5.2.

- Variant 3: This third approach is based on statistical identification. It includes age, time and cohort effects in the regressions by choosing different functional forms for either one.

For the age effects, I chose a 5-year dummy specification for all three variants. Variant 1 assumes that there are no cohort effects. The cohort variables in variants 2 (3) are cohort dummy variables in 5-year (10-year) intervals. Finally, time enters as transformed time dummies in the Deaton-Paxson approach in variant 2 (see Appendix 3.5.2), while it takes the form of a linear trend in the other specifications. Table 3.1 summarizes the estimated variants.

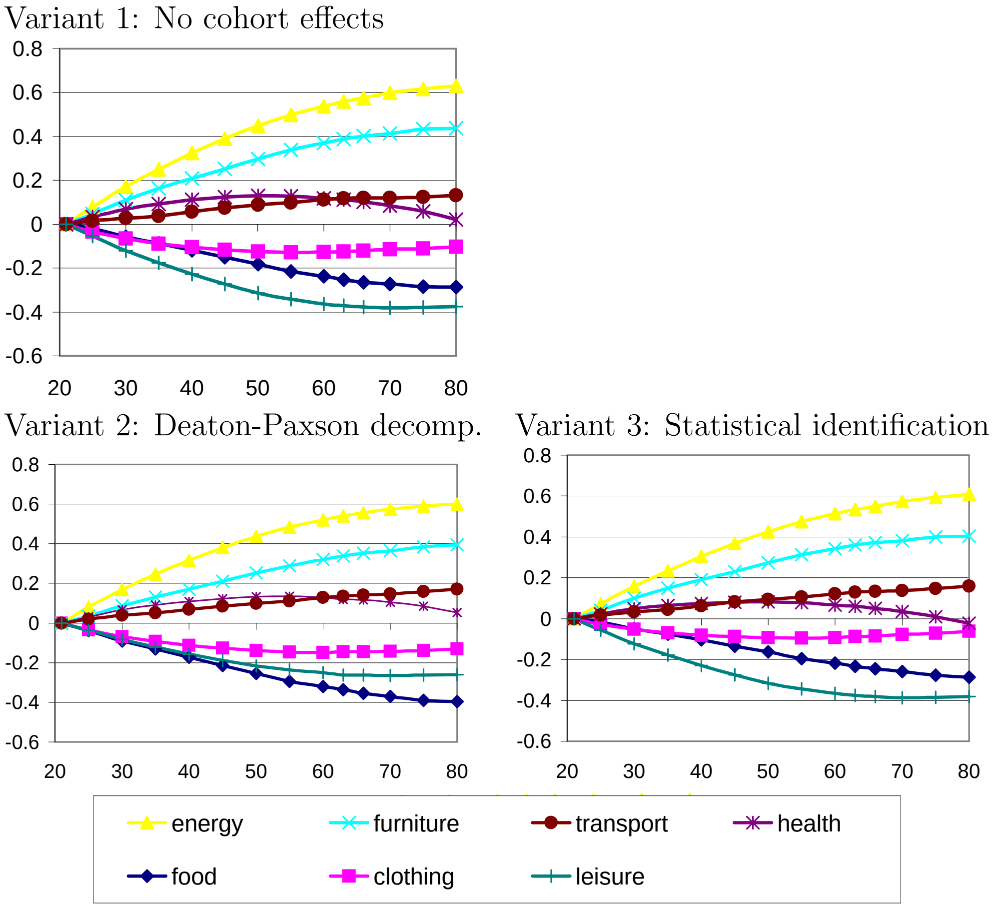
Table 3.1: Summary of the three alternative identification variants

Variant	**Age effect**	**Cohort effect**	**Year effect**
1 *	**5-year dummies**	**none**	**linear trend**
	5-year dummies	5-year dummies	transf. year dummies (see App. 3.5.2)
3	5-year dummies	10-year dummies	linear trend

* All results presented in the subsequent sections are based on Variant 1.

The pure age profiles for all eight composite goods are depicted in Figure 3.2. The estimated coefficients for the dummies show that the age profiles are distinctly non-linear. A comparison of the profiles under these different identification approaches shows that there are no large differences in the estimated age coefficients. Hence, I will use variant 1 as the basis for the projections throughout this chapter. It has some suitable properties that are helpful for the projections. For example, the absence of cohort effects rules out the necessity to make ad hoc assumptions about the cohort effects of newly born future cohorts.

Figure 3.2: Estimated age coefficients using Variants 1 to 3



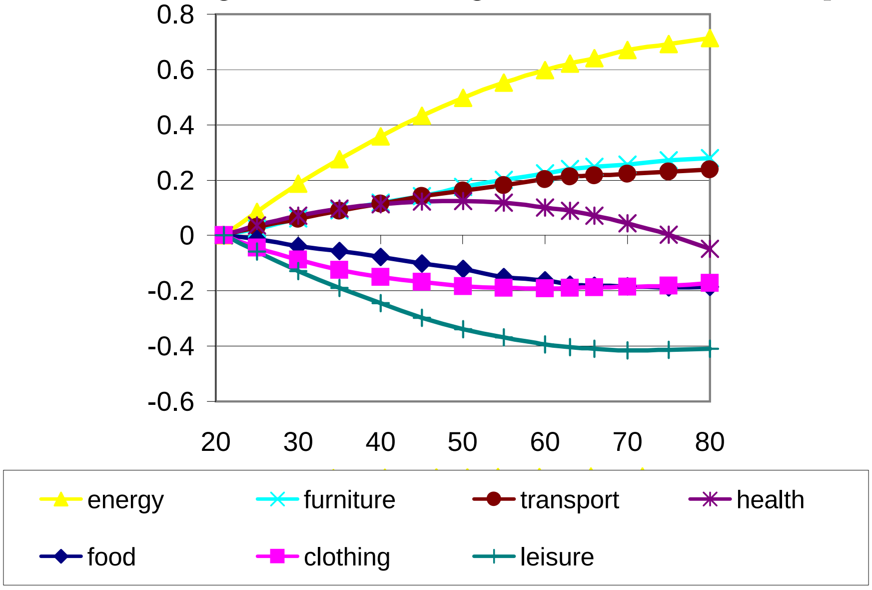
Annotation: The coefficients are normalized to an initial zero at age 20 for ease of comparison.

3.2.5 Results

Table 3.2 shows the results of the demand system estimation based on Variant 1. The regression includes age and time dummies, a linear and quadratic log expenditure term, and household characteristics such as a dummy which takes the value 1 if there are children at all in the household, the number of children and the number of children squared as well as log household size, a dummy variable indicating whether the household head is working, and a dummy for self-employed household heads.
Furthermore, I include additional interactions of all covariates with owner-occupier status. There might be systematic differences in the composition of demand depending on the decision whether to rent or own a house or a flat. Housing expenses can be pure consumption, but if a house or flat is owned by the household, expenses are also part of the savings of a household. In order to capture potential non-separability between the decision whether to own or rent a house and other consumer expenses, I introduce these interactions with the dummy of owner-occupier status taking the value one, if the household owns the flat or house it lives in (see Figure 3.3).

Finally, I interact the log expenditure terms with age and age squared in order to get age-specific Engel curves (see Section 3.2.5).

Figure 3.3: Estimated age coefficients using Variant 1 with ownership interactions



Annotation: The coefficients are normalized to an initial zero at age 20 for ease of comparison.

Age effects

Figure 3.2 illustrates the substantial age affects. While the expenditure shares for food, furniture and energy increase strongly with age, the shares spent on leisure, clothing and transport decline substantially. The pattern of health is hump-shaped. These patterns are surprising since one would expect health expenditures to increase even at advanced ages. However, one has to bear in mind that the category "Health & Body care" includes only out-of-pocket health expenditures. These may decrease to a minimum for the older old because their health costs are covered to a larger extent by health insurance and are thus not measured here. The treatment of major or more serious health problems which typically occur in older ages is much more likely to be covered by health insurance. The older old often have some chronical diseases like high blood pressure etc. and usually have to take prescribed pills on a daily basis. Additionally, they often receive assistance they do not pay privately.
Furthermore, Figure 3.2 does not incorporate the effect of total expenditures which also varies by age, due to the unequal distribution of overall expenditures over age groups. Therefore, one has to look at the age-specific Engel curves as well when trying to untangle the age profiles of demand.

Table 3.2: Regression results

	food	clothing	energy	furnit.	health	transp.	leisure
age dummies							
age21-24	-0.0093	-0.0407	0.0649	0.0245	0.0248	0.0165	-0.0294
	(1.17)	(8.52)***	(18.00)***	(3.02)***	(4.76)***	(1.65)*	(4.96)***
age25-29	-0.0219	-0.0851	0.1504	0.0489	0.0605	0.0470	-0.0881
	(1.41)	(9.15)***	(21.43)***	(3.10)***	(5.95)***	(2.41)**	(7.63)***
age30-34	-0.0484	-0.1286	0.2521	0.0868	0.0962	0.0765	-0.1584
	(1.91)*	(8.51)***	(22.12)***	(3.39)***	(5.83)***	(2.41)**	(8.44)***
age35-39	-0.0649	-0.1652	0.3406	0.1159	0.1210	0.1048	-0.2194
	(1.90)*	(8.11)***	(22.14)***	(3.35)***	(5.43)***	(2.45)**	(8.66)***
age40-44	-0.0878	-0.1907	0.4235	0.1434	0.1377	0.1319	-0.2745
	(2.09)**	(7.61)***	(22.37)***	(3.37)***	(5.02)***	(2.51)**	(8.81)***
age45-49	-0.1101	-0.2081	0.4975	0.1659	0.1481	0.1595	-0.3268
	(2.25)**	(7.14)***	(22.60)***	(3.36)***	(4.64)***	(2.61)***	(9.02)***
age50-54	-0.1309	-0.2240	0.5616	0.2007	0.1502	0.1777	-0.3688
	(2.39)**	(6.86)***	(22.77)***	(3.62)***	(4.20)***	(2.59)***	(9.09)***
age55-59	-0.1593	-0.2293	0.6172	0.2261	0.1435	0.1990	-0.3981
	(2.67)***	(6.44)***	(22.98)***	(3.75)***	(3.69)***	(2.66)***	(9.00)***
age60-62	-0.1725	-0.2323	0.6623	0.2488	0.1260	0.2189	-0.4226
	(2.71)***	(6.13)***	(23.14)***	(3.87)***	(3.04)***	(2.75)***	(8.97)***
age63-65	-0.1869	-0.2306	0.6871	0.2644	0.1132	0.2285	-0.4327
	(2.86)***	(5.91)***	(23.31)***	(3.99)***	(2.65)***	(2.79)***	(8.92)***
age66-69	-0.1913	-0.2277	0.7065	0.2720	0.0974	0.2339	-0.43874
	(2.86)***	(5.69)***	(23.40)***	(4.01)***	(2.23)**	(2.79)***	(8.83)***
age70-74	-0.1938	-0.2257	0.7343	0.2796	0.0695	0.2390	-0.4440
	(2.82)***	(5.51)***	(23.74)***	(4.02)***	(1.55)	(2.78)***	(8.72)***
age75-79	-0.1977	-0.2223	0.7578	0.2954	0.0281	0.2474	-0.4428
	(2.83)***	(5.33)***	(24.04)***	(4.17)***	(0.62)	(2.82)***	(8.54)***
age80+	-0.1942	-0.2128	0.7783	0.3032	-0.0232	0.2553	-0.4398
	(2.76)***	(5.07)***	(24.55)***	(4.26)***	(0.51)	(2.90)***	(8.43)***
time trend							
year	-0.00144	-0.00113	-0.00044	-0.00087	0.00143	0.00089	0.00186
	(43.08)***	(56.81)***	(29.35)***	(25.91)***	(65.95)***	(21.43)***	(75.15)***

The reference category for the age dummies is the age group between 18 and 20 years.

Table 2 (continued): Regression results

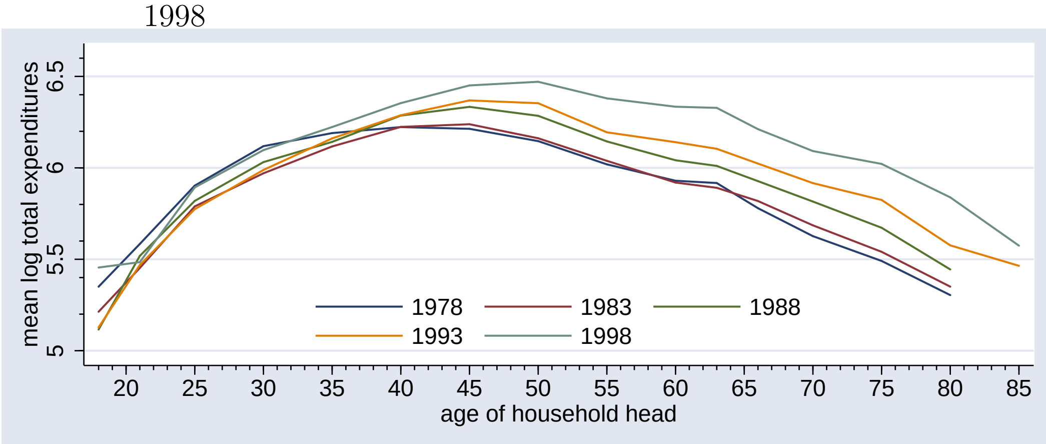
	food	**clothing**	**energy**	**furnit.**	**health**	**transp.**	**leisure**
log total expenditures							
ln(x)	-0.3757	-0.0522	0.1216	0.2298	0.2078	0.4124	-0.0816
	(9.68)***	(2.25)**	(6.96)***	(5.85)***	(8.20)***	(8.48)***	(2.84)***
ln(x)^2	0.0265	0.0036	-0.0090	-0.0168	-0.0175	-0.0385	0.0010
	(7.74)***	(1.78)*	(5.86)***	(4.84)***	(7.82)***	(9.00)***	(0.38)
ln(x)	0.0056	0.0040	-0.0075	-0.0024	-0.0064	-0.0061	0.0043
$*age$	(4.99)***	(5.97)***	(14.93)***	(2.15)**	(8.71)***	(4.33)***	(5.17)***
ln(x)^2	-0.0006	-0.0003	0.0005	0.0001	0.0006	0.0007	-0.00009
$*age$	(6.02)***	(4.20)***	(10.14)***	(1.37)	(8.79)***	(5.49)***	(1.25)
ln(x)	-0.00004	-0.00003	0.00004	0.00001	0.0001	0.00004	-0.00002
$*age^2$	(5.71)***	(5.91)***	(10.76)***	(1.65)*	(13.55)***	(3.96)***	(3.98)***
ln(x)^2	0.00001	0.0000	0.0000	0.0000	-0.00001	0.0000	0.0000
$*age^2$	(7.36)***	(2.88)***	(5.18)***	(1.07)	(13.10)***	(5.42)***	(1.13)
household composition							
ln($size$)	0.0874	-0.0114	0.0054	0.0109	-0.0143	0.0105	-0.0247
	(83.68)***	(18.32)***	(11.48)***	(10.31)***	(20.91)***	(8.03)***	(31.83)***
$nokids$	0.0132	-0.0085	-0.0073	-0.0101	-0.0028	0.0053	0.0128
	(3.98)***	(4.29)***	(4.90)***	(3.02)***	(1.30)	(1.27)	(5.20)***
$\#kids$	-0.0173	0.0073	-0.0001	-0.0150	0.0081	-0.0252	0.0230
	(4.62)***	(3.28)***	(0.07)	(3.97)***	(3.31)***	(5.38)***	(8.30)***
$\#kids^2$	0.0025	-0.0013	0.0005	0.0027	-0.0019	0.0035	-0.0039
	(2.72)***	(2.39)**	(1.13)	(2.90)***	(3.19)***	(3.09)***	(5.67)***
$self-$	0.0156	0.0005	0.0061	-0.0081	-0.0004	-0.0021	-0.0023
$empl.$	(14.45)***	(0.76)	(12.55)***	(7.42)***	(0.53)	(1.55)	(2.89)***
not	0.0000	-0.0060	0.0088	-0.0088	0.0022	-0.0191	0.0048
$work.$	(0.00)	(9.58)***	(18.51)***	(8.26)***	(3.27)***	(14.51)***	(6.15)***
$owner$	1.1298	-0.4654	0.7469	-0.6265	-0.4353	-0.5044	-0.8316
$occup.$	(8.01)***	(5.53)***	(11.75)***	(4.39)***	(4.73)***	(2.85)***	(7.95)***
Obs.	203746	203746	203746	203746	203746	203746	203746
R^2	0.29	0.04	0.43	0.04	0.08	0.09	0.08

Annotation: Further covariates are interacted terms of owner-occupier status with the household composition variables, the age dummies and the expenditure terms. The results are reported in Appendix 3.5.3. Absolute values of t statistics in parentheses. *,**,*** denote significance at 10, 5, 1%

Estimated Engel curves

As Table 3.2 shows, total expenditure affects the composition of demand in a significant and nonlinear way, as the significance of the quadratic term in most of the estimated equations shows. Furthermore, the interaction between age-specific and budget-specific demand is important. Most of the interacted terms are significant. Figure 3.5 underlines the role of age in the relation between income, respectively total expenditures, and demand for the different composite goods.
The Engel curves of transportation and furniture are distinctly hump-shaped. However, while transport shares decrease distinctly with age, conditional on total expenditures, furniture shares decrease with age only for households with large spending, and decrease significantly otherwise.
Health & Body Care is also inversely u-shaped and its share increases substantially with age. The latter is consistent with common knowledge that health expenditures increase almost exponentially with age. It is obvious from the figure that there is not much heterogeneity in the Engel curves of the age groups until age 50. It is only for the retirees of 60 years and over, that the share spent on out-of pocket health increases strongly with the level of total expenditures.

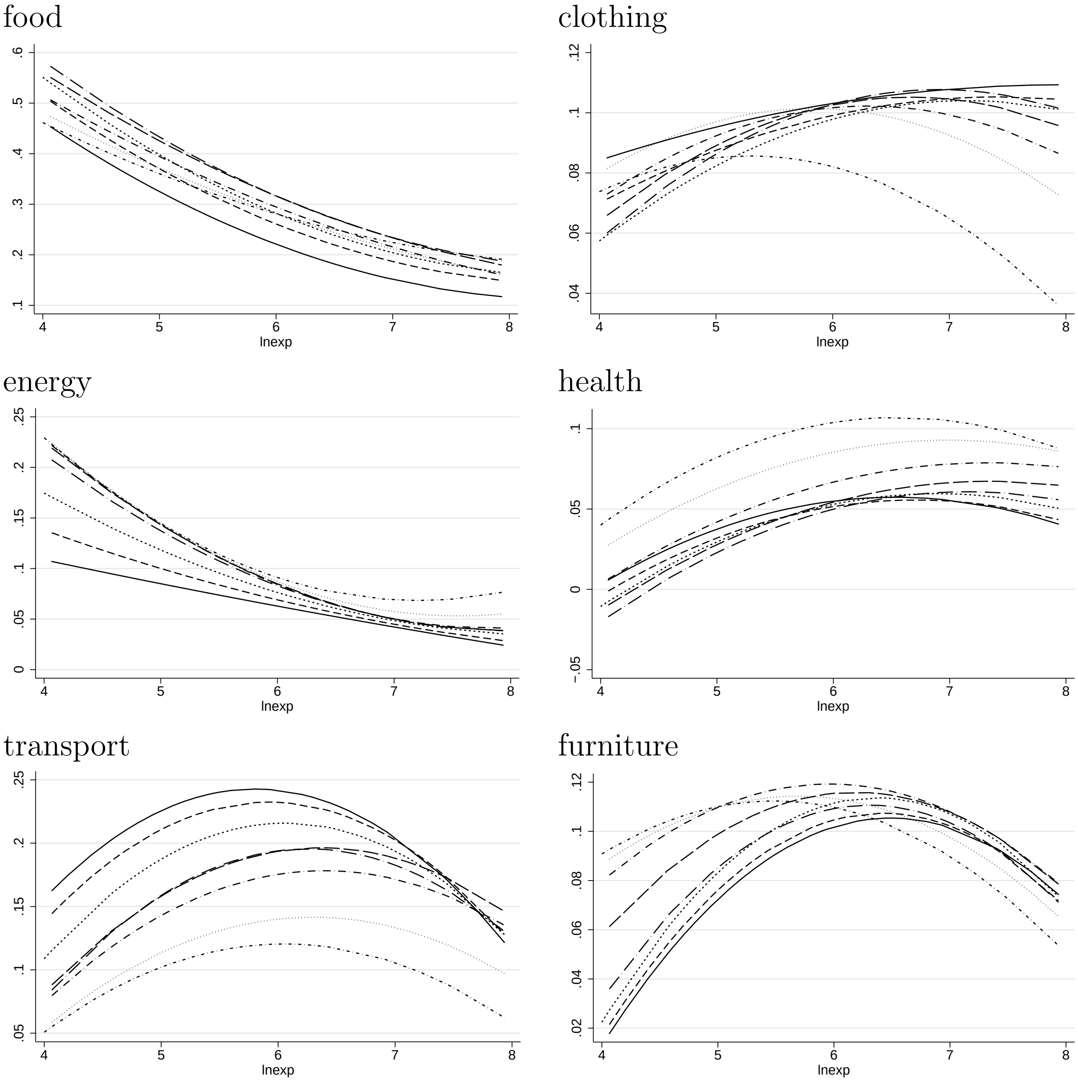
Figure 3.4: Average log total real expenditures over age groups by sample years 1978-1998



Food and energy shares are necessities that decline with rising total expenditures. Food expenditures are the largest part of total nondurable expenditures of households of medium age, and is smaller for young and older households. The share spent on energy, on contrary, is increasing remarkably by age, especially for households with lower total expenditures. For richer households, the share increases by much less, with the exception of those aged 80 years or more.
Considering total spending, it is important to understand that much of what we interpret as an *age* effect on expenses actually confounds with effects of total consumption, or, loosely speaking, *income* effects. Household resources change over the life-cycle - often as a function of age, and thus influence household behavior in addition to potential age-related taste changes. For example, households usually experience income cuts

when they enter retirement, probably be even so in the future when the demographic pressure on the social security systems becomes even more severe.
Therefore, it is important to look at the age distribution of total expenditures which is depicted in Figure 3.4 (without correcting for cohort effects). The age profile of total expenses, however, is very pronounced and of a hump-shaped form. This distinct age profile has to be accounted for when analyzing the aggregate effects of aging: although elderly households gain weight in the aggregate by simply becoming more numerable, they have, on average, a smaller budget than prime-age households.

Figure 3.5: Engel curves for some selected composite goods



The other explanatory variables are set to their age-specific means.

Total expenditures are allowed to vary around the mean by two standard deviations.

Household characteristics

The relative small set of household characteristics included in the analysis results mainly from data restrictions. The more recent waves of the EVS (1993 and 1998) contain richer information about households including education variables and female employment status. However, this information is not available for the older waves.
As expected, larger households have a higher expenditure share for goods that cannot be shared, like food, energy, furniture and transportation. Synergy effects within the household decrease the share spent on furniture and transportation & communication. On contrary, large households tend to reduce their expenditures for luxury goods like education & leisure expenditures.
Households without children spent a lower share on clothing, energy and furniture, but relatively more on food and leisure goods. If there are kids in the household, the shares of leisure and clothing initially rise in the number of children and decline above the threshold of three children. The opposite holds for furniture, food and transportation: shares decrease with the first two children and increase after the third child. Only the energy share is monotonously increasing.
Households with a non working head spend a significantly higher share of their total expenditures on health, energy and leisure activities, and less on clothing, furniture and transportation than their employed counterparts. This is intuitive since work-related expenditures for transportation and clothing cease to apply. At the same time, non workers have more leisure and want to complement them with leisure goods. They spend probably more time at home, therefore energy demand rises.

The age-specific expenditure patterns found in this section are not only relevant for determining household demands for goods and services at the micro-level - they also affect the aggregate demand structure of an economy. The aging of societies across the world does not only alter the functioning of social security systems and capital markets. It is also likely to affect the market for goods and services, in particular through the distinctly age-specific expenditure patterns shown in this section which trigger changes in aggregate demand.

3.3 Effects of aging on aggregate demand

As is widely known, the demographic changes have been substantial in the last decades and the aging process of the population will become even more severe in the future. Within Europe, the aging process in Germany is among the most pronounced.
Figure 3.6 shows population pyramids for the years 1980, 2010, 2030 and 2050. It clearly illustrates the significant drop in the population share of the young and the increase in the elderly population. While in 1980, the majority of the population was younger than age 45, this pattern reverses until 2030. The intensity of the aging process underlines the importance of researching into its macroeconomic consequences,

e.g. the implications for goods markets and demand composition.
Hence, I explore how population aging can affect the aggregate demand structure of the household sector. First, I explain the aggregation procedure which is based on the micro-economic estimates conducted previously (Section 3.3.1). Second, I carry out an aggregation of the West German demand structure for the in-sample years 1978, 1983, 1988, 1993 and 1998 (Section 3.3.2). Then, I project changes in the demand composition induced by population aging using demographic projections by the Rürup Kommission (Bundesministerium für Gesundheit und Soziale Sicherung 2003).[5]. Section 3.3.3 gives an overview of the scenarios that are used in the analysis. The demand changes that result from these scenarios are then discussed in Section 3.3.4.

Figure 3.6: Population by age (in 100 thousand), 1980-2050

Source: Rürup Commission (2003)

In the demand projections presented in the following, I neglect all supply side effects by assuming that supply is perfectly price-elastic. This assumption is certainly not warranted in the short-run. However, demographic change is a long-term phenomenon. In the long run it is not clear, whether the relative prices react to the demographically

[5]This commission was appointed by the German government in order to work out reform proposals for the German social security system. The projections build on a set of demographic assumptions that were agreed upon by leading experts in the field. They are deemed more precise than the UN projections for Germany, however, the results do not change much if one uses the UN projections.

induced demand changes at all, and if, in which direction they change. This depends on the evolution of technical progress and other factors. Thus, instead of making arbitrary assumptions about the future evolution of these variables, I present the ceteris paribus results of demographically induced changes to isolate the influence of population aging and associated foreseeable changes in household characteristics. These are threefold: From the demographic projections, one can derive the future path of household composition including the partnership decision and the fertility decisions. Second, the evolution of total expenditures over time can be approximated by projections of future economic growth. Third, the distribution of total expenditures across households depends on the social security reforms carried out, since they substantially influence the intergenerational distribution of income.
I approach the projection task in scenarios. They are designed to disentangle the direct effect of a shift in the population age structure and the above mentioned accompanying effects of aging. These scenarios start with a simple baseline case where I assume that all household characteristics etc. remain at the base year level of 1993.[6] The only variation in the future stems from the changing age structure of the population. In the subsequent scenarios (see Section 3.3.3), I relax some of these restrictive assumptions: I allow for growing incomes, and investigate two accompanying effects of aging, namely changes in the household composition and changes in the distribution of spending power over age. Next; I explain the aggregation procedure.

3.3.1 The aggregation procedure

The aggregation idea is simple. The estimation results from section 3.2.5 shed light on the household behavior during the sample years. I assume that the behavior of households with the same socio-economic characteristics and the same age does not change over time. However, due to population aging, the *number* of households with the same characteristics changes. This accords well with the identifying assumptions made in the estimation where I excluded cohort effects and identified household behavior by age and time effects. In the projections, I assume a constant time effect at the base year level of 1993. Then, I predict the expenditure shares for the various goods of the base year sample population and aggregate them using household weights.
To aggregate over households, I have to map the *households* observed in the microdata onto the population data which displays the number of *individuals* per age group. Therefore, I cannot simply use the population age shares as weights in the aggregation. Instead, these age shares have to be transformed into weights at the household level. The idea for constructing the weights is simple: From aggregate population data, I know the number of West German citizens of age a at each point in time t. Using the

[6] The most recent sample year, 1998, was not used as the base year, because the survey design changed between 1993 and 1998. The changes affect the grouping of goods into categories and the way, in which households were asked to record their expenses. Therefore, I chose 1993 as the base year, because the survey design in 1993 is very consistent with that of the former years, and closest to that of the year 1998. Appendix 3.5.1 describes the procedure that I used to make the 1998 data consistent with the older waves of the EVS.

sampling weights provided in the EVS, I can calculate the age distribution of household heads in West Germany for the sample years. Next, I impose the restriction that the household characteristics change over age, but not over time.[7] According to the definition of the sampling weights, each household of age a in the EVS in year t is representative for a certain number of households of age a in the population at time t. By the assumption made above it will also be representative for households of age a in any other year. Therefore, with changes in the population age structure, the number of households of age a will vary. The weights used to aggregate the data are thus:

$$weight_{a,h,t} = \frac{sw_{a,h,93}}{pop_{a,93}} \cdot pop_{a,t} \cdot x_{a,h,t} \tag{3.10}$$

where $sw_{a,h,93}$ is the sampling weight of a household h with a head of age a in the base year 1993, $pop_{a,t}$ is the population of age a at time t, $pop_{a,93}$ is the respective population in the base year, and $x_{a,h,t}$ are total expenditures of the household at time t. By using total population figures per age group instead of age shares, the weights reflect not only changes in the age structure, but also changes in population growth. The first and second terms in the weighting function reflect the assumption that household characteristics for households with a head of age a are time invariant, while the number of similar households of the same age varies over time. By the third term, I take into account that households differ in total spending due to differences in incomes and consumption-savings decisions. Thus, they also have different weights in aggregate spending, reflected by their total expenditures $exp_{a,h,t}$. Finally, the weights are normalized by the sum of all household-specific weights.

3.3.2 Population aging and the aggregate demand structure from 1978-1998

In this section, I present the inter-sectoral demand shifts that have already taken place within the sample period. I calculate it by simply multiplying the predicted expenditure shares for the eight goods by the weights for each household and summing over all households. The weights simplify to

$$weight_{h,t} = sw_{h,t} * x_{h,t} \tag{3.11}$$

since the sampling weights allow the direct aggregation from the sample population to the West German population.

Figure 3.7 compares the actual aggregated demand shares for the eight goods with the fitted ones. It shows that the specification of the demand system fits the data quite well in general. Disparities are only visible between the actual and fitted values for transportation which pass through to the left-out quantity Other goods. This is

[7]This restrictive assumption about the evolution of the covariates is made only for the baseline scenario. It will be relaxed step by step in the other scenarios to allow for changes in income and household composition.

potentially due to the durable nature of part of the transportation category which I cannot model in detail due to the lack of data on car ownership. However, even for these two categories, the prediction error is not larger than 10 percent.
Figure 3.8 shows a clear upward trend in the shares of health and education & leisure expenditures as well as a decline in the shares of food and clothing. However, this might be also due to time trends like the erosion of health insurance benefits resulting in higher health costs, the spreading of cheap food discounters and more competition among food retailers etc. The time trend also picks up short-term price trends, therefore I also looked at the in-sample projections keeping time constant at the base year level of 1993. When doing so, the demand trends over time become much less pronounced. The downward trend in Food and the upward trend in Other Goods are strong, but there are only small increases in health (about 4%) and small decreases in clothing and energy expenditure shares.

Figure 3.7: Fitted and actual aggregate expenditure shares during the sample years: 1978-1998

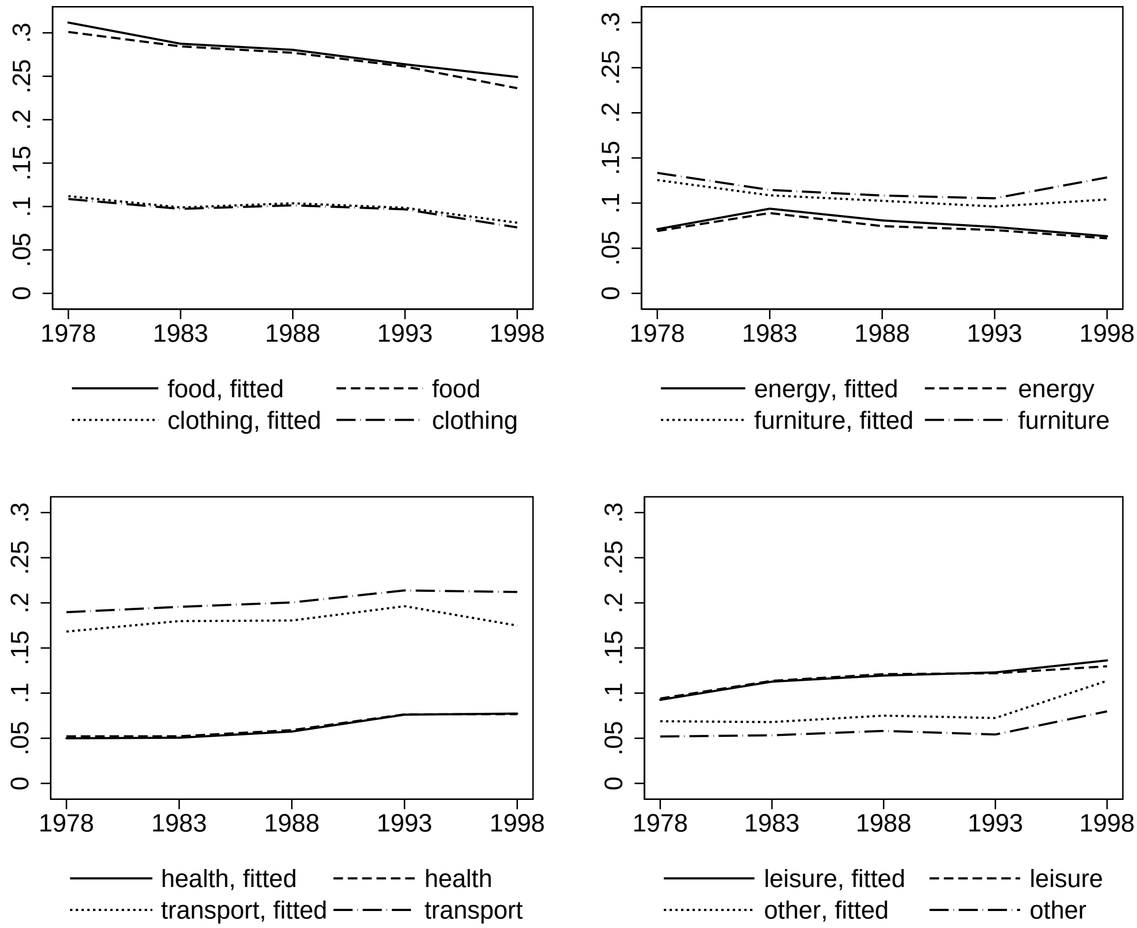
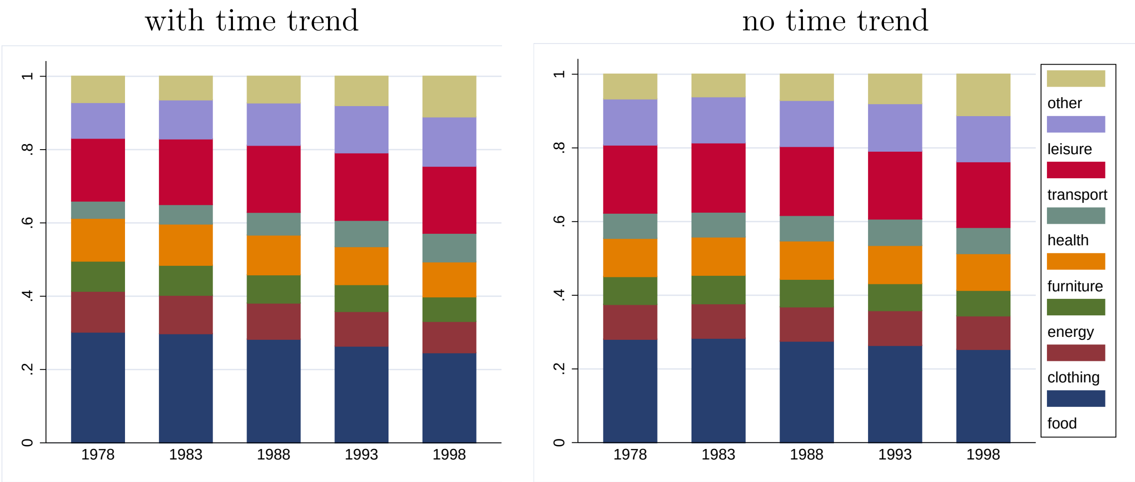


Figure 3.8: Fitted aggregate expenditure shares during the in-sample years: 1978-1998



3.3.3 Projecting aggregate demand in scenarios

The aim of this chapter is to demonstrate the impact of population aging and various socio-economic changes associated with it. Therefore, the projections are done in four scenarios. The comparison of the scenarios allows to separately analyze the effects of changes in socioeconomic variables in the course of aging.

Scenario I: pure population aging
In this scenario, I assume that the composition and characteristics of households of the same age contained in the EVS 1993 remain constant. Of course, this assumption is not innocent. Family formation, the timing of entry into the labor force and other important life cycle decisions underly changes over time. Hence, this scenario serves as a baseline and illustrates the isolated direct effect of population aging on consumer demand without any accompanying effects.

Scenario II: population aging and expenditure growth
In this scenario, I relax the assumption that all household characteristics remain constant over time. The first household characteristic that is modelled as changing over time is household income. Income growth triggers changes in total expenses. Therefore, I include a general growth trend in incomes which passes on to total expenditures. I assume that total expenditures rise by 1.4% each year. This corresponds to the growth assumptions made in official forecasts (Sachverständigenrat Zur Begutachtung der Gesamtwirtschaftlichen Entwicklung 2005). Additionally, some sensitivity checks are performed assuming alternative growth rates.
This scenario helps to answer the question whether aggregate demand changes are mainly caused by the shift in the population age structure itself, i.e. a genuine taste shift between young and old. If the demand changes in this scenario are considerably

stronger than in the baseline scenario, then it is mainly the difference in spending power between the age groups which causes demand changes.

Scenario III: population aging and increasing intergenerational heterogeneity in total spending

This scenario explores the question whether aggregate demand reacts to changes in the distribution of income and hence of total spending. Distributional changes in total expenditures between old and young or rich and poor households might be an accompanying effect of population aging, since pension reforms necessary to sustain social security systems are not neutral in terms of inequality. They change the intergenerational distribution of income.

The projection of the future distribution of total expenses is based on the multi-country OLG model described in Börsch-Supan, Ludwig, and Winter (2005). A brief description of the features of the model can be found in Appendix 3.5.4. The OLG model simulates the pattern of net income under different pension systems respectively reform proposals which change the intergenerational distribution of income.

I assume that the age- and time-specific changes in net income lead to equivalent changes in total expenditures. This assumption rules out adjustments in the savings behavior of households in response to such permanent income changes. However, I compute the growth rate of each age group's projected income over time and compute the time pattern of expenditure changes based on the level of total expenditures in the base year. Thus, I only assume that expenditures rise proportionally with incomes, but take the observed (initial) consumption-savings decision into account. This assumption is supported by (Blundell, Browning, and Meghir 1994) who find that income and consumption move closely together and that consumption tracks income closely over the life cycle.

Assuming a representative agent per age group, the OLG model does not reflect that pension reforms might also change the intra-generational distribution of total expenditures. In the German expenditure survey (EVS), I observe heterogeneity in total expenditures and incomes between *and* among age groups. To maintain the intra-generational heterogeneity in the sample, I calculate the income growth rate from the OLG projections for the different age groups. Then I assume that the *intra*-generational heterogeneity remains constant and allow for changes in the *inter*-generational heterogeneity only. The weights developed in section 3.3.1 then change accordingly:

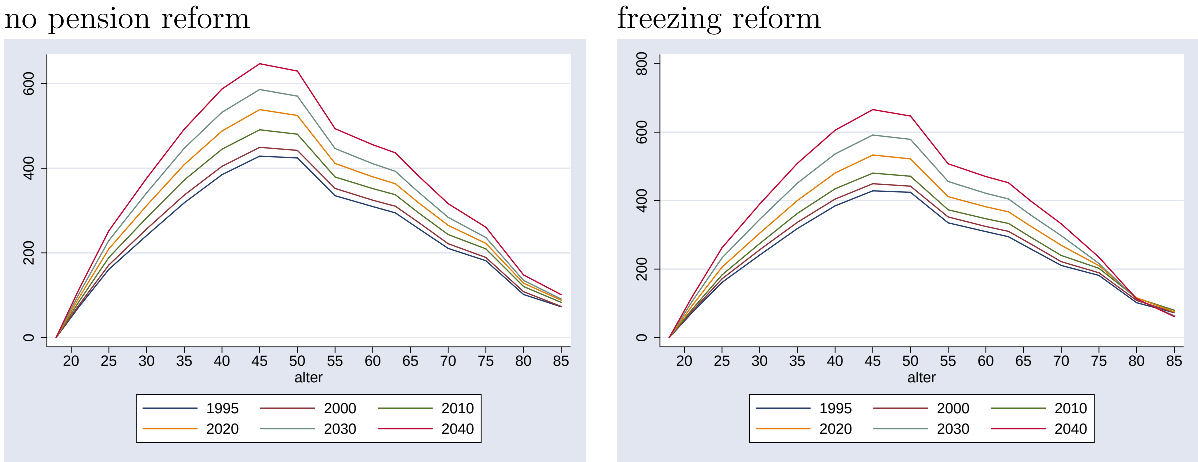
$$weight_{a,h,t} = \frac{sw_{a,h,93}}{pop_{a,93}} \cdot pop_{a,t} \cdot x_{a,h,t,OLG} \tag{3.12}$$

where $x_{a,h,t,OLG}$ is:

$$x_{a,h,t,OLG} = x_{a,h,t} * (1 + \Delta_{a,t}(x_{OLG})) \tag{3.13}$$

In contrast to scenario I, which assumed that everybody's total expenditures rise by a fixed rate, total expenditures are now increasing heterogeneously over time according to the projection from the OLG model.

Figure 3.9: Monthly total expenditures by age under alternative pension schemes, 1995-2040



I use two extreme scenarios for pension reform in Germany in order to show the upper and lower bounds of the effects: The first case assumes no pension reform. Retirement benefits are held constant at a replacement rate of 70% of the former labor income. Contributions are variable in this scenario and have to increase from 20% to 32% of labor income in 2040 in order to keep the pension system financially sustainable. This scenario will be labelled "no pension reform". It imposes the entire demographic burden on the working population - to the benefit of the retirees. With no pension reform, there will be virtually no change in the distribution of total expenditures, as can be seen in the left part of Figure 3.9. This scenario also includes expenditure growth in the magnitude of about 1.22 percent which is only slightly lower than in scenario II. Hence, I compare the results of the two pension reforms with scenario II.
The second pension reform proposal postulates the other extreme. The contribution rate is frozen at the current level of 20%. I henceforth call this scenario "freezing reform". Under this reform, benefits are variable and the replacement rate falls from 70% to only 42% of former labor income in 2040. Total expenditures increase for all age groups, but the elderly loose relative to the younger age groups (see Figure 3.9). This is not surprising since this reform proposal freezes the contribution rates so that the demographic burden is borne by the retirees alone.

Scenario IV: population aging and a changing household composition
Average household size shrinks in the course of population aging. This is partly due to the decreasing number of children. Furthermore, little downsizing is observed in housing demand when children leave the house or when spouses die. On contrary, the better health status of today's elderly enables them to live on their own for a longer time. Due to these factors, the number of households shrinks much more slowly than the population. According UN data, the German population will start to shrink in

2005, while the number of households will decline only after a 15 year delay in 2020 (Börsch-Supan, Ludwig, and Sommer (2003)). However, in the meantime, households' demographics like household size and the number of kids will change. In consequence, I relax the assumption of time-constant household characteristics to incorporate the reduction in household size in the fourth scenario.
The projections will be conducted using the FAMY household projection by the Statistisches Bundesamt (2003).[8] The tool provides age-specific projections of the average household size. I relax the assumption of the base scenario, that the characteristics of a household of age a do not vary over time. Instead, I assume that the socio-economic characteristics of households with a head of age a and household size s do not vary over time. The weights used to aggregate the data are:

$$weight_{a,h,s,t} = \frac{sw_{a,h,s,93}}{hhpop_{a,s,93}} \cdot hhpop_{a,s,t} \cdot x_{a,h,s,t} \tag{3.14}$$

where $hhpop_{a,s,t}$ denotes the number of households with size s and age of the head a at time t. Again, I use 1993 as base year. Notice that it is no longer necessary to map the individual demographic data to the household data. Instead, I directly use a demographic projection based on households. This new weighting procedure captures changes in the age structure of the population *and* changes in the number and composition of households. It reflects the trend towards a higher fraction of single households and small families. No change in incomes over time is modelled in this scenario.

3.3.4 Projection Results

Scenario I: The direct effect of an aging population on demand
Table 3.3 displays the projected aggregate demand of the household sector and its total percentage change between 1995 and 2040. At first glimpse, the aging effects on the aggregate do not appear large. Looking more closely at the percentage changes over time, however, increasing health and energy shares in the order of about 5 to 7 percent are to be expected until 2040 and the share of the category Other increases by about 16 percent. These increases are counteracted by a decline in the share of transport goods and services of about 7.6 percent and smaller declines in the share spent on leisure and clothing of about 3 to 4 percent.

[8] A detailed description of FAMY can be found in Appendix 3.5.5.

Table 3.3: Projected aggregate expenditure shares (in %), 1995-2040, base line scenario

year	1995	2000	2010	2020	2030	2040	% change	
							1995-2030	1995-2040
food	25.0	25.1	25.0	24.9	24.9	24.9		-0.7
clothing	9.6	9.6	9.6	9.5	9.4	9.3		-3.0
energy	7.1	7.2	7.2	7.3	7.4	7.5		5.3
furniture	9.1	9.2	9.1	9.1	9.1	9.0		-2.1
health	7.8	7.8	7.9	8.0	8.2	8.3		6.6
transport	18.7	18.5	18.2	18.0	17.7	17.3		-7.6
leisure	12.0	12.0	11.9	11.7	11.6	11.5		-4.4
other	10.6	10.7	11.1	11.4	11.8	12.3		16.3

Thus, if aging took place without any accompanying changes of the socio-economic environment of households, the demand composition would change in an intuitive way: The higher fraction of elderly people in the economy would lead to relatively higher energy demand and higher demand for health goods. Furthermore, the demand for personal goods, hotels and package holidays (Other goods) would increase as well. The results are due to the fact that in 2040, the age group under 40 years will have a low weight in the aggregate demand. On contrary, not only people above 60 years will be numerous, but also the age group 40-60 years will form a large fraction of the West German population - and will therefore have an important weight in the aggregate. This latter group has much higher total expenditures than the elderly and will heavily influence the aggregate demand structure.
However, as has been shown by other authors (e.g. Börsch-Supan (2003a, Börsch-Supan, Ludwig, and Sommer (2003)), the age structure of the population brings about and is accompanied by additional changes in the socio-economic situation of households. Some of these are reflected in the following.

Scenario II: population aging and economic growth
The results in Table 3.4 show that population aging in a growing economy would lead to an increase in the share of health expenditures of about 9 per cent until 2040, and raise the expenditure shares of Other goods like holiday travel by more than 90 percent. This massive increase is due to the high income elasticity of this category. All other expenditure categories including energy would experience declines measured in shares. The difference to the baseline scenario is caused by the increases in consumer expenses over time. Since I let expenditures rise by the same percentage for all households, this scenario shows the demand changes if we all become richer in addition to the demographic changes ahead. The increase in the health share is due to the rising expenditures for out-of-pocket health with age, and due to the low income elasticity of health expenditures. The Engel curve for health depicted in Figure 3.5 shows this effect clearly. On contrary, the expenditure shares of necessities like food and energy would decrease by about 18 respectively 13 percent. Furniture and transport shares

are cut back in the same range. Appendix 3.5.6 contains the projection results for alternative assumptions about expenditure growth. Higher growth rates obviously yield more pronounced changes of the demand pattern over time, and vice versa. The qualitative trends are robust.

Table 3.4: Projected aggregate expenditure shares (in %), 1995-2040, scenario II

year	1995	2000	2010	2020	2030	2040	% change 1995-2030	% change 1995-2040
food	24.5	24.0	22.9	21.9	21.0	20.1		-18.0
clothing	9.6	9.6	9.5	9.4	9.2	9.0		-6.3
energy	6.9	6.8	6.5	6.2	6.1	6.0		-13.0
furniture	9.1	9.0	8.7	8.5	8.1	7.6		-16.5
health	7.8	8.0	8.1	8.3	8.4	8.5		9.0
transport	18.6	18.3	17.8	17.3	16.5	15.7		-15.6
leisure	12.1	12.0	11.9	11.7	11.6	11.3		-7.1
other	11.4	12.3	14.6	16.7	19.2	21.8		91.2

However, one may ask how plausible the assumption of symmetric growth in incomes and expenditures is. The intensive political discussion about the sustainability of social security systems and intergenerational fairness shows, that aging leads to changes in the income distribution through the pension system. It is the goal of most pension reform proposals to "correct" this built-in automatism of a pay-as-you-go system towards a more equal burden-sharing between generations. The following section uses projections of the future income distribution under alternative pension reform proposals.

Scenario III: population aging and increasing intergenerational heterogeneity in total spending
In this scenario, I compare the effects of the two extreme pension systems, the "no pension reform" case and the "freezing reform". The results, depicted in Table 3.5, show that the effects of the reforms are very similar. The high population age share of the old and the middle-aged decreases the share of transportation expenditures in both scenarios. Food and energy erode even more strongly than in the first two scenarios. Meanwhile, the fraction of total expenditures spent on health increases slightly less. Finally, the decrease in the education & leisure expenditure share is slightly more under the freezing reform than under the current system.

Table 3.5: Projected aggregate expenditure shares (in %), 1995-2040, scenario III

year	1995	2000	2010	2020	2030	2040	% change 1995-2030	% change 1995-2040
current system								
food	24.4	24.0	22.9	22.1	21.3	20.7	-12.9	-15.5
clothing	9.6	9.6	9.5	9.4	9.3	9.1	-3.5	-5.3
energy	6.9	6.8	6.5	6.3	6.2	6.1	-11.1	-12.1
furniture	9.1	9.0	8.7	8.5	8.2	7.8	-9.5	-13.5
health	7.8	8.0	8.1	8.2	8.4	8.5	7.1	8.1
transport	18.6	18.3	17.8	17.4	16.7	16.1	-10.1	-13.6
leisure	12.1	12.0	11.9	11.8	11.6	11.4	-3.5	-5.0
other	11.4	12.4	14.5	16.3	18.3	20.3	60.1	77.6
freezing reform								
food	24.4	24.0	23.4	22.5	21.7	21.0	-11.4	-14.3
clothing	9.6	9.6	9.6	9.5	9.5	9.3	-1.7	-2.8
energy	6.9	6.8	6.6	6.3	6.2	6.0	-11.0	-13.0
furniture	9.1	9.0	8.8	8.7	8.4	8.1	-7.3	-11.1
health	7.8	8.0	8.0	8.1	8.3	8.3	5.6	6.3
transport	18.6	18.3	18.0	17.7	17.2	16.6	-7.8	-10.8
leisure	12.1	12.0	11.9	11.9	11.8	11.7	-1.9	-2.8
other	11.4	12.4	13.6	15.2	17.1	19.0	49.2	65.7

Generally, the freezing reform triggers slightly smaller changes in aggregate demand, because it redistributes toward the younger population with lower spending power, while maintaining the current system accelerates the demographic burden on the working population. The difference is small because of the small expected difference in the income distribution profiles shown in Figure 3.4. The reforms yield relatively similar outcomes because they do not model the intra-generational redistribution of the pension system. The pension system in the OLG model is an insurance system in which benefits are paid according to contributions.[9] Both reforms, however, once more illustrate the influence of rising total expenditures on the composition of demand: the age dependency of total expenditures has a hump-shaped profile. Thus, the growth in expenditures, which is present in both scenarios, will increase the weight of the middle-aged in aggregate demand due to their higher absolute spending.

In summary, the range of proposed pension reforms in Germany will not have strong effects on the demand patterns. The macroeconomic implications of aging societies are caused primarily by the direct effect of aging on capital, labor and goods markets,

[9] Hence, the impact of a pension reform like the proposed "Grundrente", which redistributes towards the poor, is not incorporated here.

and not by indirect effects via the social security system.

Scenario IV: population aging and a changing household composition
In this scenario, I account for age-specific changes in the household size. These are natural accompanying effects of population aging, as i) the number of single households among the younger population increases, ii) fertility is low, iii) increased life expectancy implies that parents live on their own for a longer time, after their children have left home, and iv) more elderly will live in single households after the death of the partner. All these factors contribute to a decreasing average household size. Moreover, iii) and iv) delay the reduction of the number of households. According to the underlying household projection, the number of single households is going to almost double until 2030, while the number of households larger than two persons is going to shrink by about 30%. Average household size is projected to fall from 2.44 to 2.07 between 2000 and 2030.
What effects on the composition of aggregate demand should be expected when accounting for changing household size? It is most likely, that a larger number of single households in the population is associated with a higher demand for a certain range of goods, i.e. washing machines, furniture, energy etc. Especially those goods that exhibit returns to scale should be demanded relatively more in societies with many single households than in a society with a larger average household size. In addition, the trend towards larger apartments and houses in the last decades in spite of decreasing average household size is also expected to increase aggregate demand for durables like furniture and also for energy.

Table 3.6: Projected aggregate expenditures shares (in %), 1995-2030, scenario IV

year	2000	2010	2020	2030	% change 1995-2030
food	26.4	26.3	26.3	26.3	-0.2
clothing	9.9	9.8	9.8	9.7	-1.6
energy	7.3	7.5	7.7	7.9	8.2
furniture	9.6	9.5	9.5	9.5	-1.4
health	7.6	7.8	7.9	8.0	6.1
transport	19.7	19.1	18.9	18.6	-5.6
leisure	12.3	12.3	12.2	12.2	-0.8
other	7.2	7.6	7.6	7.7	6.5

Table 3.6 shows that the demand changes are much more moderate than in scenario I, where I did not account for changing household composition. However, the demand change in favor of health has with 6.1 percent about the same size as in the baseline scenario. The results show that the assumption of constant household composition in scenario I does not hold. By this assumption, one underestimates the demand changes for energy and Other goods and overestimates the change in demand

for furniture, clothing, transport and leisure. This is due to the fact that the number of households decreases more slowly and average household size decreases faster than assumed in scenario I. Hence, the the increasing number of single households is accounted for in this scenario. In consequence, the future demand share for energy is higher, since economies of scale cannot be realized in single households and a lower decrease of the share for expenses on clothing and leisure. The latter accord well with the microeconometric results in Section 3.2.5, as clothing and leisure expenditure shares decrease in household size.

However, some caveats have to be mentioned: First, the changes are smaller, because we look at the shorter timespan between 2000 and 2030. Comparing the results from this scenario and scenario I for 2000 until 2030, however, does not alter the differences substantially. Second, the household projection does not reach back to the past so far, so I proxy the household distribution in the base year 1993 by the distribution in the year 2000. This approximation renders the computation less precise and potentially leads to a slight underestimation of the demand changes.

3.4 Conclusions

In the microeconomic analysis, strong age-specific differences in household demand structures in West Germany are identified. In the course of the life cycle, health, and education & leisure goods become more important components of total nondurable expenditures—mainly due to their higher total expenditures compared with young households. In an aging economy like Germany, these age effects translate into aggregate demand changes for the composite goods over time. These changes are substantial. Especially furniture, clothing, transport and education & leisure expenditures become a less important factor in total spending, while health and Other goods gain in weight in aggregate demand.

The use of separate scenarios, which separate various aspects of population aging, helps to better understand the transmission mechanisms of population aging. While the pure effect of a shift in the population age structure does already trigger significant demand changes, the effects are magnified when moderate growth in total expenditures is assumed. Furthermore, changes in the intergenerational distribution of total expenditures do not result in large differences in the projected evolution of aggregate demand composition. This is due to the small distributional changes that are assumed, although two extreme pension schemes are modelled.

Hence, even under extreme reform proposals, the effect of expenditure growth is much stronger than the indirect effect resulting from a pension reform and its effect on the spending power of households.

Finally, taking into account the changes in family formation which lead to a rapidly decreasing household size, but a slow decrease in the number of households, does not alter the results much. The effect of population aging becomes slightly smaller, but the qualitative results are the same.

In summary, the results indicate that future trends in consumer demand caused by

population aging. However, these changes are not caused solely by age-specific tastes, but also to a large extent by the different spending power of the age groups.
These effects trigger changes in sectoral production and employment. If relatively more of health and leisure goods are demanded then sectoral production has to adjust, too. Thus, there might be a higher demand for professions associated with health services and pharmaceutical production as well as for services in the leisure goods sector which comprises sports activities, cultural activities like cinema, theater etc., gardening, and so forth. This way, population aging does not only change demand trends in the (West) German economy substantially, but can also affect the German labor market unless the changes in demand are absorbed by changing trade patterns.

3.5 Appendix

3.5.1 Description of the composite goods & services

In the four EVS waves 1978, 1983, 1988 and 1993, the eight composite goods categories are defined in the same way. The single exception are travel expenditures: they are contained in the category "Other goods" in 1993 while they form a separate category in the older waves. Therefore, I construct a category "travel & other" which is consistent over the four waves.
In 1998, the European COICOP classification of goods was adapted so that the categories are now consistent with those in other European surveys, but not consistent with the definitions in the preceding waves. Therefore, I reconstruct the classification adapted for the older waves for 1998. The detailed information on the subcategories available in the EVS 1998 enables me to regroup expenses.
The resulting eight categories are:

Food	Food at home, food out, tobacco, alcohol
Clothing & Shoes	Mens', womens', childrens' and sports clothing, shoes; repairs and amendments of shoes & clothing
Energy	Energy (excluding fuel)
Furniture & Home Electronics	Furniture, home textiles, furnishings, electrical appliances, other household equipment, household consumables, repairs
Health & Body Care	(Out-of-pocket) health goods and services, body care goods and services
Transportation & Communication	Motor vehicles, bikes, fuel, repairs of and services for motor vehicles & bikes, car travel expenses, driver's licence fees, travel fares, telephone charges, mail charges
Education & Leisure	Holiday expenses, audio-visual equipment, records, toys, photo & sports goods, personal articles, books & newspapers, gardening products, subscriptions, lesson charges, theater, cinema etc., petcare
Other goods	Personal goods, hotels and similar expenses, package holidays

3.5.2 The Deaton-Paxson decomposition

This decomposition is achieved by making the time effects orthogonal to a time trend (Deaton and Paxson 1994). The year dummies have to be replaced by:

$$d_t{}^* = d_t - [(t-1)d_2 - (t-2)d_1] \tag{3.15}$$

where d_t is a year dummy for the year t, and d_1 and d_2 are the dummies for the first two years in the sample. The "base year" is thus a timeless average of all years, and

any time trend is attributed to cohort and ages, rather than to time. Due to the additional restriction, that the time effects sum to zero, the dummies for the years 78 and 83 are left out in the estimation.
Moreover, I estimated different specifications of the cohort effects. First, the cohort effect enters as a spline function with kinks at birth years 1930 and 1950. This is advantageous compared to using cohort dummies, because this parameterization allows straightforward projections in the second part. With dummies, I would have to make ad hoc assumptions about the cohort effects of newly entering cohorts that are not included in the sample. The spline function avoids such ad hoc assumptions. However, this specification of the cohort effect might be too restrictive, so I also show results with a full set of dummies.

3.5.3 Regression results: owner-occupier status

This section contains the estimated coefficients for the interaction variables of household characteristics and income with the owner-occupier dummy not reported in Table 3.2:

	food	**clothing**	**energy**	**furnit.**	**health**	**transp.**	**leisure**
log total expenditures interacted with owner-occupier status							
$ln(exp)$	-0.54527	0.25214	-0.37914	0.36865	0.14381	0.19278	0.45435
	(6.84)***	(5.30)***	(10.56)***	(4.57)***	(2.76)***	(1.93)*	(7.69)***
$ln(exp)^2$	0.04142	-0.01821	0.02851	-0.03062	-0.01022	-0.0135	-0.03456
	(6.28)***	(4.62)***	(9.59)***	(4.58)***	(2.37)**	(1.63)	(7.06)***
$ln(exp)$	0.0131	-0.00735	0.00921	-0.0105	-0.00068	-0.00312	-0.01237
$*age$	(5.91)***	(5.56)***	(9.23)***	(4.68)***	(0.47)	(1.12)	(7.53)***
$ln(exp)^2$	-0.00097	0.00051	-0.00068	0.00091	0.00002	0.00018	0.00095
$*age$	(5.16)***	(4.56)***	(8.05)***	(4.78)***	(0.17)	(0.78)	(6.84)***
$ln(exp)$	-0.00007	0.00005	-0.00005	0.00007	-0.00002	0.00002	0.00008
$*age^2$	(4.91)***	(5.12)***	(7.46)***	(4.57)***	(1.67)*	(1.09)	(7.01)***
$ln(exp)^2$	0.00001	0.00000	0.00000	-0.00001	0.00000	0.00000	-0.00001
$*age^2$	(3.96)***	(3.68)***	(5.81)***	(4.68)***	(1.99)**	(0.61)	(6.12)***
age21-24	-0.15202	0.05564	-0.05862	0.08828	0.03568	0.07837	0.07166
	(4.94)***	(3.03)***	(4.23)***	(2.83)***	(1.78)*	(2.03)**	(3.14)***
age25-29	-0.29768	0.13414	-0.14726	0.18222	0.05297	0.09088	0.18561
	(7.04)***	(5.32)***	(7.73)***	(4.26)***	(1.92)*	(1.72)*	(5.92)***
age30-34	-0.44514	0.21654	-0.25763	0.27755	0.07839	0.13009	0.31625
	(7.35)***	(5.99)***	(9.44)***	(4.53)***	(1.98)**	(1.72)*	(7.04)***
age35-39	-0.58425	0.29472	-0.35136	0.36703	0.10677	0.15561	0.43726
	(7.45)***	(6.29)***	(9.94)***	(4.62)***	(2.09)**	(1.58)	(7.51)***
age40-44	-0.70551	0.35763	-0.43851	0.44303	0.13533	0.19447	0.53995
	(7.44)***	(6.31)***	(10.26)***	(4.61)***	(2.19)**	(1.64)	(7.67)***
age45-49	-0.81881	0.40913	-0.51514	0.51616	0.16336	0.22361	0.63826
	(7.48)***	(6.26)***	(10.44)***	(4.66)***	(2.29)**	(1.63)	(7.86)***

	food	clothing	energy	furnit.	health	transp.	leisure
age dummies interacted with owner-occupier status							
age50-54	-0.91712	0.45672	-0.58202	0.56945	0.19525	0.25286	0.71771
	(7.51)***	(6.27)***	(10.58)***	(4.61)***	(2.45)**	(1.65)*	(7.92)***
age55-59	-0.99496	0.48979	-0.63994	0.62357	0.22739	0.26618	0.78492
	(7.50)***	(6.18)***	(10.70)***	(4.64)***	(2.62)***	(1.60)	(7.97)***
age60-62	-1.06767	0.51837	-0.68983	0.65962	0.2625	0.28172	0.84345
	(7.55)***	(6.14)***	(10.83)***	(4.61)***	(2.85)***	(1.59)	(8.04)***
age63-65	-1.09586	0.53166	-0.71741	0.67233	0.28579	0.28678	0.87166
	(7.53)***	(6.12)***	(10.94)***	(4.56)***	(3.01)***	(1.57)	(8.07)***
age66-69	-1.13342	0.54085	-0.7377	0.69226	0.30996	0.29039	0.89652
	(7.60)***	(6.08)***	(10.98)***	(4.59)***	(3.19)***	(1.55)	(8.11)***
age70-74	-1.17377	0.55381	-0.76395	0.71099	0.34181	0.2922	0.92197
	(7.69)***	(6.08)***	(11.10)***	(4.60)***	(3.43)***	(1.53)	(8.14)***
age75-79	-1.21126	0.55945	-0.78643	0.724	0.38719	0.28894	0.93986
	(7.79)***	(6.03)***	(11.22)***	(4.60)***	(3.82)***	(1.48)	(8.15)***
age80+	-1.22977	0.55058	-0.8064	0.71974	0.42929	0.28782	0.9543
	(7.86)***	(5.90)***	(11.44)***	(4.55)***	(4.21)***	(1.47)	(8.23)***
household composition interacted with owner-occupier status							
ln($hhsize$)	-0.00274	0.00699	0.00037	-0.01945	-0.00509	0.00464	0.00063
	(1.74)*	(7.43)***	(0.52)	(12.20)***	(4.95)***	(2.35)**	(0.54)
no kids	-0.01293	0.0068	0.00424	0.01696	0.00386	-0.02136	-0.00399
	(2.86)***	(2.52)**	(2.08)**	(3.71)***	(1.31)	(3.78)***	(1.19)
$\#kids$	-0.00184	-0.00008	-0.00177	0.01458	-0.00101	-0.00061	-0.00046
	(0.37)	(0.03)	(0.79)	(2.90)***	(0.31)	(0.10)	(0.12)
$(\#kids)^2$	0.00018	0.00011	0.00015	-0.00247	0.00105	-0.0009	0.00078
	(0.15)	(0.15)	(0.29)	(2.05)**	(1.35)	(0.60)	(0.88)
not working	-0.00817	0.00221	-0.00238	0.00784	0.00507	0.00703	-0.00329
	(4.98)***	(2.26)**	(3.23)***	(4.72)***	(4.73)***	(3.42)***	(2.71)***
constant	1.4085	0.18163	0.15867	-0.43255	-0.42951	-0.72629	0.05683
	(22.67)***	(4.90)***	(5.67)***	(6.88)***	(10.59)***	(9.33)***	(1.23)

3.5.4 Description of the OLG-model

In scenario III, I use income predictions from the OLG model by Börsch-Supan, Ludwig, and Winter (2005) which is based on the traditional model of Auerbach and Kotlikoff (1987). It is a large scale simulation model comprising 80 overlapping generations and multiple countries respectively world regions. The model simulates the key macroeconomic variables such as GDP, savings and consumption over the period 2000 to 2050. It is especially designed to simulate international capital flows between countries and world regions, and for the evaluation of policy reform, in particular pension reform.

The model contains one representative agent per generation who maximizes her utility

fully rationally over the life cycle. The agent's utility depends on his consumption. Labor is exogenous and is calibrated according to a projection of labor market participation. This forecast originates from a demographic projection by the UN and additional assumptions about female labor force participation, a decline of EU-wide unemployment to the natural rate of 5 per cent until 2030, and a rise in the retirement age in the same period.
The total consumption of the representative agent of age a is the difference between net labor and asset income minus savings.

3.5.5 Description of the FAMY-model

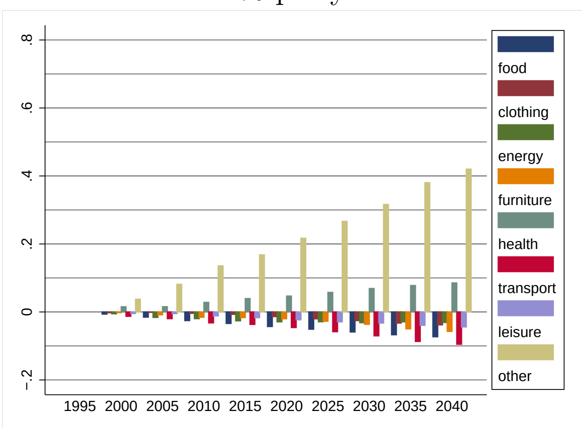
In scenario IV, I use the household projections that are derived from demographic projections using the Pro-FAMY simulation model. This tool was developed jointly by the Bundesinstitut für Bevölkerungswissenschaft, the Max-Planck Institut für Demografie and empirica. The projections have kindly been provided to me by Harald Simons.
The Pro-FAMY model combines demographic projections with projections about the changes in living arrangements, i.e., the composition of households, marital status, and the number of children. For a detailed description of Pro-FAMY see Hullen (2003).

3.5.6 Alternative growth rates in Scenario II

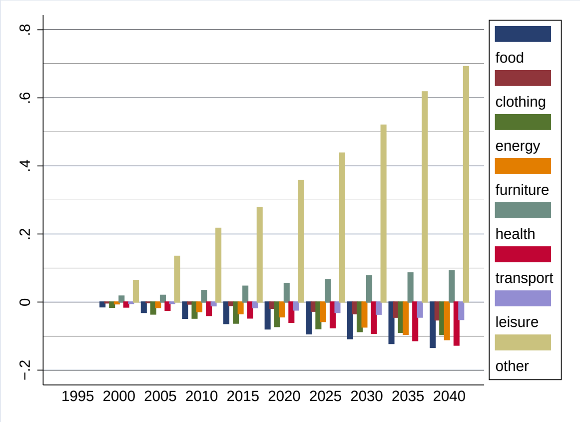
The section shows the results of scenario II if one makes alternative assumptions about the growth rate of income. In addition to the assumption of 1.4 percent growth annually, the demand changes are projected in a low variant assuming 0.5 percent, and a high variant assuming a growth rate of 1 percent annually.

Figure 3.10: Projected percentage change in aggregate expenditure shares under various growth rates in total expenditures

0.5% per year



1% per year


.8
.6
.4
.2
0
−.2
1995
2000
2005
2010
2015
2020
2025
2030
2035
2040
food
clothing
energy
furniture
health
transport
leisure
other

4 Consumer expenditures and home production at retirement - New evidence from Germany

4.1 Introduction

This chapter investigates whether consumer expenditures change around retirement in Germany and whether this is accompanied by changes in home production. A distinct drop in spending around retirement has already been documented for the US, Italy and the UK. This drop has been termed the retirement consumption puzzle because standard life cycle theory predicts that forward-looking agents with concave utility functions smooth consumption over time, such that no drop is to be expected. Various reasons have been put forward in the literature to solve this puzzle and to reconcile observed behavior with the life cycle theory. They range from unexpected health and income shocks around retirement to the cessation of work-related costs, non-separability between consumption and leisure, and the substitution of expenditures by increased home production.

This chapter contributes to the literature by presenting evidence on the magnitude of the drop in expenditures in Germany. Additionally, I analyze the role of home production in solving this empirical puzzle and reconciling it with the life cycle model. Home production has been investigated so far by looking at detailed expenditure categories like food at home which can be substituted by home production. Disproportionate expenditure drops in these categories have been interpreted as indirect evidence of increased home production activities. This interpretation cannot be separated from disproportionate expenditure cuts on some commodities that are *not* compensated by increases in home production. Combining the analysis of expenditure data with time use data, I can draw direct conclusions about the home production activities of retirees and non retirees, and whether they complement the observed drop in spending.

Since the structure of the German and Italian expenditure data is very similar, the empirical analysis conducted in this chapter is very much inspired by Miniaci, Monfardini, and Weber (2003) who investigate the retirement consumption puzzle in Italy. I restrict the analysis to nondurable expenditures and do not decompose expenses by types of commodities.

Using the German budget survey (*Einkommens- und Verbrauchsstichprobe (EVS)*) over the period 1978-1998, I find a significant one-off drop in nondurable consumer expenses at retirement which is comparable to those found for the US, Italy and the UK. After a descriptive analysis of cohorts, I investigate this drop in a multivariate regression analysis controlling for differences in household characteristics of retired and not retired households[1], and for age and cohort effects using the Deaton-Paxson decomposition. The results point to a 17% drop in nondurable spending which varies across age groups. Furthermore, the analysis shows that the drop is discontinuous and levels off partially during retirement.

Additionally, I use two waves of the German time use survey (*Zeitbudgeterhebung*) from the years 1991/92 and 2001/02 to investigate whether this drop is compensated by increased home production. This explanation for the drop in expenditures bases on the notion that consumption does not equal expenditures. If households engage to a considerable degree in producing goods and services themselves, they can consume more than just their market purchased goods and services. The analysis of the time use patterns of retirees and non retirees shows that home production is with 70 additional minutes per day significantly higher in households with a retired head.

The remainder of the chapter is organized as follows: Since the literature on the retirement consumption puzzle is quite recent, and no comprehensive survey has been published yet, I give an extensive overview over the literature in Section 4.2. Next, I describe the data (Section 4.3) and give some basic facts about retirement behavior in Germany and the retirement definition used (Section 4.4). Then, I provide first results on the puzzle and its potential explanations for Germany in a descriptive analysis on the basis of the *Einkommens- und Verbrauchsstichprobe* and the *Zeitbudgeterhebung* in Section 4.5. Third, I refine this analysis using regression techniques and complement the analysis of expenditure data by an analysis of the time use of the elderly in Section 4.6. Section 4.7 concludes.

4.2 Literature review

The life cycle model predicts that rational forward-looking agents make their savings decisions such that consumption is smoothed over the life cycle (Modigliani and Brumberg 1954). In spite of several extensions of the life cycle model which comprise uncertainty about the length of life, precautionary savings motives, and bequest motives, the model has recently been challenged by empirical studies showing that US and British households reduce their consumer expenditures significantly upon entry into retirement (Banks, Blundell, and Tanner 1998; Bernheim, Skinner, and Weinberg 2001; Hamermesh 1984; Hurd and Rohwedder 2005; Miniaci, Monfardini, and Weber 2003). This phenomenon has been termed the retirement consumption puzzle.

The drop in consumer expenditures is sizeable: Bernheim, Skinner, and Weinberg (2001) find that 31% of US households reduce their expenses by at least 35 percentage points at retirement, while Hamermesh (1984) found that 53% of the retired couples reduced their spending by more than 10% relative to the average change in real spending between 1973 and 1975. Laitner and Silverman (2005) report the drop to amount to 16% for the US on the basis of the *Consumer Expenditure Survey.*

[1] Throughout the chapter, I use the terms "households with a retired head" and "retired households" synonimously. This is done to simplify the formulation.

Contradictory evidence is provided by Christensen (2004) who uses Spanish panel data, the *Encuesta Continua de Presupuestos Familiares*, to isolate the effect of retirement, i.e., the increase in leisure time, on expenditure. Due to special features of the Spanish pension system, income does not change upon retirement for a group of retirees, so that the income effect and the effect of additional leisure on consumer behavior are not confounded. Christensen does not find evidence of a drop in consumer expenditures and also the estimation of a demand system does not provide any significant changes in consumer behavior around retirement.

There are a few studies based on food expenditures. Based on this subset of total consumer expenditures, Smith (2004) draws a less drastic picture—at least regarding the consistency with the theoretical predictions of the life cycle model. She finds that 57% of retirees in the UK experience no drop in food expenses at retirement. Out of the remaining 43%, the majority of 24 percentage points experienced a decline in expenses which was associated with involuntary retirement due to a bad health status or unemployment. Thus, only 19% of the households in the *British Household Panel* experience a puzzling decline in food spending. On the contrary, Bernheim, Skinner, and Weinberg (2001) find that total food expenditures of the average US household decline by roughly 30 % between the pre and post retirement periods. Similarly, Aguiar and Hurst (2004) investigate food spending using data on US household food diaries (*Continuing Survey of Food Intakes by Individuals*) and find a decline in food spending by an average of 11%.

4.2.1 Work-related costs

Several reasons have been put forward to explain this puzzle, and to reconcile it with the life cycle theory. The first argument is that total consumer expenditures decrease due to the cessation of work-related expenses upon retirement. "Households with higher work-related expenses should accumulate less wealth and experience larger declines in consumption at retirement" (Bernheim, Skinner, and Weinberg 2001). Hence, the idea behind this argument is that households simply re-optimize their consumption bundle because formerly necessary expenses related to work are now redundant. These work-related expenses consist of meals purchased out of home, adult clothing, transport costs for travelling to and from work, and expenses for domestic services. Banks, Blundell, and Tanner (1998) for the UK, Bernheim, Skinner, and Weinberg (2001) for the US, as well as Miniaci, Monfardini, and Weber (2003) for Italy have explored whether work-related expenses are large enough to account for the sizeable one off-drop in consumption. The general finding is that the cessation of work-related costs reduces spending in old age to some extent, but cannot explain the magnitude of the observed drop.

4.2.2 Unanticipated income shocks around retirement

A second explanation are unanticipated shocks occurring around retirement, i.e., individuals expect a larger retirement income *ex ante* than they receive *ex post*. Such an unanticipated negative income shock reduces lifetime wealth and hence induces households to re-optimize and adjust their expenditures downward. Bernheim, Skinner, and Weinberg (2001) find that "even when we remove the effects of unexpected retirement, the size of the consumption discontinuity is still strongly related to wealth and income" (p.854). In a study of British households, Banks, Blundell, and Tanner (1998) find that differential mortality risk and work-related costs, i.e., anticipated changes at retirement, explain a large fraction of the observed fall in consumption. However, about one third of the drop cannot be explained by these factors. Hence, the authors argue that this must be due to "unanticipated shocks occurring around the time of retirement" (p.784).

Evidence that individuals overestimate their pension benefit entitlements has been provided by Dilnot, Disney, Johnson, and Whitehouse (1994) using the *Retirement Survey*. They find that 40% of individuals had expected more benefits than they received, and expectations were too pessimistic only for one tenth of the sample. Thus, when individuals learn about the incorrectness of their expectations, they realize that their lifetime resources are smaller than they thought and adapt their consumption level accordingly.

The most direct evidence on whether unexpected shocks can explain the retirement consumption puzzle has been provided by Hurd and Rohwedder (2003,2005). In a supplement to the *Health and Retirement Survey* called *Consumption and Activities Mail Survey (CAMS)*, workers are asked directly how much they expect their spending to change when they retire and they ask retirees about their actual retirement income. They find that individuals anticipate their future spending correctly: Among singles (couples), the average anticipated drop in spending is about 20% (for both groups) compared to an actual decline of about 17% (12%). In Hurd and Rohwedder (2005), the authors refine their evidence by asking those respondents who retired during the first and second wave of CAMS whether their spending changed when they retired. Using this small panel, they find similar numbers. 46% of those retiring between the two *CAMS* waves experienced a decline in spending, confirming the expenditure drop. But even a larger fraction of people, namely 59%, anticipated a decline in spending. The relative difference between anticipations and recollections is about the same as in the cross-section, namely 13-16 percentage points of consumer expenditures. Thus, the share of respondents anticipating a decline is larger than the share reporting a decline in spending after retirement entry. The authors conclude that based on cross-sectional as well as on panel data, there is little indication for unexpected income shocks at retirement. Furthermore, they conclude that these results are in line with the estimated reduction in spending of 14% in Bernheim, Skinner, and Weinberg (2001) which they attribute to unexpected shocks. However, Table 6 in Hurd and Rohwedder (2005) shows that though the majority of 49.8% of those retiring between the waves anticipates their spending in retirement correctly, the other 50.2% of people anticipates their spending in retirement wrongly. While 16.3% fare better than they thought, 33.9% fare worse than anticipated. Taking the difference between these groups, a net fraction of 17,6% of those retiring experiences an unexpectedly lower spending than they thought before retiring. This unexpected drop suggests that some people experience an unexpected shock around retirement.

4.2.3 Unanticipated health shocks

Another unexpected shock which could explain the drop in expenditures could be a sudden deterioration of the health status which induces a person to retire earlier than planned. Hence, they forego additional earnings and their lifetime resources are reduced. Hurd and Rohwedder (2005) use the self-reported health status and find that subjective health can explain some part of the observed drop, but again does not fully account for the magnitude of the drop. More precisely, Hurd and Rohwedder (2005) exploit a question on whether health was an important reason for retiring. Among those households for whom health was an important reason (21.9% of the sample), 68% had a decline in spending with an average magnitude of around 25%. The other two-thirds of respondents who did not state health to be a retirement reason reduced spending by 11% only. This represents evidence that people who retire early because of bad health also reduce spending more in retirement. However, this approach does not allow to separate an expected from an unexpected health deterioration. While expected health shocks lead to a reduction in lifetime resources and hence to lower overall expenditures, unexpected health shocks which lead to early retirement involve a reduction of expenses following the shock. Thus, the results are consistent with the idea of unexpected health shocks (otherwise one would expect lower total spending compared to the healthy households, but one would *not* expect a larger reduction in spending upon retirement), but they do not represent direct evidence.

4.2.4 Substitution between consumption and leisure

Another explanation for the retirement consumption puzzle becomes evident when one generalizes the standard life cycle model to have more than one argument in the utility function. Assuming that utility depends on consumption and leisure, the within-period utility function is $u(f(c_t, l_t))$. Laitner and Silverman (2005) show that there should not be a discontinuous drop in consumption growth at retirement if the utility function is separable. However, if one does not make this restrictive assumption, then the marginal utility of consumption depends on leisure. The direction can go either way: If consumption and leisure are complements, then households will want to increase their consumption after retirement to take advantage of the increased marginal utility of consumption via higher leisure. If they are substitutes though, the marginal utility of consumption will decrease with higher leisure, such that households compensate the higher leisure by consuming less goods and services. This second case would be consistent with the observed drop in consumer expenditures *and* the life cycle hypothesis. Furthermore, one would also expect the discontinuous jump in leisure to translate into a drop of expenses which is also discontinuous. Laitner and Silverman (2005) summarize this argument as follows: "Intuitively, if a household's taste for intertemporal smoothing is sufficiently high, it will choose to decrease its consumption at retirement so that lost utility from consumption offsets gains from additional leisure. If it has a lower desire for intertemporal smoothing, on the other hand, the household might want to increase its consumption at retirement to take advantage of the complementarity of consumption and leisure." (p. 28).

Hurd and Rohwedder (2003) expect that the substitution elasticity between consumption and leisure differs across households due to "differences in tastes and economic resources" and they also suppose heterogeneity across types of goods and types of leisure activities.

4.2.5 Changes in home production

Related to the issue of non-separability between consumption and leisure, an alternative way to reconcile the empirical facts with the life cycle theory becomes evident when one extends the standard model framework to comprise two consumer goods. If one good is purchased at the market and one can either be bought or produced at home, the theoretical predictions change depending on the substitution elasticity between the consumer good and the home production good (see Chapter 5, and Laitner and Silverman 2005). To put it differently, when workers retire, they have more leisure time at their disposal given constant hours spent on work at home. In consequence, their marginal utility of leisure falls, thus reducing the opportunity cost of working in home production: Retirees can make up for their reduced retirement income by producing consumer goods at home because they have substantially more (leisure) time. Additionally, households might just purchase goods less costly as before, e.g. by comparing prices more intensively or by shopping at more shops in search of lower prices. In the presence of such substitutional behavior households do not reduce their consumption, but only their expenses.[2] In contrast, households will offset the increased utility from leisure by reducing consumption expenses, if leisure and consumer goods are complements, and if households have a high intertemporal elasticity of substitution. In a two good model, one would not expect consumer expenses to remain constant, and one would expect consumption and consumer expenditures to differ. The home production argument differs from the non-separability argument made above: Even if one does not allow for goods and services to be produced at home, the leisure abundance in relation to the pre-retirement situation can lead to a consumption drop, depending on the substitution elasticity between consumption and leisure. If leisure time can additionally be used to produce consumer goods, the drop in consumer expenditures will be larger.

[2] If one assumes that utility is derived from consumption and leisure and home production is *not* possible, households can only reoptimize their utility by varying their level of consumption and their leisure time. On contrary, if one allows for home production, then households can additionally substitute between self-produced consumption and purchased consumer goods.

The scope for substituting market goods by home-produced ones is large: Households can cook more at home rather than eat out, cook more from basic ingredients which are cheaper, spend more time searching for good bargains in all consumer goods categories, do home cleaning and garden maintenance themselves, repair and wash their clothing themselves, perform simple repairs and clean their car themselves. Hurd and Rohwedder (2005) investigate whether time spent on home production changes upon retirement, and they find that time spent on these substitutes for market goods increases from 14 to roughly 20 hours per week for males aged 60-64 and from 24 to 29 hours for females.

Aguiar and Hurst (2004) compare food spending and food intake (measured in calories or vitamins) and find no evidence of reduced consumption. They interpret their findings as evidence of a change in food production which uses less or cheaper market goods and more time. Using additionally the *National Human Activity Pattern Survey*, they find matching evidence of a strong increase in time spent on food production which amounts to 21% for households in past-peak-retirement age 66-68 compared to pre-peak-retirement age 60-62. They also do not find evidence of a decline in food quality among retirees: they are just as likely to consume brand name products as workers and they do not switch to fattier cuts of meat. What they do, however, is to reduce their visits at fast food restaurants. “The probability of dining at a restaurant with table service does not vary across retirement status” (p.2). Hence, Aguiar and Hurst (2004) show that consumption is not equal to expenditures. Especially when comparing workers and retirees who have substantially different budgets of (leisure) time, consumption might be generated using strongly heterogeneous combinations of the inputs time and money.

Another study on food consumption using the *Panel Study of Income Dynamics* finds a reduction in expenditures on food at home and food out of 9% for married couple households with a retired male head (Lundberg, Startz, and Stillman 2001). This drop cannot be found among single households. Hence, the authors attribute the drop in expenditure to a change in marital bargaining power at retirement. Wives use their increased bargaining power to raise household savings because they expect a longer retirement period than their husbands due to a higher life expectancy.

The scope of studies using food expenditures in explaining the retirement consumption puzzle is limited for various reasons. First, food spending is just a subset of total expenditures. Browning, Crossley, and Weber (2003) argue that it is a good proxy for total nondurable expenditures, but Attanasio and Weber (1995) argue that this procedure is unsuitable. Their argument is that preferences are nonseparable between food and other nondurables, and that the relative price of food is very variable. Second, food is a necessity. Abstracting from home production for a moment, one would not expect households to cut their expenses on this item first in reaction to lower incomes. Hence, if households experience a drop in total nondurable expenditures, using food spending as a measure would lead to an underestimation of the drop. Third, the scope for home production, by which a household can substitute expenses by time, is potentially very large in food production.

4.3 The data

The empirical analysis in this chapter is based on two data sets: fives cross-sections of the large-scale expenditure survey *Einkommens- und Verbrauchsstichprobe* with over 200,000 households from 1978 to 1998, and two cross-sections of the time use survey *Zeitbudgeterhebung* for the years 1991/92 and 2001/02, with roughly 15,000 households. In the *EVS*, respondents are asked to record their expenses in a housekeeping book. In the time use survey, respondents also keep a diary, but record their activities during the day for two (three) days in the 1991/92 (2001/02) survey.

The dependent variables are (i) nondurable expenditure (and its log) which I deflate by the consumer price index provided by the Statistisches Bundesamt, and (ii) time spent on home production in the household in minutes per day. I will confine the analysis to nondurable consumption throughout the whole chapter. On the assumption of separability between durable and nondurable goods, this is an appropriate consumption measure.[3] The second dependent variable, home production, is defined as cooking and preparing meals, washing and repairing clothes, maintenance, repairs and cleaning of house and garden, caring for children and elderly people, and shopping activities. For both surveys, I use the provided sampling weights.

The empirical model in this section incorporates identifying assumptions about the nature of age, cohort and time effects. Since I use a dataset of repeated cross-sections, I can treat the data as a synthetic panel of cohorts.[4] The well-known identification problem between these three components is "solved" using the Deaton-Paxson approach which assumes time effects to be zero in the long-run. In the estimation, transformed year dummies are used which allow for short-run time effects like business cycles, but rule out a long-run time trend (Deaton and Paxson 1994). Hence, all remaining time variation is attributed to age and cohort effects. To control for age and cohort effects, I define age and cohort dummies in 5 year intervals, except for the age groups 60-62, 63-65, 66-69 which are defined over three year intervals. Since the *Zeitbudgeterhebung* has only been conducted twice, I do not have enough waves to separate age and cohort effects, so the cohort and year dummies are omitted in this part of the empirical analysis. However, in comparison to the *EVS*, a richer set of household characteristics, especially education and home ownership, is available which I use in the multivariate analysis in Section 4.6.

[3] If, however, households' substitution between durable and nondurable goods is related to retirement, then one might miss important dynamics in consumer behavior at retirement when excluding expenses on durables from the analysis. In order to capture interactions between both groups of goods, I condition the nondurable demands on ownership of the most sizeable durable, namely house ownership.

[4] A detailed discussion of this approach can be found in Browning, Deaton, and Irish (1985). The underlying assumption of this approach is that each cross sectional sample is a random draw the population, and that the panel identifier, here the birth year, does not change over time. A selection problem can arise due to changes in household composition and differential mortality. Both factors induce a change in the sample of a cohort from one survey year to the other. By including household size as a regressor in the estimation, I account for this selection problem.

4.4 Measurement of retirement status and retirement incentives in Germany

The key explanatory variable in this chapter, retirement status, is a dummy taking the value 1 if the household head rates herself as retiree or if she reports any type of pension income as main income source (Definition 1).[5] An alternative measure is to declare every household head who is not self-employed or a farmer, as retired if he or she is beyond age 65. In this second definition of retirement status, I additionally declare every household as retired in which one person is retired and the other one declares herself as out of the labor force (Definition 2). Official statistics show that retirement incentives work in the way that roughly every employee is retired beyond the official retirement entry age 65.

Figure 4.1 displays the fraction of retired respondents by age under the two alternative definitions of retirement status, as observed in the two data sets. The first observation is that the two definitions of retirement status yield similar results. Only after age 64, the probability of being retired is higher under Definition 2—and only in the time use survey. I will use the more conservative Definition 1 in the following.

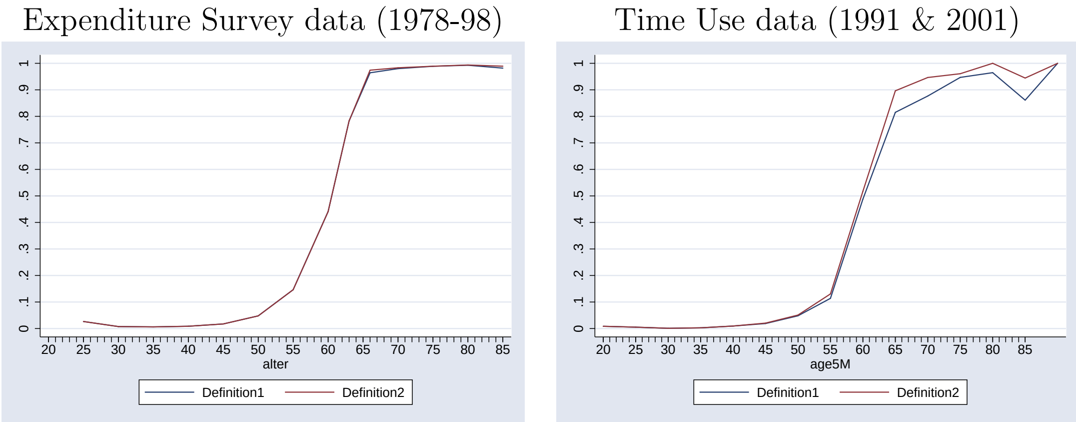
The second observation is that the retirement probability differs between the two data sets beyond age 65. This is likely due to the much smaller sample size in the time use data. The data cells of the very old ages are relatively small, such that a few outliers can dominate the average. However, up to age 64, the shape and level of the probability to be retired is about the same in the two samples.[6] 10% of the household heads are already retired at age 55, and most retirement entries are observed between ages 56 to 64. Over 90 percent of respondents are retired at age 65, and the remaining non-retirees are most likely self-employed or farmers. These two groups face completely different retirement incentives because their old-age provision system works much differently than that for employees.[7]

[5] This definition is likely to lead to an underestimation of the fraction of retired people at any point in time, because the German pension system offers a large variety of pathways into retirement. One of the most prominent ones was to retire early and receive unemployment benefits for some period until becoming eligible for early retirement benefits. Since I do not observe enough information about the work history of the sample households, I cannot account for all these pathways, and hence restrict the analysis to the ones that can be observed unambiguously.

[6] A breakdown of the retirement probabilities by survey year shows that the difference in time periods within and between the two samples does not account for the differences in retirement.

[7] Self-employed often run a family business and keep assisting in the family business. Hence, many self-employed might retire gradually or not at all.

Figure 4.1: Retirement frequency of household head: Expenditure Survey vs. Time Use data



The wide age range over which people retire in Germany is partly due to differences in statutory retirement ages for different population groups. For example, women (men) were allowed to retire at the age 60 (65) until 1992. This differential retirement age was removed in 1992 and set to 65 for both sexes and workers. Workers with a long work history, usually those with lower education, could retire earlier, at age 63, after 1992. However, the main reasons are generous early retirement schemes that were in place. Especially, disability benefits were easily available until 1992, and were paid without a downward adjustment of pensions. Hence, the German pension system sets very different retirement incentives for different workers, depending on the work history, gender, whether they are public or private sector workers, and so forth. For an overview of the incentive structure of the German pension system, see Berkel and Börsch-Supan (2004), Börsch-Supan and Wilke (2004) and Börsch-Supan, Schnabel, Kohnz, and Mastrobuoni (2004). Except for a few self-employed, retirement is completed around age 65. Unfortunately, neither the *Einkommens- und Verbrauchsstichprobe* nor the *Zeitbudgeterhebung* record any information on the work history of retired respondents. If one had data on contribution years, type of employment (civil servant, worker or private sector employee), or past earnings, one could exploit this information to properly model the retirement timing. The lack of any instruments for the retirement probability and for retirement income limits the scope of this analysis. Given the differences between households in the timing of retirement, many researchers have decomposed their results by age groups. Interacting the retirement dummy with age allows for heterogeneous effects of retirement on consumption and time use.

In the retirement consumption puzzle literature, this heterogeneity of retirement decisions, which stems mainly from differential retirement incentives set by the rules of the pension system (Börsch-Supan, Kohnz, Mastrobuoni, and Schnabel 2004), has not yet received much attention, although strategic retirement entry has been intensely studied and the patterns are well known (see e.g. Börsch-Supan, Reil-Held, and Schnabel (2001) and Berkel and Börsch-Supan (2004)). The main reason for this negligence is that information on work histories is missing in most of the surveys that have been used to study the puzzle. The tradeoff in the choice of the data is that most household panel surveys do not contain information on total expenditures and even more seldom detailed expenditure data. For this reason, most studies are based on repeated cross-sections which, however, do not record any information on past work histories. The first exception are Hurd and Rohwedder (2005) who analyze two panel waves who were designed to record detailed expenditure information. The drawback of their study is that the number of respondents who retired between the two waves is relatively small. The second exception is Christensen (2004) who uses Spanish panel data.

Table 4.1: Expected and actual retirement age in Germany in 2003

	expected retirement age		actual retirement age	
	all	45-49 yr old	sample	official stat.
men	65.7	64.1	59.9	60.5
women	64.8	59.5	59.5	60.9
total	65.3	64.3	59.7	60.7

Sources: Retirement Survey described in Börsch-Supan, Heiss, and Winter (2004), and official retirement statistics from Verband Deutscher Rentenversicherungsträger (2004)

Looking at a German cross-sectional survey conducted by the Mannheim Research Institute for the Economics of Aging in 2003, I compare the expected and actual retirement entry ages to get an idea whether expectations and behavior are coherent in the aggregate. Table 4.1 displays the average expected and actual retirement ages of the respondents in the survey and additionally the average retirement age according to official statistics. It illustrates that average actual retirement age is much lower than expected retirement age, namely 5.8 respectively 5.3 years earlier. The average retirement age of the survey respondents is between half a year and a year lower than in the population. This discrepancy is also found in Börsch-Supan, Essig, and Wilke (2005) who show in a recent survey of German Households, *SAVE*, that the expected retirement entry age exceeds the average retirement entry age in the population substantially. This difference between expectations and realizations can be due to various reasons: (i) today's expectations incorporate expectations about tomorrow's pension reforms whose directions is towards longer working lives and lower benefits. Hence, the pension timing of people retiring today and younger generations might be very different. (ii) people might experience a "surprise" at later stages in life, and realize that they accumulated more wealth and benefit entitlements than they expected so that they can retire earlier than planned, and (iii) there might be unexpected health shocks which force a fraction of workers to retire earlier than planned. In consequence, one would need information about expected and realized replacement rates in order to distinguish between the possible explanations for the discrepancy. To see how seriously explanations (i) and (ii) affect retirement age expectations, column 2 of Table

4.1 depicts the expectations of the age group between 45 and 49 years, i.e., the group which is closest to retiring. The rules and incentives of the pension system that this age group is facing is closer to those who are already retired. Furthermore, one would expect this age group to know most about the conditions they are in and the retirement incentives they are facing. And indeed, the results are consistent with these hypotheses: Expected retirement age in this group is lower among the 45 to 49 year old than overall average expected retirement age.

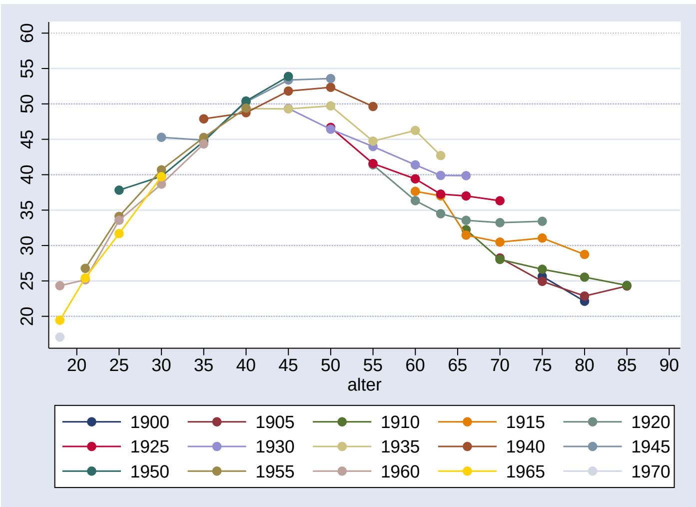
4.5 Descriptive evidence on consumer expenditures and time use

4.5.1 Is there a consumption drop?

The standard method of investigating consumption in repeated cross-sectional data is to construct pseudo-panels of cohorts. The underlying assumption for following cohorts over time is that survey respondents of each cohort are randomly drawn from the cohorts in the population. Such cohort data cannot tell us anything about dynamics within cohorts, but it helps analyzing the average evolution of cohort behavior and cohort characteristics over time. In particular, it can be used to control for unobservable fixed effects over time - with cohort fixed effects replacing the household fixed effects (Deaton 2000).

Many studies of income, savings and consumption dynamics work on the assumption that behavior differs across cohorts (Börsch-Supan, Reil-Held, Rodepeter, Schnabel, and Winter 2001; Börsch-Supan 2003b). I follow this approach and begin with presenting some descriptive evidence using cohort data.[8]

Figure 4.2: Nondurable expenditures by age and cohort (in 1000 DM per year)



[8]I use 5 year bands to define cohorts and assume time effects to be zero.

Figure 4.2 shows age cohort profiles for nondurable expenditures. Expenditures start to drop after age 45, the age where retirement probability starts to increase as seen in Figure 4.1. In comparison with Italy and the US, the drop is 5 years earlier. However, this is probably mostly a statistical artefact which is due to the 5 year averaged age variable. Furthermore, the age profile drops significantly after age 45.

Figure 4.3: Expenditures by age and retirement status (in 1000 DM per year)

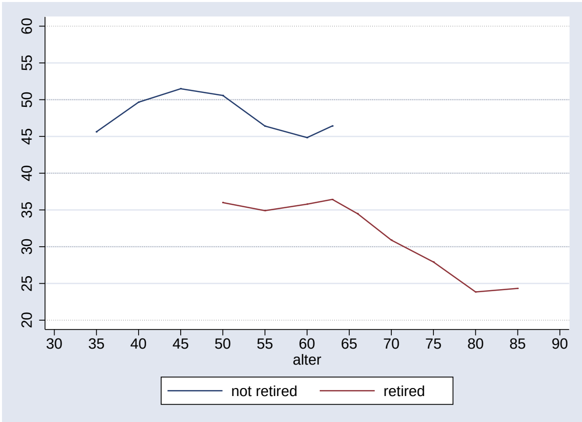


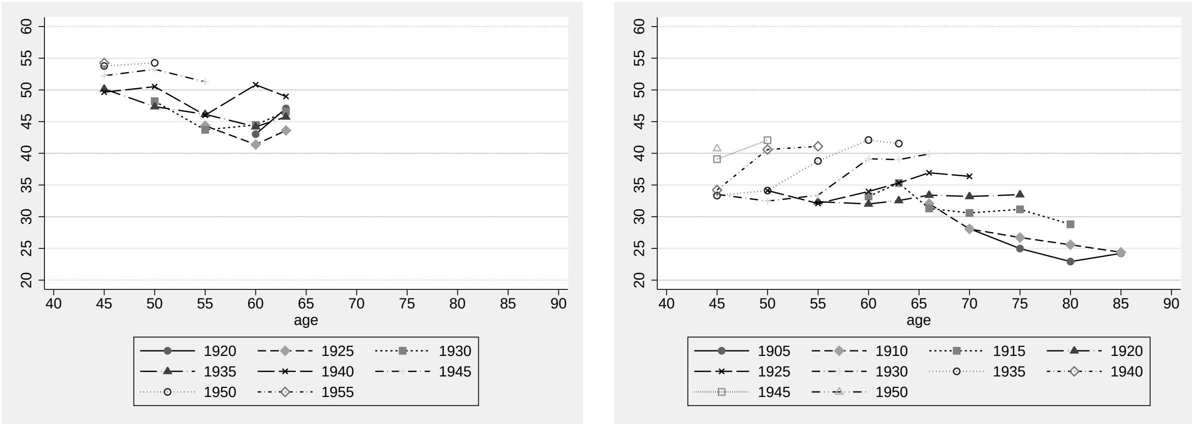
Figure 4.3 plots total and log nondurable expenditures by age and retirement status, neglecting cohort heterogeneity for the moment. The results show a dramatic drop in expenses which amounts to roughly 20% of nondurable pre-retirement spending. Furthermore, the Figure suggests that there is again a reduction in spending during the retirement phase after age 66. The figure also suggests potential selection effects in retirement entry. The increase in spending among non-retirees beyond age 60 and the increase in spending among retirees in the same age group suggests that some of the wealthier households with higher expenses enter later into retirement.[9] The increase of expenditures after age 80 is likely a statistical artefact resulting from small cell sizes in that group.

Decomposing this picture additionally by cohort for those beyond age 50, one gets Figure 4.4. It shows that the observation of a spending drop is not obscured by cohort effects. Even when comparing retirees and non-retirees of the same cohort, there is a distinct fall in expenses. Surprisingly, the age profiles of households with a retired head are increasing for the younger retiree cohorts and decreasing for the older ones. Alternatively, assuming cohort effects to be zero and allowing for time effects, the drop is similarly dramatic, but the age profiles are relatively flat until age 65 and decreasing afterwards.

[9]In these figures, I plot the group of not retired households only until age 65, because over 99% of employees are retired at age 66.

Figure 4.4: Expenditures by age, retirement status and cohort

not retired | retired



Note: Expenditures are in 1000 DM per year.

4.5.2 Does home production jump at retirement?

Now, I turn to the descriptive analysis of home production based on the time use survey. Since I have only two cross-sections of data, I cannot separate cohort and age effects well. Hence, I neglect the cohort variation in this part of the analysis.

Figure 4.5: Household home production time by age

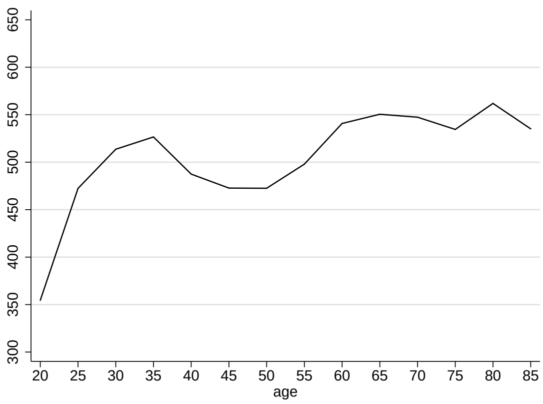
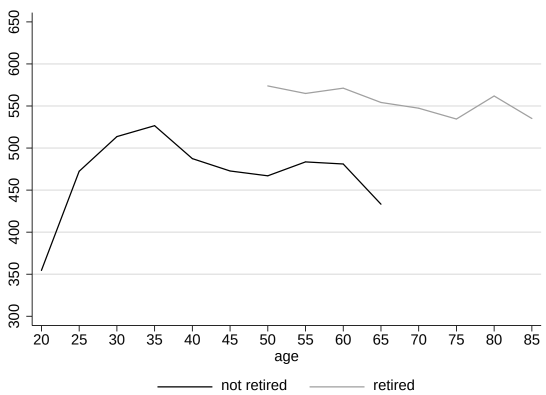


Figure 4.5 depicts household home production time by age. The graph has two humps: the huge increase in home production time between 20 and 35 can be attributed to the large time requirements of caring for and raising children. As they grow older, the time needed for child care becomes lower. Then, after age 50, home production time increases again and decreases only after age 70, probably due to functional limitations and worsening health conditions. This can be due to various factors: (i) the graph confounds age and cohort effects. (ii) As proposed in this chapter, home

production time might increase due to the reduction in resources and the abundance of leisure time after entry into retirement. (iii) Age 50-70 might be the age group where parents become grandparents, so this age group might engage in caring for their grandchildren. Additionally, the parents of 50-60 year old might be in need of care, as they enter the group of the oldest old, if they are still alive. Hence, there are various reasons, why home production might increase from age 50 onwards.

To analyze the importance of reason (ii) in more detail, I now plot home production ba age and retirement status. Consistent with the home production argument, Figure 4.6 shows a similarly dramatic increase in the time households spend on home production after entry into retirement. The difference between households with a retireed and those with a not retired head is roughly 40 minutes per day and roughly a 15 percent increase relative to the 270 minutes of home production that not retired households in the age group 55 do per day.

Figure 4.6: Household home production time by retirement status and age



4.6 Regression analysis

In this section, I turn to a multivariate analysis of the drop in spending as well as the increase in time spent on home production at retirement. In order to check whether retirement entry affects spending additionally to age-related changes, I estimate age profiles, and additionally use retirement status and other household characteristics as regressors. In both subsections, I use an OLS estimator with robust standard errors.[10]

[10] I obtain a robust variance estimator using the Huber-White-Sandwich estimator which gives heteroskedasticity-consistent standard errors.

4.6.1 Nondurable expenses

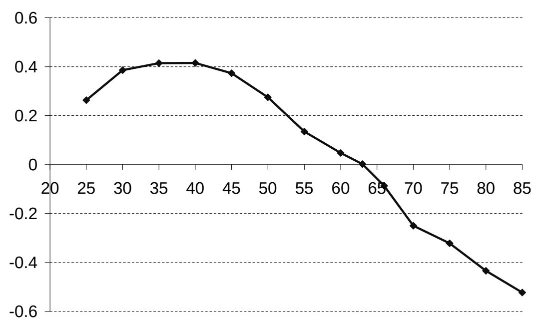
In this first part, where I investigate consumer expenditures, the following empirical specification is used:

$$\begin{aligned}\ln x_h = &\sum_{c_l}^{c_h} \alpha_c coh_{hc} + \sum_{a_l}^{a_h} \beta_a age_{ha} + \sum_{t_l}^{t_h} \gamma_t time_{ht} + \sum_{k=1}^{K} \eta_k Z_{hk} \\ &+\delta \cdot ret_h + \sum_{a_l=50}^{a_h=65} \zeta \cdot ret_h \cdot age_{ha} + \epsilon_{ht}\end{aligned} \tag{4.1}$$

where x_h are log nondurable expenses of household h, *coh* are cohort, *age* are age, *time* are the transformed time dummies, and Z are household and other characteristics.[11] The key variables of interest are retirement status *ret*, and four interacted age-retirement dummies for the age groups close to retirement.

Table 4.2 shows the estimation results. I start with the age cohort profiles in column (1), identified using the Deaton-Paxson decomposition and augmented by the retirement dummy. Figure 4.7 plots the estimated age coefficients from column (1). The age profile is hump-shaped and peaks already at ages 40-44.

Figure 4.7: Estimated age profile of log nondurable expenditures



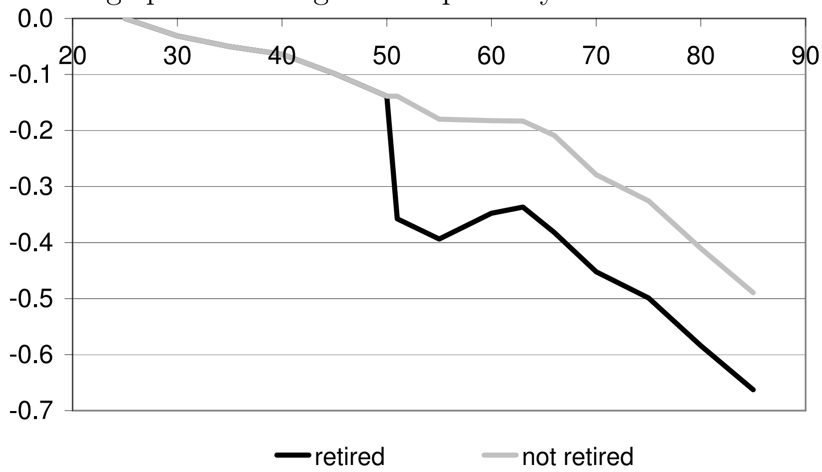
In column (2), I add retirement status and the age-specific interactions with the retirement dummy. Overall, consumer expenses of the retired are 29% lower than the spending of not retired households. The interactive effects show that those who are retired at age 50-54 experience an even larger drop in expenditures which is significant at the 5% level. While I do not find a significant additive effect of retirement for households with a retired head in the age group 55 to 59, I find a lower impact of retirement on the age groups 60 to 65. For these age groups, spending is only about 20% lower than that of not retired households whose head is in the same age group. However, these results are biased, as the next column (3) shows. Here, I add some omitted household characteristics. The retirement dummy reduces to 0.17

[11] Time subscripts are omitted to keep the notation simple.

when I control for household characteristics, but remains significantly negative. The interactive age-retirement coefficient for the age group 50 to 54 is about the same as before, and the estimated coefficient for the next age group (55 to 59 years) is very similar and significant. On the contrary, the interaction dummies for the age groups 60 to 65 turn insignificant.

Figure 4.8 compares the age profiles of households with a retired head with those of households whose head is not retired. The profiles show the distinct effect of retirement on nondurable spending which is largest for the early retiring households between age 50 and 54. The drop becomes much smaller beyond age 59.

Figure 4.8: Age profiles of log consumption by retirement status



One of the additional household characteristics that are included in column (3) is household size which I measure as the log number of equivalent adults living in the household. To compute this number, I use a coarse equivalence scale where each child (adult) obtains a weight of 0.5 (1). The estimated coefficient is highly significant and positive, but with 0.43 well below unity. This implies that I cannot split up the households into individuals by using per capita expenditures. Additionally, it might also indicate that the equivalence scale is not well chosen.[12]

Those with larger houses or apartments (measured in m^2) have higher spending—probably due to higher incomes or higher wealth. I include additional controls for self-employed and farmer households because they face entirely different pension schemes and often do not retire at all or retire gradually. Self-employed have higher nondurable spending which is probably a wealth effect. The estimated coefficient for the farmer dummy is significant and negative. One measurement problem in the data is that I do not observe self-employment or farmer status when a household declares itself as retired. As a robustness check, I also estimated column (3) without the self-employed and the farmer variable and the results are basically unchanged.

[12]The negative significant coefficient of the number of kids might be an additional indication that the equivalence scales are not very precise.

Another group who should have lower consumption levels are the unemployed. The lifetime resources of unemployed households are lower due to foregone earnings, such that I expect consumption to be adjusted downwards when a household experiences periods of unemployment. The significant negative coefficient confirms that. Again, I do not observe former unemployment for households with a retired head, so I also experimented with omitting this variable—with similar results. The effect of retirement reduces to 0.14 and the counteracting effects of the interaction terms for the age groups between 60 and 65 years become larger. However, the adjusted R^2 also falls from 0.49 to 0.46.

The other control variables indicate that couples spend more than single households, and households with a female head spend less than those with a male one. The latter is probably an income effect originating from the fact that many of these households are headed by widows who receive (lower) widow pensions.

In order to further enhance the understanding of household spending behavior around retirement, I explore in column (4) how much of this "retirement effect" on spending is due to income differences between retirees and non retirees. Secondly, I investigate whether retired households differ in their spending reductions conditional on whether they are poorer or richer. I concentrate on income rather than wealth, because the EVS does not provide good wealth measures. As a measure of the income position of a household, I use quintile dummies based on disposable income, and to look at heterogeneous behavior of retirees, I additionally interact them with retirement status.

Column (4) shows that households with a higher income spend more than households with a lower income. This seems to contradict the life cycle hypothesis, but given that I cannot condition on wealth, income also serves as a wealth proxy in the regression. The column also illustrates that the income effect on expenditures is of different size for the retired households. This might be due to households' reaction to unexpected income shocks around retirement. Furthermore, it might reflect the fact that retired households are more frequently found in the lower quintiles that non retired households. The coefficient of the retirement dummy becomes smaller when one includes an income measure in the regression (11% instead of 17%), but it remains strongly significant. Hence, the results suggest that the consumption retirement puzzle is also due to factors that are independent of income changes, e.g. differential home production.

Summarizing, I find a significant expenditure drop upon retirement of about 17% when I control for age and cohort effects and household characteristics. The drop is different for retired households of different age groups. It is largest for early retired households between ages 50 and 60, and lower thereafter. A caveat of this analysis is the lack of suitable instruments for strategic retirement timing of households.[13] I partially account for the heterogeneous retirement timing by allowing for an age-specific retirement effect.

[13]For more detailed information on the design of the German pension system and the retirement incentives it sets, see Börsch-Supan, Schnabel, Kohnz, and Mastrobuoni (2004).

In the next section, I turn to the analysis of changes in home production time upon retirement. The underlying question is: Do retiree households really consume less or do they substitute market purchased goods in part by home-produced ones?

Table 4.2: **R**egression results: Consumption

dependent variable: log(total nondurable expenditures)				
	(1)	(2)	(3)	(4)
retired head		-0.28705	-0.17333	-0.1122
		(-16.81)***	(-12.79)***	(-8.61)***
$age50 * ret$		-0.05789	-0.04553	-0.03399
		(-2.03)**	(-2.05)**	(-1.85)
$age55 * ret$		-0.01185	-0.04043	-0.04015
		(-0.51)	(-2.26)**	(-2.63)***
$age60 * ret$		0.08165	0.00806	0.0012
		(3.46)***	(0.44)	(0.08)
$age63 * ret$		0.07384	0.01986	0.01952
		(2.60)***	(0.92)	(1.06)
2nd inc.quint. * ret				0.13014
				(16.94)***
3rd inc.quint. * ret				0.16725
				(20.32)***
4th inc.quint. * ret				0.1951
				(21.69)***
5th inc.quint. * ret				0.1806
				(18.30)***
2nd inc.quint.				0.32399
				(57.51)***
3rd inc.quint.				0.4882
				(86.27)***
4th inc.quint.				0.64365
				(110.86)***
5th inc.quint.				0.88063
				(145.03)***
$age25$	0.26303	0.25321	0.03063	0.00573
	(19.38)***	(18.73)***	(2.64)***	(0.53)
$age30$	0.38555	0.36864	-0.00065	-0.05116
	(27.44)***	(26.31)***	(-0.05)	(-4.61)***
$age35$	0.41448	0.39504	-0.01943	-0.08121
	(28.57)***	(27.33)***	(-1.55)	(-7.10)***
$age40$	0.41512	0.39598	-0.03331	-0.10012
	(27.30)***	(26.14)***	(-2.57)**	(-8.47)***

	(1)	(2)	(3)	(4)
*age*45	0.37335	0.35724	-0.06763	-0.13453
	(23.84)***	(22.92)***	(-5.11)***	(-11.21)***
*age*50	0.27473	0.2735	-0.10814	-0.16285
	(16.77)***	(16.62)***	(-7.83)***	(-13.02)***
*age*55	0.13469	0.16119	-0.14913	-0.19023
	(8.08)***	(9.56)***	(-10.63)***	(-14.98)***
*age*60	0.0472	0.1206	-0.15174	-0.19625
	(2.63)***	(5.99)***	(-9.13)***	(-13.43)***
*age*63	0.00184	0.14103	-0.15267	-0.21697
	(0.10)	(5.26)***	(-7.30)***	(-11.75)***
*age*66	-0.0867	0.15173	-0.1781	-0.23966
	(-4.82)***	(6.42)***	(-9.09)***	(-13.84)***
*age*70	-0.24958	-0.00602	-0.24831	-0.29445
	(-13.34)***	(-0.25)	(-12.34)***	(-16.47)***
*age*75	-0.32152	-0.0758	-0.29514	-0.34423
	(-15.69)***	(-2.92)***	(-13.59)***	(-17.61)***
*age*80	-0.43394	-0.18651	-0.37996	-0.43226
	(-18.70)***	(-6.65)***	(-16.08)***	(-20.29)***
*age*85	-0.52287	-0.27272	-0.45885	-0.50683
	(-13.42)***	(-6.55)***	(-12.59)***	(-15.19)***
*coh*1900	0.07557	0.07419	0.03444	0.03339
	(2.48)**	(2.43)**	(1.32)	(1.37)
*coh*1905	0.11088	0.11105	0.06433	0.06517
	(3.76)***	(3.75)***	(2.55)**	(2.77)***
*coh*1910	0.16168	0.16535	0.09874	0.08806
	(5.45)***	(5.54)***	(3.87)***	(3.71)***
*coh*1915	0.23759	0.24277	0.15267	0.1174
	(7.89)***	(8.03)***	(5.93)***	(4.90)***
*coh*1920	0.27354	0.28242	0.1623	0.11636
	(8.94)***	(9.20)***	(6.19)***	(4.76)***
*coh*1925	0.30146	0.30861	0.15274	0.10588
	(9.79)***	(9.98)***	(5.79)***	(4.31)***
*coh*1930	0.30986	0.31411	0.13599	0.09002
	(9.96)***	(10.05)***	(5.09)***	(3.63)***
*coh*1935	0.29848	0.29504	0.14169	0.08013
	(9.54)***	(9.39)***	(5.27)***	(3.21)***
*coh*1940	0.27223	0.26766	0.15143	0.06356
	(8.59)***	(8.41)***	(5.58)***	(2.53)**
*coh*1945	0.2206	0.21586	0.11767	0.02876
	(6.87)***	(6.70)***	(4.28)***	(1.13)
*coh*1950	0.12433	0.11931	0.05218	-0.01831
	(3.86)***	(3.69)***	(1.90)	(-0.72)
*coh*1955	0.04255	0.03557	0.00931	-0.05138
	(1.31)	(1.09)	(0.33)	(-2.00)**

	(1)	(2)	(3)	(4)
*coh*1960	-0.0478	-0.0595	-0.03566	-0.08959
	(-1.46)	(-1.81)	(-1.27)	(-3.46)***
*coh*1965	-0.08661	-0.10435	-0.05676	-0.10438
	(-2.62)***	(-3.14)***	(-2.00)**	(-3.98)***
*coh*1970	-0.09691	-0.12096	-0.09681	-0.13741
	(-2.75)***	(-3.42)***	(-3.21)***	(-4.92)***
*coh*1975	-0.15582	-0.18665	-0.22553	-0.24515
	(-3.40)***	(-4.06)***	(-5.88)***	(-6.78)***
*year*1988	-0.02123	-0.02364	0.00507	0.00224
	(-6.12)***	(-6.82)***	(1.78)	(0.90)
*year*1993	0.05007	0.0506	0.06592	0.0248
	(13.73)***	(13.86)***	(23.40)***	(10.02)***
*year*1998	-0.02034	-0.01886	-0.03816	-0.01435
	(-7.25)***	(-6.72)***	(-17.43)***	(-7.40)***
nkids			-0.04139	-0.00007
			(-18.69)***	(-0.04)
ln(*eq.adults*)			0.43315	0.16011
			(51.71)***	(22.57)***
female head			-0.04713	0.00734
			(-10.17)***	(1.79)
couple			0.13861	0.11945
			(19.16)***	(19.49)***
self-empl.			0.02768	-0.05359
			(4.42)***	(-10.31)***
farmer			-0.2723	-0.08756
			(-27.85)***	(-11.16)***
unemployed			-0.40478	-0.19263
			(-53.67)***	(-26.74)***
house size			0.00361	0.00143
			(77.27)***	(35.62)***
city size			0.04341	0.02201
			(32.71)***	(19.26)***
Constant	9.95015	9.98053	9.62873	9.71141
	(290.43)***	(290.49)***	(328.94)***	(356.63)***
#*Obs.*	201826	201826	201826	201826
Adj. R^2	0.20	0.21	0.49	0.63

Robust t statistics in parentheses. **, *** significant at 5%, 1%

4.6.2 Home production

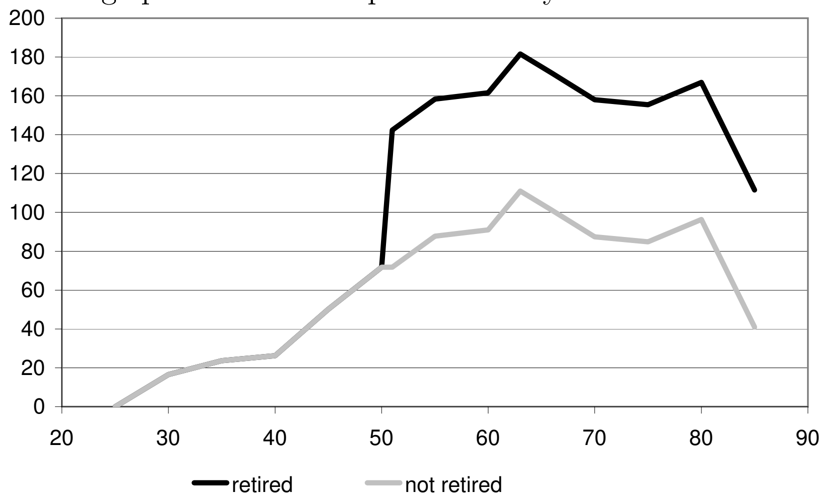
The estimations in this section are based on the *Zeitbudgeterhebung*. The empirical specification replicates to a large degree the one in the preceding section and is as follows:

$$\ln hp_{ht} = \sum_{a_l}^{a_h} \beta_a age_{ha} + \sum_{k=1}^{K} \eta_k Z_{hk} + \delta \cdot ret_h + \sum_{a_l=50}^{a_h=65} \zeta \cdot ret_h \cdot age_{ha} + \epsilon_{ht} \qquad (4.2)$$

where the dependent variable is household home production time per day, hp. I make use of the richer set of household demographics available in this data set, e.g. education and home ownership, and control for the weekday at which time use was recorded in the diary.

The results are shown in specification (1) of Table 4.3. The estimated coefficient for the retirement dummy is consistent with the hypothesis that households substitute consumer expenses in part by increased home production in retirement. The increase is in the magnitude of 70 minutes per day, an increase of almost 30%, and the coefficient is highly significant. The interacted age-retirement dummies are not significant, so there is no indication of age-specific retirement effects. Figure 4.9 illustrates the estimated age profiles for retired households and not retired ones. The age profile of not retired households is increasing until age 60-65, and falls rapidly after age 75, probably due to functional limitations and the deterioration of health conditions. For households with a retired head, home production time increases discontinuously at age 50. Thus, the drop in consumer expenses is met by a significant and discontinuous increase in home production.

Figure 4.9: Age profiles of home production by retirement status



The household characteristics have the expected signs: More home production is done in households with children, particularly young children who require a large amount of care. Female headed households spend more time on home production. The same applies to house ownership which indicates a higher required effort in maintaining the home. The self-employed do less home production which corresponds with their higher spending from the last section, while unemployed people do more.

Again, as in the former section, I look at whether the retirement effect could be mainly due to income differences. Including income quintiles and their interactions with retirement status in specification (2) again does not change the results drastically. Naturally, it reduces the "retirement effect", but only by one sixth. As expected, people in the upper income quintiles engage less in home production activities. On the contrary, however, retired people in the 2nd lowest income quintile do significantly less home production. This unexpected result might be explained by the relation between income an health status, i.e. poorer people tend to be more affected by health problems which might prevent them from engaging in home production. Since no health information is contained in this survey, I cannot pin down this potential explanation.

Table 4.3: **R**egression results: Home Production

dependent variable: household home production time (in mins per day)					
	(1)	(2)		(1)	(2)
retired head	70.569	60.083			
	(4.21)***	(3.26)***			
$age50 * ret$	41.368	46.004	2nd inc.quint.		-28.394
	(1.18)	(1.29)	* ret		(2.31)**
$age55 * ret$	35.303	42.332	3rd inc.quint.		-23.514
	(1.36)	(1.62)	* ret		(1.62)
$age60 * ret$	31.137	32.965	4th inc.quint.		21.438
	(1.27)	(1.31)	*ret		(1.23)
$age63 * ret$	8.053	7.065	5th inc.quint.		-0.291
	(0.26)	(0.23)	*ret		(0.01)
$age25$	22.325	22.427	$age60$	113.289	122.305
	(1.55)	(1.51)		(6.11)***	(6.37)***
$age30$	38.888	45.157	$age63$	133.317	142.662
	(2.87)***	(3.24)***		(4.99)***	(5.30)***
$age35$	46.019	55.285	$age66$	123.428	137.611
	(3.36)***	(3.91)***		(5.77)***	(6.24)***
$age40$	48.603	59.146	$age70$	109.757	123.453
	(3.55)***	(4.17)***		(5.01)***	(5.48)***
$age45$	72.475	85.269	$age75$	107.166	120.678
	(5.25)***	(5.97)***		(4.77)***	(5.19)***
$age50$	94.109	101.939	$age80$	118.703	136.111
	(6.86)***	(7.19)***		(4.82)***	(5.34)***
$age55$	110.104	114.929	$age85$	63.339	78.846
	(7.79)***	(7.82)***		(1.95)*	(2.42)**

	(1)	(2)		(1)	(2)
ln(*eq.Adults*)	44.295	40.523	2nd inc.quint.		-13.645
	(4.53)***	(4.06)***			(1.58)
nkids0-5	143.321	143.352	3rd inc.quint.		-28.920
	(26.77)***	(26.14)***			(3.14)***
nkids6-18	35.799	35.178	4th inc.quint.		-57.151
	(10.00)***	(9.90)***			(5.67)***
female head	31.772	30.340	5th inc.quint.		-87.229
	(5.15)***	(4.83)***			(8.39)***
couple	224.047	246.087	Central	1.788	0.732
	(25.77)***	(26.49)***		(0.37)	(0.15)
schoolyears	1.469	2.770	East	2.695	-12.954
	(2.01)**	(3.49)***		(0.46)	(2.08)**
self-empl.	-76.179	-68.550	Tuesday	-3.918	-6.035
	(10.36)***	(9.23)***		(0.54)	(0.81)
unempl.	92.793	70.757	Wednesday	-1.922	-4.034
	(10.36)***	(7.20)***		(0.26)	(0.53)
app. Owner	1.205	8.644	Thursday	3.195	-0.831
	(0.14)	(1.03)		(0.43)	(0.11)
house owner	25.614	24.574	Friday	19.317	17.810
	(3.97)***	(3.78)***		(2.57)**	(2.36)**
garden	41.561	41.303	Saturday	62.682	60.586
	(7.78)***	(7.60)***		(7.75)***	(7.36)***
house size	-0.002	0.131	Sunday	-83.438	-87.408
	(0.03)	(1.69)*		(10.67)***	(10.98)***
const.	53.968	54.895			
	(3.54)***	(3.52)***			
#Obs.	13548	13140	Adj. R^2	0.44	0.44

Robust t statistics in parentheses. *, **, *** significant at 10%, 5%, 1%

4.7 Conclusions and directions for further research

In this chapter, I have used a large expenditure data set of repeated cross sections spanning the period 1978 until 1998 to study the changes in consumer expenditures at retirement. The results show that there is a similar drop in expenditures in Germany as in other countries like the UK and the US. The magnitude of the drop is around 17% of pre-retirement expenses on nondurable consumption. Taken together, there is empirical evidence in many developed countries now that households reduce their consumer expenses at retirement. Thus, in spite of different pension systems and differential retirement incentives, one even finds drops of similar magnitude in some countries, for example in Germany and the US.

To investigate whether this expenditure drop causes a consumption drop of equal size, I analyze time use patterns at retirement, also on the basis of a large data set of repeated cross-sections. If households engage more actively in home production during retirement, then the expenditure drop is offset at least partially by increased consumption from home produced goods and services. I analyze the role of home production directly by looking at the time spent on such activities, while other studies often infer a changed home production from changed spending on commodity groups that can be produced at home. The main finding is that there is a discontinuous increase in home production at retirement which amounts to an additional 70 minutes per day. This significant and sizeable increase indicates that households flexibly adapt to the change in time and money resources in retirement, and that home production can explain a good part of the expenditure drop.

In the following, I discuss some directions for further research that extend the analysis conducted in this chapter and mitigate some shortcomings of this analysis.

Endogenous retirement age

As already described in Section 4.4, individuals make an active retirement choice which depends on various factors like their past work career, their leisure preferences, the design of the pension system, etc. A complicated set of rules within the pension system and generous early retirement schemes create strong incentives to retire at a certain age conditional on the work history and characteristics of the individual. The retirement timing strongly determines resources in retirement in Germany, and hence also consumer expenditures in old age via their influence on lifetime wealth. The EVS does not offer any information on the work history of respondents which I could use in order to instrument retirement status. In further research, one could use the *German Socio-Economic Panel (SOEP)* to analyze changes in time use and food consumption. Also based on the *SOEP*, Berkel and Börsch-Supan (2004) have computed option values which reflect the trade-off between retiring now versus retiring later for every retirement entry age. This incentive variable posits an ideal instrument for retirement entry age.

Decomposing consumption by commodities

A logic extension of this analysis is to decompose the expenditure data by commodity groups. The decomposition allows to analyze how much of the overall expenditure drop is due to the cessation of work-related costs. Additionally, there are some goods and services that can be produced at home rather than purchased. An example is food consumed at home. Some studies have shown that food spending drops significantly at retirement, and that this is due to more home production (Aguiar and Hurst 2004). Decomposing expenses by commodities would allow to directly compare whether the spending cuts in a category is counteracted by increased home production in the respective home production activity. Hence, a more detailed analysis of the expenditure and time use categories would allow to directly match them. This undertaking could be conducted on the basis of the two data sets used in this analysis.

Unanticipated income shocks
A new wave of the German panel data set *SAVE* which will be released soon, allows to analyze whether households face unanticipated income shocks around retirement. In addition to the question about expected and actual retirement age, respondents are also asked about their experience and expectations about the replacement rate, which is defined as the fraction of the last pre-retirement income that the household receives as retirement income. Differences between expectations before and realizations after retirement can be used to verify, whether households experience income shocks that force them to reduce consumption in old age.

Health shocks
Hurd and Rohwedder (2005) have investigated the role of health shocks for consumption at retirement, using self-reported health. The same data set, the *Health and Retirement Survey*, also contains detailed "objective" health measures, in particular information on major health events like strokes, heart attacks and the like. Possibly, these major health events are more precise measures of health shocks than changes in self-reported health, since major health events generally happen as real shocks. Exploiting this information could yield new insights.

Consumption *during* retirement
The discontinuous drop of consumption at retirement has received much attention. However, consumer behavior over the entire retirement phase is at least equally interesting. For example, one could imagine that the sudden abundance of leisure time requires an adjustment of the newly retired to the changed daily rhythm. Furthermore, one might think of the time after retirement as a learning process during which retirees discover new ways to spend their time which was formerly structured to a large extent by their work schedule. Additionally, it would be interesting to study the linkages between health and consumption during retirement when bad health does not directly affect lifetime wealth anymore via foregone earnings.

5 Market work, home production, consumer demand and unemployment among the unskilled

5.1 Introduction

In this chapter, we present and test a general equilibrium model in which increases in labor supply trigger an increase in the relative demand for unskilled labor and therefore improve the labor market prospects of unskilled workers. This feedback effect works through changes in the composition of consumer demand respectively changes in home production.

We consider three margins at which labor supply can change: labor force participation, (weekly) working time and retirement age. Debates on increasing versus cutting down on weekly working time[1], prolonging working life by raising the retirement age[2] and increasing labor force participation particularly among women resurface periodically in the political discussion. The arguments against or in favor of these policy measures are well known. Opponents of increased labor market participation think that—for want of jobs—it does not make much sense to have people work longer (hours or years) or to have more people enter the labor force in times of high unemployment. This view is based on what has become known as the "lump of labor fallacy". It does not take into account that changes in labor *supply* entail changes in income and consumer demand and thus ultimately in labor *demand*. In other words, the amount of work to be done is not a fixed lump. This idea that the economy adjusts to changes in labor supply—at least in the long run—is well established among economists. Empirical studies on employment effects of working time reduction are inconclusive. They generally suffer from the fact that changes in working time usually involve changes in unit wage costs (e.g., working time reduction with compensatory wage increases) and the effects of the two are hard to separate (Calmfors and Hoel 1988; Calmfors and Hoel 1989; Hunt 1999; Logeay and Schreiber 2003). A thorough review of the literature can be found in OECD (1998), pp. 117-148.[3]

[1] An increasing number of firms in Europe is currently returning to longer working hours in the face of increasing global competition.

[2] Measures to increase retirement age have been set in place and are currently being discussed again in order to finance pay-as-you-go funded social security systems in times of population aging.

[3] Calmfors and Hoel (1989) give five reasons of why working time reduction might actually lead to a reduction in labor demand: (i) Wage rates per unit of time may rise. (ii) Even if wage rates remain constant, wage costs per unit of time may rise due to the existence of fixed costs per employee. (iii) Labor productivity per hour may fall because the proportion of "non-productive"

This chapter presents and tests a new argument in this old debate. While a voluminous empirical and theoretical literature on the employment effects especially of working time reduction already exists, very few studies look at how different types of workers are affected by these measures.[4] In this chapter, we show that changes in labor supply effectuate changes not only in the *level* but also in the *composition* of the demand for labor.

A rise in labor supply has two direct effects: Workers have higher incomes and less (leisure) time. This change in the endowment of people is likely to have effects on the composition of consumer demand. People with higher incomes can consume more. At the same time, they have less time at their disposal. Due to these endowment changes, they raise expenditures on those goods or services, that they have "produced" on their own so far. Examples of such outsourcing of home production are house cleaning, preparing food (using a pizza delivery service rather than making it at home,...), car washing, fixing bicycles, ironing shirts, walking dogs, repairs at home, do-it-yourself, child care, etc. The goods that everyone can make on their own are exactly those that can be "produced" by unskilled workers. So, as a consequence of growing labor supply, consumer demand shifts towards goods and services that are supplied mostly by unskilled workers and the relative demand for unskilled labor rises. Thus, measures geared at changing labor market participation do not only result in level effects on employment, but also affect workers with different skill levels asymmetrically.

In the model economy considered in this chapter, individuals maximize their utility over consumption and leisure and allocate their time over three types of activities: market work, home production, and leisure. Consumption is not equal to expenditures in our model, but consists of goods and services purchased on the market as well as self-produced goods.[5] We study the effects of changes in labor market participation in the absence of compensatory wage changes or any other change in unit labor costs. Hence, our argument is independent of potential union or policy-induced wage-setting schemes. Unemployment in this model emerges because wages are downwardly rigid.[6] The adverse effects of this rigidity of wages are (obviously) especially strong at the lower end of the skill distribution. Given this concentration of unemployment at unskilled labor, exogenous changes that increase the demand for products that are intensive in the use of unskilled labor have positive employment effects. The employment effects are shown to be more severe, the more complementary are the consumer goods and leisure.

---

time devoted to starting up and finishing work may rise. (iv) The factor cost of employing new workers rises relative to the cost of increasing overtime when standard hours are cut. (v) Capital utilization will decrease to the extent that the operating time of the capital stock is reduced pari passu with working time.

[4]Corneo (1995) is a notable exception.

[5]The argument that consumption is more than expenditures goes back to Becker (1965) and Gronau (1977).

[6]Labor market frictions that entail downward rigidity of wages include unemployment benefits, minimum wages, welfare aid, wage-compression due to strong unions, etc.

In the second part of this chapter, we test the basic mechanism of our model. We analyze the empirical link between market work, home production and the demand for goods and services that are substitutes for home production at the household level, and we test the macroeconomic relation between labor supply measures and unemployment.

We proceed in three steps: First, we use the German time use survey from 1991/92 and investigate whether the time spent on home production activities differs by household labor supply. We find evidence of decreasing time spent on home production upon higher labor supply, encompassing working hours and labor force participation. However, looking at the allocation of time does not clarify whether home production is simply reduced without any compensatory outsourcing.[7] Furthermore, we cannot control for potential productivity differences in home production between working and non-working individuals, such that heterogeneity in time allocation does not necessarily translate into differences in the amount of outsourcing of the two groups. In a second step, we therefore look at a well-defined subset of services substituting for home production using the same survey and analyze whether outsourcing increases upon higher labor supply. Again, we find evidence supporting our hypothesis, that outsourcing increases when market work rises. The third hypothesis of our model, that this increased outsourcing of home production raises the demand for unskilled labor, cannot be quantified using this data, since there is no matching information on sectoral production functions. Hence, we use macroeconomic panel data on OECD countries and directly test the reduced form relation between labor supply measures and unemployment. The results corroborate the prediction from the theoretical model.

A number of studies has provided empirical support for some of the mechanisms of our model: The research project DEMPATEM surveyed in Schettkat and Salverda (2004) presents evidence that the demand for services in general has increased over time, partly due to the increased labor force participation of women. The focus of DEMPATEM is on international differences in the structure of consumer demand, especially in the types of services demanded. The German case study in this international comparison project analyzes the determinants of changes in the structure of consumer demand, including labor force participation as an explanatory variable (Van Deelen and Schettkat 2004). However, the authors only investigate the differences between workers and nonworkers and do not take into account the amount of time worked. They find that "the second earner seems to push up (general) service expenditures".

Special attention to household services is given in Brück, Haisken-DeNew, and Zimmermann (2003). They show that the demand for household services is very income-elastic, and that there is potentially a large market for such services. We additionally show, that not only an increasing income, but also the decrease in disposable time raises the demand for household services and other substitutes for home produc-

[7] In the following, we will use the term "outsourcing" to describe the act of buying household services and other home-producible goods and services instead of producing them in the household.

tion. Both effects together imply that increased labor supply can create jobs for the unskilled—via changes in consumer demand.

The remainder of the chapter is organized as follows: In Section 5.2, we develop the theoretical model. In Section 5.3, we provide empirical support for the theoretical predictions of our model. Conclusions are drawn in Section 5.4.

5.2 The theoretical model

The economy is populated by a continuum of measure 1 of heterogeneous households indexed by skill level $j \in [0, 1]$. Within each household, all members have the same skill level. For simplicity, we assume that the entire age distribution is represented in each household. A share λ of household members per cohort participates in the labor force. Working age ranges from 0 to retirement age ρ. Life ends at age 1. For a worker's labor market prospects, only the skill level plays a role while age (as long as it is below ρ) is irrelevant. Working time per worker is ω units of labor per period. Labor supply of each household ξ is equal to the individual working time ω times the integral over all cohorts (within that household) from 0 to ρ and over those workers who actually participate in the labor force:

$$\xi = \rho \cdot \lambda \cdot \omega.$$

In order to be able to make comparative statics with respect to labor supply, we model λ, ρ, and ω as exogenous. For simplicity, we set these parameters equal across households, skill-levels, and cohorts. Heterogeneity with respect to these parameters would amplify the complexity of the model without generating any further insights. Households have preferences over two consumer goods and leisure. One good can be produced at home or purchased on the market, while the other one can only be purchased at the market and is the numéraire. Unemployment arises because of a minimum wage which depends on the average income level (see Subsection 5.2.2.[8]

5.2.1 Production in firms

Both goods are produced by a continuum of measure 1 of homogenous firms using all types of labor. Good 1 is the self-producible good and good 2 is the market good. The technology for good i is

$$y_i = \int_0^1 e^{j \cdot (1+\chi_i)} \cdot n_{i,j} \cdot dj \tag{5.1}$$

where $n_{i,j}$ is labor input of skill type j for the production of good i. Marginal productivity $\frac{\partial y_i}{\partial n_{i,j}} = e^j$ is increasing with skill level j for both goods.[9] χ is a productivity

[8] If wages were perfectly flexible, i.e., without unemployment, the model would yield similar effects: An increase in market work would lead to higher employment, especially among the unskilled, and to a decrease in wage inequality. Only if labor demand were perfectly inelastic, employment would remain unchanged and we would only observe a change in wage inequality.

[9] The exponential specification implies that the distribution of labor income is skewed to the right.

parameter reflecting differential comparative advantage of skills. $\chi_2 > \chi_1$ implies that the production of good 2 is more skill-intensive, i.e., the productivity advantage of workers with higher skills (higher j) is larger in sector 2. For simplicity, we set $\chi_1 = 0$ and $\chi_2 = \chi$. Firms act as price-takers on input and output markets. Maximizing profits

$$\pi_i = p_i \cdot \int_0^1 e^{j\cdot(1+\chi_i)} \cdot n_{i,j} \cdot dj - \int_0^1 w_j \cdot n_{i,j} \cdot dj \tag{5.2}$$

leads to demand for type j labor in sector i:

$$n_{i,j}^d = \begin{cases} \infty & \Leftrightarrow \quad w_j < p_i \cdot e^{(1+\chi_i)\cdot j} \\ [0,\infty) & \Leftrightarrow \quad w_j = p_i \cdot e^{(1+\chi_i)\cdot j} \\ 0 & \Leftrightarrow \quad w_j > p_i \cdot e^{(1+\chi_i)\cdot j} \end{cases} \tag{5.3}$$

where w_j is the wage for type j labor and p_i is the price of good i.

Figure 5.1: Allocation of Types j to Sectors

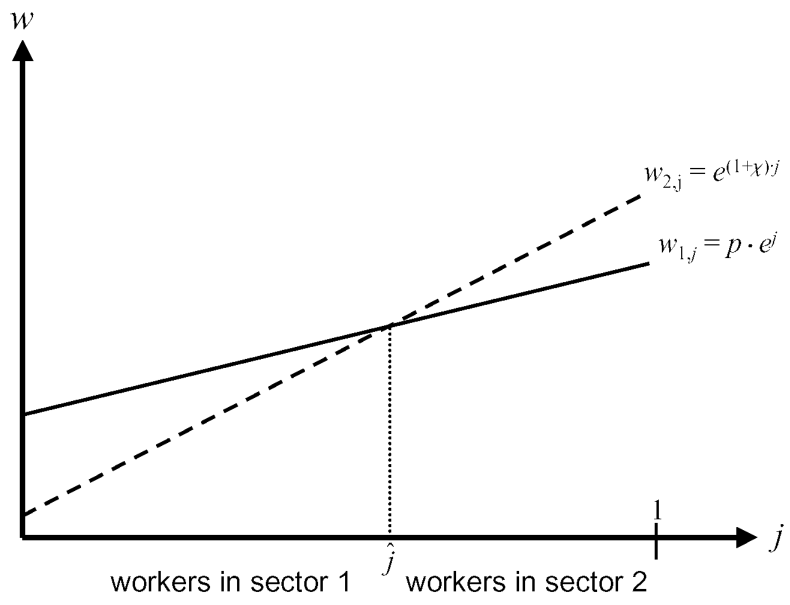


Figure 5.1 illustrates the allocation of types to sectors. On the horizontal axis is the space of types. On the vertical axis are the wages in the two sectors as functions of the type j. Workers supply labor to the firm that offers the highest wage. In equilibrium, firms in sector 1 pay $w_j = p \cdot e^j$ while firms in sector 2 pay $w_j = e^{(1+\chi)\cdot j}$.[10] This difference in wages determines the allocation of types to sectors. Type $\hat{j} = \ln p^{\frac{1}{\chi}}$ is indifferent between working in sector 1 and working in sector 2. All lower types prefer working in sector 1 while all higher types prefer working in sector 2. The higher

[10] The price of the numéraire, good 2, is normalized to 1. We assume that parameter constellations are such that production is positive in both sectors. This implies a relative goods price $p = \frac{p_1}{p_2}$ larger than 1.

is the relative price of good 1, the more skill types prefer to work in sector 1. The productivity advantage χ of sector 2 has a negative direct effect on $\hat{\jmath}$ but an indirect effect through p which might counteract the direct effect. For a discussion of the interaction between these two effects, see Weiss (2004).

Equilibrium wages for different types of workers are thus

$$w_j = \begin{cases} p \cdot e^j & \Leftrightarrow \quad j < \ln p^{\frac{1}{\chi}} \\ e^{(1+\chi)\cdot j} & \Leftrightarrow \quad j \geq \ln p^{\frac{1}{\chi}}. \end{cases} \tag{5.4}$$

Retirement age $\rho \in [0,1]$, labor force participation $\lambda \in [0,1]$, and fixed working time $\omega \in [0,1]$ restrict labor supply of households at each skill level j to $\xi \in [0,1]$. Labor supply in the two sectors is thus given by

$$n^s_{1,j} = \begin{cases} \xi & \Leftrightarrow \quad j < \ln p^{\frac{1}{\chi}} \\ \in [0,\xi] & \Leftrightarrow \quad j = \ln p^{\frac{1}{\chi}} \\ 0 & \Leftrightarrow \quad j > \ln p^{\frac{1}{\chi}} \end{cases} \qquad n^s_{2,j} = \begin{cases} 0 & \Leftrightarrow \quad j < \ln p^{\frac{1}{\chi}} \\ \xi - n^s_{1,j} & \Leftrightarrow \quad j = \ln p^{\frac{1}{\chi}} \\ \xi & \Leftrightarrow \quad j > \ln p^{\frac{1}{\chi}} \end{cases} . \tag{5.5}$$

Goods supply is given by

$$y_1 = \int_0^{\ln p^{\frac{1}{\chi}}} e^j \cdot \xi \cdot dj = \xi \cdot \left(p^{\frac{1}{\chi}} - 1\right) \qquad y_2 = \int_{\ln p^{\frac{1}{\chi}}}^1 e^{(1+\chi)\cdot j} \cdot \xi \cdot dj = \xi \cdot \frac{e^{1+\chi} - p^{\frac{1+\chi}{\chi}}}{1+\chi} . \tag{5.6}$$

Supply of good 1 (2) is increasing (decreasing) in the relative goods price p. Supply of both goods is increasing in labor supply ξ. χ which represents the productivity advantage of sector 2 has a negative (positive) effect on the supply of good 1 (2).

5.2.2 Wage rigidity and unemployment

Unemployment in this model is due to a downward rigidity of the wages. We assume that the wage cannot fall below a minimum $\tilde{w}$ which is indexed to the average income level in the economy.[11] This assumption introduces a rigidity that keeps relative wages from adjusting perfectly to changes in relative labor demand. Therefore, changes in relative labor demand affect employment. This sort of rigidity in the relative wage arises if strong unions ensure a compressed wage structure, if a legal minimum wage exists that is indexed to the average wage, or if welfare aid or unemployment benefits depend on the average income. Another source of such a rigidity in the relative wage could be considerations of fairness as, e.g., put forward in the "fair wage-effort hypothesis" by Akerlof and Yellen (1988) and Akerlof and Yellen (1990) and recently

[11] In France, Japan, Spain (among others), the legal minimum wage is explicitly indexed to the average wage (see Cahuc and Zylberberg (2004), page 715). In other countries, this link might not be as explicit, but by and large, wages at the lower end of the distribution are usually somehow tied to the evolution of average wages over time. This assumption is not crucial for the results. On the contrary, the endogeneity of the minimum wage is moderating the employment effect of changes in labor supply.

confirmed in a series of experimental studies surveyed by Fehr and Gächter (2000).[12] In this model, $\tilde{w}$ should be seen as a simple means to capture all these phenomena leading to a rigidity in the relative wage.[13]

We assume that the "minimum wage" $\tilde{w}$ is a constant fraction θ of the average wage:

$$\tilde{w} = \theta \cdot \int_{\tilde{j}}^{1} w_j \cdot dj = \theta \cdot \left(\frac{\chi \cdot p^{\frac{1+\chi}{\chi}} + e^{1+\chi}}{1+\chi} - p \cdot e^{\tilde{j}} \right) \tag{5.7}$$

where $\tilde{j}$ is the type whose market wage is equal to the minimum wage. All higher types receive higher wages while all lower types are unemployed. So, $\tilde{j}$ also represents the fraction of unemployed workers.

The unemployment rate $\tilde{j}$ is determined by the equality of the minimum wage $\tilde{w}$ and the market wage of a type $\tilde{j}$ worker, $w_{\tilde{j}}$:

$$\theta \cdot \left(\frac{\chi \cdot p^{\frac{1+\chi}{\chi}} + e^{1+\chi}}{1+\chi} - p \cdot e^{\tilde{j}} \right) \overset{!}{=} p \cdot e^{\tilde{j}}.$$

Solving for $\tilde{j}$ yields the following lemma.

Lemma 1 *The rate of unemployment $\tilde{j}$ is given by*

$$\tilde{j} = \ln \left(\frac{\theta}{1+\theta} \cdot \frac{\chi \cdot p^{\frac{1+\chi}{\chi}} + e^{1+\chi}}{p \cdot (1+\chi)} \right). \tag{5.8}$$

It is increasing in θ and decreasing in p.

Not surprisingly, the more generous is the minimum wage (the higher θ), the higher is the rate of unemployment.

The effect of the relative goods price p corresponds to the so-called Stolper-Samuelson-Effect in trade theory. An increase in the relative price of good 1 leads to an increase in the relative demand for lower types of labor (in which the production of good 1 is intensive). This change in relative labor does not fully translate into respective changes in the relative wage so that employment increases.[14]

Note that working life ρ, working time ω, and labor force participation λ do not have any direct effect on unemployment $\tilde{j}$ in the model. It is shown in the next section that they affect employment through their effect on the relative goods price p.

[12] The fair wage-effort hypothesis is motivated by equity theory in social psychology and social exchange theory in sociology. According to this hypothesis, workers withdraw effort as their actual wage falls short of what they consider their "fair wage". Such behavior causes unemployment by introducing a downward rigidity in wages. Kahnemann, Knetsch, and Thaler (1986) have shown that individual conceptions of fair wages often diverge substantially from the levels that would clear competitive labor markets. See Weiss and Garloff (2005) for a detailed discussion of causes and effects of rigidities in the relative wage.

[13] In a system of union wages classified by skill levels, $\tilde{w}$ can be seen as the lowest wage level in this classification. For ease of labelling, we will in the remainder of the chapter refer to $\tilde{w}$ as the minimum wage.

[14] If wages were perfectly flexible, unemployment would not exist and an increase in labor supply would—via this Stolper-Samuelson-Effect—translate into a decrease in wage inequality.

Figure 5.2: Allocation of Types j to Sectors and Unemployment

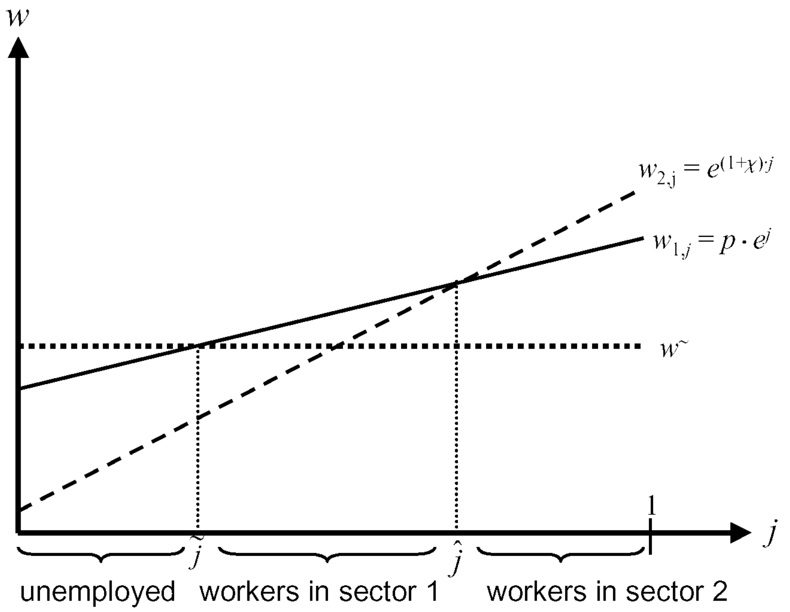


Figure 5.2 illustrates the effect of the minimum wage on employment. For the high types, the wage they can earn in sector 2 exceeds the wage they would receive in sector 1. Therefore, they work in sector 2. The medium range types earn a higher wage in sector 1 than in sector 2. These types work in sector 1. The low types, whose market value in both sectors falls short of the minimum wage, cannot find a job.

An increase in the relative price of good 1, p, exerts an upward pressure on the wage in sector 1. In terms of Figure 5.2, an increase in p implies an upward shift of the solid line. For the highest unemployed types, the wage is pushed above the minimum wage. They find employment, so that total unemployment decreases.[15]

The effect of the fixed working lifetime on the relative goods price p depends on consumer demand which is analyzed in the next subsection.

5.2.3 Consumption and home production

All households share the same preferences over consumption and leisure

$$U_j\left(c_{1,j}, c_{2,j}, l_j\right) = \left(c_{1,j}^{\gamma} + c_{2,j}^{\gamma} + l_j^{\gamma}\right)^{\frac{1}{\gamma}} \tag{5.9}$$

[15] The intersection between the solid line (wage in sector 1) and the dotted line (minimum wage) moves to the left. In fact, the dotted line (the minimum wage) shifts upward as well, but this shift is less pronounced because the minimum wage is indexed to both, the wage in sector 1 (which increases) and the wage in sector 2 (which remains unchanged).

where l_j is leisure time of a type j household, $c_{i,j}$ is consumption of good i, and $\sigma = \frac{1}{1-\gamma}$ is the elasticity of substitution between consumption of good 1, consumption of good 2, and leisure.[16]

Good 1 is either bought on the market at price p or produced at home with technology

$$y_{1,j}^h = \alpha \cdot hp_j \tag{5.10}$$

where n_j^h is the time that a type j household devotes to home production and α is a productivity parameter. We assume that at home, skill types do not differ in productivity. This assumption is made for simplicity. It has no qualitative effect on the results as long as lower types have a comparative advantage in the production of the good that can be produced at home. Good 2 is bought on the market at price 1. For employed households, the budget and time constraints are respectively

$$p \cdot \left(c_{1,j} - y_{1,j}^h\right) + c_{2,j} = w_j \cdot \xi \quad \text{and} \quad l_j + ph_j + \xi = 1 \tag{5.11}$$

For unemployed households, the budget and time constraints are respectively[17]

$$p \cdot \left(c_{1,j} - y_{1,j}^h\right) + c_{2,j} = 0 \quad \text{and} \quad l_j + hp_j = 1 \tag{5.12}$$

Maximizing utility (5.9) subject to the constraints (5.10) through (5.12) yields

$$c_{1,j} = \begin{cases} \frac{\alpha^{\frac{1}{1-\gamma}}}{1+\alpha^{\frac{\gamma}{1-\gamma}} \cdot \left(1+p^{\frac{\gamma}{1-\gamma}}\right)} & \Leftrightarrow \quad j < \tilde{j} \\ \frac{\alpha^{\frac{1}{1-\gamma}} \cdot \left(\frac{w_j \cdot \xi}{\alpha \cdot p} + (1-\xi)\right)}{1+\alpha^{\frac{\gamma}{1-\gamma}} \cdot \left(1+p^{\frac{\gamma}{1-\gamma}}\right)} & \Leftrightarrow \quad j \geq \tilde{j} \end{cases} \qquad c_{2,j} = \begin{cases} \frac{(\alpha \cdot p)^{\frac{1}{1-\gamma}}}{1+\alpha^{\frac{\gamma}{1-\gamma}} \cdot \left(1+p^{\frac{\gamma}{1-\gamma}}\right)} & \Leftrightarrow \quad j < \tilde{j} \\ \frac{(\alpha \cdot p)^{\frac{1}{1-\gamma}} \cdot \left(\frac{w_j \cdot \xi}{p \cdot \alpha} + 1 - \xi\right)}{1+\alpha^{\frac{\gamma}{1-\gamma}} \cdot \left(1+p^{\frac{\gamma}{1-\gamma}}\right)} & \Leftrightarrow \quad j \geq \tilde{j} \end{cases} \tag{5.13}$$

$$l_j = \begin{cases} \frac{1}{1+\left(1+p^{\frac{\gamma}{1-\gamma}}\right) \cdot \alpha^{\frac{\gamma}{1-\gamma}}} & \Leftrightarrow \quad j < \tilde{j} \\ \frac{\frac{w_j \cdot \xi}{\alpha \cdot p} + 1 - \xi}{1+\left(1+p^{\frac{\gamma}{1-\gamma}}\right) \cdot \alpha^{\frac{\gamma}{1-\gamma}}} & \Leftrightarrow \quad j \geq \tilde{j} \end{cases} \qquad n_j^h = \begin{cases} \frac{\left(1+p^{\frac{\gamma}{1-\gamma}}\right) \cdot \alpha^{\frac{\gamma}{1-\gamma}}}{1+\left(1+p^{\frac{\gamma}{1-\gamma}}\right) \cdot \alpha^{\frac{\gamma}{1-\gamma}}} & \Leftrightarrow \quad j < \tilde{j} \\ \frac{(1-\xi) \cdot \left(1+p^{\frac{\gamma}{1-\gamma}}\right) \cdot \alpha^{\frac{\gamma}{1-\gamma}} - \frac{w_j \cdot \xi}{\alpha \cdot p}}{1+\left(1+p^{\frac{\gamma}{1-\gamma}}\right) \cdot \alpha^{\frac{\gamma}{1-\gamma}}} & \Leftrightarrow \quad j \geq \tilde{j} \end{cases} \tag{5.14}$$

Consumption of good 1 (2) is decreasing (increasing) in the relative goods price. Leisure is also decreasing in the relative price of the home-producible good 1. The higher the price for good 1, the higher is the opportunity cost of leisure because time can also be used to produce good 1. Home production time is increasing in the relative price (of the home-producible good 1).

[16] For simplicity, we assume, that within a household, consumption and leisure of all household members are aggregated before they enter the joint utility function.

[17] To keep things simple, we assume that there are no unemployment benefits. Unemployed households live on their home production.

5.2.4 General equilibrium

In the following, we assume that the parameter constellation is such that (i) production in both sectors is strictly positive, (ii) unemployment is strictly positive and strictly below 100%, and (iii) all types of households spend some strictly positive amount of time on home production. These assumptions restrict the analysis to interior solutions.

Definition 1 *An equilibrium corresponds to a price system* $\left\{\{w_j\}_{j\in[0,1]},\{p_i\}_{i=1,2}\right\}$ *and an allocation* $\left\{\{c_{ij}\}_{j\in[0,1],i=1,2},\{l_j\}_{j\in[0,1]},\{hp_j\}_{j\in[0,1]},\{y_i\}_{i=1,2},\{y^h_{1,j}\}_{j\in[0,1]}\right\}$ *that satisfy the following conditions:*

- ***(Utility Maximization):*** *Given the price system* $\left\{\{w_j\}_{j\in[0,1]},\{p_i\}_{i=1,2}\right\}$, *the strategy* $\left\{\{c_{ij}\}_{i=1,2},l_j,hp_j\right\}$ *maximizes the utility (5.9) of each household of type* $j\in[0,1]$ *under the technological constraint (5.10), and the respective budget and time constraints (5.11) or (5.12).*
- ***(Profit Maximization):*** *Given the price system* $\left\{\{w_j\}_{j\in[0,1]},\{p_i\}_{i=1,2}\right\}$, *the production plan* $\left\{\{n_{i,j}\}_{j\in[0,1]},y_i\right\}$ *maximizes profits (5.2) of each firm in sector* i.
- ***(Market Clearing):***
  For each consumer good $i=1,2$: $\int_0^1 c_{i,j}\cdot dj=y_i$.
  For each production factor $j\in[0,1]$: $\sum_{i=1}^2 n_{i,j}=\xi$.

Proposition 1 *Under assumptions (i), (ii), and (iii), an equilibrium exists and is unique. The relative goods price* p *as a function of technology parameters* α, χ, *preference parameter* γ, *institutional parameter* θ, *labor force participation* λ, *retirement age* ρ, *and working time* ω *is given implicitly by*

$$(\alpha\cdot p)^{\frac{\gamma}{1-\gamma}}\cdot\frac{\alpha\cdot p\cdot\ln\left(\frac{\theta}{1+\theta}\cdot\frac{\chi\cdot p^{\frac{1+\chi}{\chi}}+e^{1+\chi}}{p\cdot(1+\chi)}\right)+\frac{\chi\cdot p^{\frac{1+\chi}{\chi}}+e^{1+\chi}}{(1+\theta)\cdot(1+\chi)}+\frac{1-\xi}{\xi}\cdot\alpha\cdot p}{1+\left(1+p^{\frac{\gamma}{1-\gamma}}\right)\cdot\alpha^{\frac{\gamma}{1-\gamma}}}=\frac{e^{1+\chi}-p^{\frac{1+\chi}{\chi}}}{1+\chi} \tag{5.15}$$

where $\xi=\rho\cdot\lambda\cdot\omega$.

Proof. See Appendix 5.5.1. ■

Proposition 2 *An increase in retirement age* ρ, *labor force participation* λ, *or working time* ω *leads to an increase in the relative goods price* p:

$$\frac{\partial p}{\partial\rho}>0\qquad\frac{\partial p}{\partial\lambda}>0\qquad\frac{\partial p}{\partial\omega}>0. \tag{5.16}$$

Proof. See Appendix 5.5.1. ■

Increases in retirement age, labor force participation and working time all imply a rise in market work. An increase in market work makes households reduce home production and demand more of good 1 from the market. As a consequence, the relative price of good 1 rises.

From Lemma 1 we know that unemployment $\tilde{j}$ depends on the relative goods price p. This is the channel through which market work ξ affects unemployment.

Proposition 3 *An increase in retirement age ρ, labor force participation λ, or working time ω leads to a decrease in the unemployment rate $\tilde{j}$. This effect—in terms of $\frac{\partial \tilde{j}}{\partial \xi} \cdot \frac{\xi}{\tilde{j}}$—is stronger the smaller is the elasticity of substitution between consumption and leisure $\sigma = \frac{1}{1-\gamma}$.*

Proof. See Appendix 5.5.1. ■

As stated in Proposition 2, an increase in market work leads to an increase in the relative price of good 1. This shifts relative demand for lower types (in which the production of good 1 is intensive) upward. This lifts the wages of some hitherto unemployed types above the minimum wage. They find employment and unemployment falls.

What is the role of the substitution elasticity in this effect? If substitutability is high, an increase in market work can easily be offset by a respective decrease in home production without the need for drastic changes in goods and factor prices. In this case, the wage rigidity does only little harm. In the extreme case of perfect substitutes, the relative goods price is equal to 1 and the unemployment rate is $\tilde{j} = \ln\left(\frac{\theta}{1+\theta} \cdot \frac{\chi + e^{1+\chi}}{1+\chi}\right)$ independently of market work ξ. If on the contrary substitutability is low, substantial changes in relative goods and factor prices are required to induce changes in consumption and leisure following an increase in market work. In this case, the wage rigidity has larger effects.

In summary, our general equilibrium model provides a new argument why common statements that often appear in the political discussion are wrong. They state that (i) if working life is prolonged, the old take away the jobs from the young, (ii) if more women work, they take away the jobs from the men, (iii) if the employed work longer work hours, the employment prospects of the unemployed are corroded. The idea underlying these statements is that the total amount of work to be done is fixed, has been termed the "lump-of-labor fallacy". However, on the contrary, higher labor supply leads to more production, higher incomes and thereby higher demand for goods and labor. Our theoretical model shows that this increase in the demand for goods and services asymmetrically favors the demand for those goods and services whose production is intensive in the use of unskilled labor. In consequence, while the induced increase in labor supply is symmetric across all skill levels, the increase in labor demand is biased towards unskilled labor. Given the concentration of unemployment at unskilled labor, this shift in relative labor demand has positive employment effects.

5.3 The empirical analysis

In this section, we present evidence supporting our view that increased market work goes along with less home production, more outsourcing of household work and other self-producible goods and lower unemployment. Our empirical evidence is organized as summarized in Figure 5.3: Firstly, we investigate the allocation of time by household members conditional on their working time (Section 5.3.3). We present direct evidence that less time is spent on home production activities the more time the household members spend on market work. In order to see whether home production is substituted by respective market goods and services, we secondly investigate data on help received by the household, comprising household services, child care, care for elderly persons and technical help (Section 5.3.4). This approach yields empirical evidence supporting our hypothesis that outsourcing takes place, when market work of household members is increased. Hence, our empirical evidence supports the view, that (a) households with a higher labor market participation reduce their time spent on home production, and (b) that they substitute these tasks by outsourcing, i.e., demanding services and products that fulfill these tasks.

We consider two margins of labor market participation, namely changes in (weekly) working time and changes in labor force participation, particularly of women. The effects of a prolonged working life are not analyzed. There are some recent papers trying to explain the significant drop in consumer expenditures upon retirement which also investigate whether these households substitute home production for some goods and services formerly purchased at the market (Hamermesh 1984; Banks, Blundell, and Tanner 1998; Hurd and Rohwedder 2003; Aguiar and Hurst 2004; Heathcote 2002). Given the particular circumstances and needs of older (retired) people, the link between the length of working life and home production has been studied in Chapter 4.

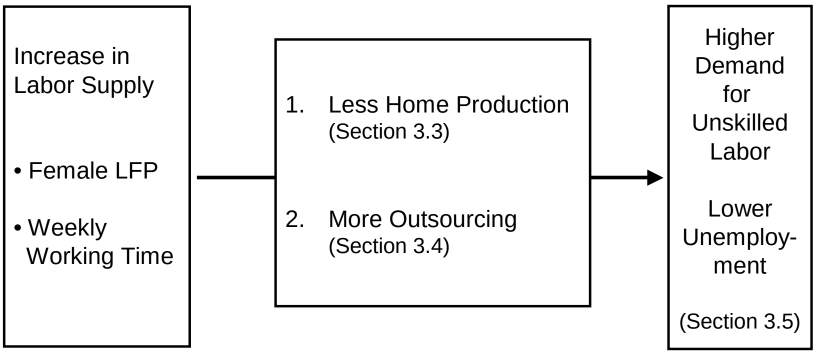
The third result of our model, that this increased outsourcing of home production raises the demand for unskilled labor and reduces unemployment, can neither be tested nor quantified using the same data set, since there is no matching information on sectoral production functions. To further test our theoretical predictions, we use macroeconomic data on OECD countries and directly estimate the reduced form relation between measures of labor supply and the unemployment rate (Section 5.3.5). We find that average working hours as well as the participation rate are negatively linked with the unemployment rate in these countries.

5.3.1 The time use data

First, we use the German time budget survey (Zeitbudgeterhebung) from 1991/92 by the Statistisches Bundesamt. We restrict the sample to West German households headed by married or cohabiting couples in the working age group 20-60.[18] Furthermore, we use the provided sampling weights in order to render the data representative.

[18] We exclude East German households, because they had very different labor market dynamics directly after the reunification in 1991/92.

Figure 5.3: Overview over the empirical analysis



Since only one wave of the data is available, we conduct a cross sectional analysis. This implies that we cannot account for unobserved heterogeneity. However, we can filter many dimensions of inter-personal heterogeneity, because the survey contains a detailed set of household and personal characteristics as well as regional characteristics.

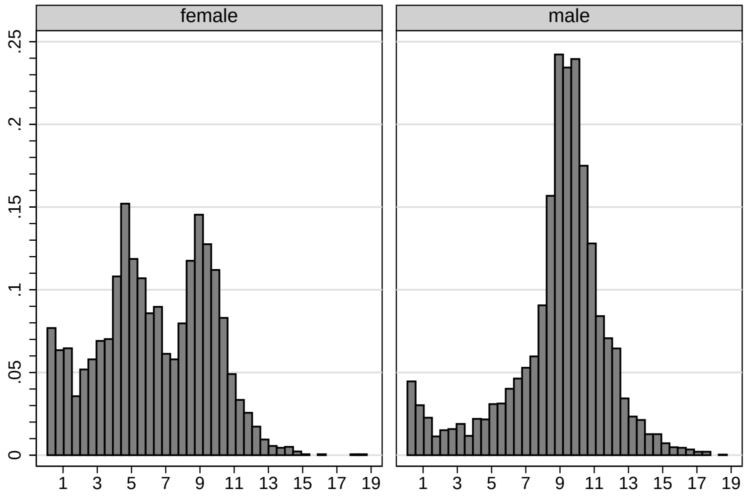
The time use of each respondent is surveyed for two days. The respondents fill in a time diary, which gives us the information on the total time spent on each activity during a day. We follow the standard classification scheme to group activities into home production, working time and leisure time. The dependent variable home production, hp, is characterized as time spent for food preparation and cleanup, cleaning inside or outside the home, caring for clothes, plants and animals, time spent for shopping, home and car repair, and all children-related activities or caring for other people. Our working time variable, denoted ω, is time spent working, commuting to work, taking breaks while at work, and searching for work.[19] The distribution of working hours among the working by sex is shown in Figure 5.4. For men, it is distinctly single-peaked around 9-10 hours per day which corresponds to a full time job plus travel time etc. On the contrary, we see a very different distribution of female working time with two peaks. The first and highest peak is around 5 hours a day which accords with a part time job. The second and lower peak is again around 9-10 hours per day. Labor force participation λ is a self-reported variable from the interview part. For a description of the other variables used in the analysis see Appendix 5.5.2 and for the income measure Appendix 5.5.3.

5.3.2 A descriptive look at market work, home production, outsourcing and the demand for unskilled labor

Since the German Time Use Survey has not been widely used by economists, we start with a descriptive overview of the time allocation by sex and employment status. We distinguish between women and men for two reasons: First, it is widely documented in

[19] The last category, leisure, comprises time spent for sleeping and napping, washing, dressing, eating, receiving medical care, and time spent for everything else.

Figure 5.4: Distribution of mean work hours per day by sex among the working



the literature (Beblo 1999; Van der Lippe, Tijdens, and De Ruijter 2004) that men and women differ in their engagement in home production activities. Second, in contrast to males, females exhibit a very heterogenous labor market participation, and policies aimed at increasing labor force participation are often targeted at women.

Table 5.1: Time use by sex (in % of total time)

	market work (incl. breaks, commuting, job search)	leisure (incl. recreation, vol. work)	home production
men	24.6	64.0	11.4
women	8.4	65.6	26.0

General time use is split into three broad categories: Both, men and women, spend about two thirds of their day on leisure activities as defined in Section 5.3.1. However, they differ substantially in how they spent the remaining time. While men spent 24.6 percent of their total time on work-related activities and 11.4 percent on home production activities on average, women allocate their time in the opposite manner (Table 5.1).[20]

Next, we decompose time use by employment status. Two things are worth noting from Table 5.2: (1) Working men and women spent less than half as much time on home production activities than their not working counterparts. (2) Differential work status does not explain the gender differences in home production time.

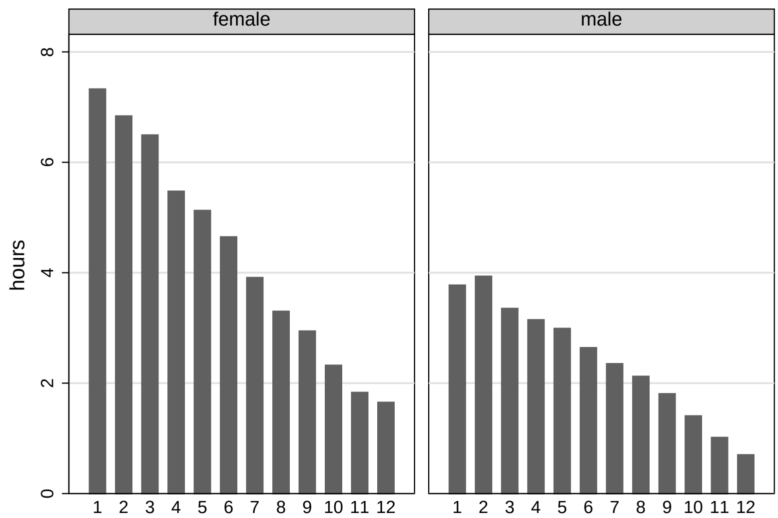
[20]Brines (1994) and Greenstein (2000) put forward sociological factors to explain these gender differences. Beblo (1999) analyzes strategic behavior in intra-family time allocation.

Table 5.2: Average home production by sex and employment status in hours per day (resp. % of total time)

	all	not working	working		
			all	part time	fulltime
men	2:46 (11.5%)	4:14 (17.7%)	1:42 (7.1%)	3:17 (13.7%)	1:22 (5.7%)
women	6:11 (25.7%)	7:01 (29.2%)	4:23 (11.1%)	5:50 (24.3%)	1:33 (6.5%)

Decomposing time use by working time shows that women with a part time job spend about an hour and 10 minutes less time on home production per day than not working women, while full time employed women spend 5 and a half hours per day less on home production (Table 5.2). Figure 5.5 illustrates this strong and negative relation between home production and working time which is stronger for women. Even among men, the differences in home production by work status and hours are sizeable: Not working men take care of the household about 4 hours and a quarter each day while full time employed men only spend about an hour and 22 minutes on home production.

Figure 5.5: Home production by sex and hours of work



Next, we look at the relation between market work and outsourcing. We have information on whether a household receives help from outside the household, and if so, how much. Received help is classified in four categories, namely (1) help in the household (cleaning, shopping, laundry), (2) child care, (3) care for elderly persons, and (4) technical help. We summarize these four categories into one. 18.2% of all households under consideration answered that they receive help from outside the household. 7.6% of all households received help that was paid for.

Table 5.3: Share of households receiving help, by employment status

	Households members are...			
Type of received help	all	both not employed	one employed	both employed
unpaid	11.6%	0.0%	7.1%	14.6%
paid	7.6%	2.3%	3.9%	10.0%
unpaid and paid	18.2%	2.3%	10.5%	23.3%

Table 5.3 furthermore illustrates, that the higher a household's labor market participation, the higher is the probability that this household receives (unpaid and paid) help from outside. Using the German Socio-Economic Panel, Hank (2001) presents similar numbers and states that "dual career households use professional help the most." The fraction of households purchasing domestic services is highest among households in which women spend many hours in market work.

5.3.3 Does increased market work lead to a reduction of home production?

The goal of this section is to investigate the relationship between labor market participation and home production in a multivariate setting. In our model, households maximize their utility from consumption and leisure as specified in equation (5.9). Producing goods and services at home saves money, but consumes time resources that could be spent on market labor or leisure activities. Hence, households will have to weigh the marginal cost of purchasing certain goods or services against the marginal cost of producing them at home.

We model the decision how much time a household j spends on home production per day as a function of household characteristics Z, the labor force participation dummy λ and minutes of market work by husband and wife on a diary day, ω, monthly household net income Inc and its interactions with labor force participation, and individual characteristics of the spouses X. The monthly income variable has been constructed from the individual net monthly incomes of husband and wife which are given in income brackets in the survey. We construct a continuous household income variable by estimating an ordered probit model with known cut points for the individual incomes and adding them up afterwards. This method which improves on the commonly used method of taking the midpoints of the brackets as the continuous income measure, and its implications are discussed in Appendix 5.5.3. Furthermore, we control for seasonal and weekly patterns T and regional differences R. The empirical specification is the following:[21]

$$\begin{aligned} hp_j = \alpha + \sum_s (\gamma_s \cdot \lambda_{s,j} + \delta_s \cdot \omega_{s,j}) + (\zeta + \sum_s \zeta_s \cdot \lambda_{s,j}) \cdot Inc_j \\ + \beta \cdot Z_j + \sum_s \eta_s \cdot X_{s,j} + \rho \cdot T_j + \tau \cdot R_j + \epsilon_j \end{aligned} \tag{5.17}$$

where hp denotes total time per day spent on home production at day t in minutes. The subscripts stand for household j and household member s where s can be the husband m or the wife f.

We estimate equation 5.17 to test our argument that the higher the household's labor supply, the less time will be spent on home production.[22] We differentiate market work by husband and wife, because—given the descriptive evidence from Section 5.3.2—we do not suppose that male and female market work are perfect substitutes. On the contrary, we suspect that increasing female labor force participation has stronger negative effects on the home production of households.

Column 1 in Table 5.4 shows a significant effect of male and female working time, ω, on the total time spent on home production in the household. As expected, the more the household members work, the less time is spent on home production. For example, if the wife works one hour more, home production time of the household is reduced by 26 minutes. The magnitude of the effect is almost twice as high compared to male working time. A t-test reveals that they are statistically significantly different. Female labor force participation λ_f is not significant in specification (1), nor are its interactions with income and income squared. However, an F-test yields a common significance (F(3, 4359)=2.15).

One might argue that there is a potential simultaneity of the work and the home production choice which biases our OLS results. The argument is that on the one hand, the supply of child care affects the labor supply decision, and on the other hand, the labor supply decision affects the household's demand for child care. We deal with the resulting endogeneity bias in two ways: First, we include three broadly defined region dummies and additionally four regional variables based on a much finer regional classification like the local unemployment rate, regional GNP per capita, the degree of urbanization, and the size of the tertiary sector. These regional characteristics are likely correlated with the degree of availability of child care, as it is part of the tertiary sector, varies by population density and urbanization of the area, and so forth. To the extent that regional characteristics are a good proxy for child care and domestic services availability, the results from specification (1) do not indicate a severe

[21] We omit the time subscript t denoting the diary day for ease of notation.

[22] We include a participation dummy only for women, since there is almost no variation in male participation in the data. The dummy variable captures potential fixed effects that might be associated with market work.

Table 5.4: Regression results

dependent variable: total household home production						
	all		w/o kids		w/ kids	
	(1)		(2)		(3)	
	participation and minutes of work					
λ_f	43.87	(1.05)	41.401	(0.49)	68.326	(1.36)
ω_m	-0.248	(-17.00)***	-0.208	(-6.81)***	-0.279	(-16.82)***
ω_f	-0.435	(-23.70)***	-0.371	(-10.80)***	-0.478	(-19.89)***
	household characteristics					
Inc	0.028	(1.70)*	0.029	(0.79)	0.026	(1.39)
Inc^2	-2.8E-6	(-1.57)	-2-2E-6	(-0.56)	-2.8E-6	(-1.41)
$Inc * \lambda_f$	-0.021	(-1.17)	-0.017	(-0.45)	-0.029	(-1.34)
$Inc^2 * \lambda_f$	1.7E-6	(0.92)	8.9E-7	(0.22)	2.3E-6	(1.05)
$Kids$0-5	116.237	(22.04)***			88.69	(14.47)***
$Kids$6-18	27.527	(7.94)***			15.722	(3.46)***
$SchoolYrs_{Avg}$	-6.794	(-2.41)**	-4.271	(-0.71)	-5.433	(-1.70)*
$SchoolYrs_{Diff}$	2.701	(1.25)	-9.659	(-1.86)*	8.236	(3.57)***
Age_{Avg}	-0.349	(-0.84)	1.237	(1.75)*	-2.23	(-3.36)***
Age_{Diff}	1.101	(1.44)	-0.265	(-0.16)	2.372	(2.70)***
	living conditions of the household					
$AppSize$	0.057	(0.57)	0.422	(1.75)*	-0.073	(-0.67)
$AppOwner$	22.631	(1.84)*	16.773	(0.68)	29.994	(2.06)**
$HOwner$	40.513	(4.83)***	57.601	(3.19)***	22.857	(2.40)**
$Garden$	30.94	(3.83)***	24.774	(1.54)	42.496	(4.45)***
$Constant$	627.462	(9.23)***	383.051	(2.64)***	784.705	(10.19)***
$Obs.$	4392		958		3434	
$Adj.R^2$	0.42		0.32		0.37	

Note: t statistics in parentheses. *,**,*** denote significance at 10%, 5%, 1%.
Additional regressors (not reported here): regional (Southern and Central Germany), seasonal and weekday dummies, and regional characteristics like unemployment rates, gross national product, urbanization and the size of the tertiary sector.

endogeneity problem: none of the regional variables turns out significant. As a second robustness check, we split the sample into couples with and without children, because we suppose that an endogeneity bias will be present mainly with regard to child care availability. Women might decide to start working again when they can easily source out child care, i.e. when the grandparents live close by or when institutionalized child care is easily available. Hence, childless couples should be affected to a much lesser extent. We find a slightly lower impact of working time on home production in childless households —about 4 minutes difference compared to results from (1)— but the differences are not substantial.

The total effect of female labor supply (including participation and working time) on a household's home production is shown in Table 5.5. The table displays the difference in household home production time between a not working and a working woman. Increases in market work imply accompanying pay raises which also affect home production time and the amount of outsourcing. We take this into account using the differences in the conditional mean incomes of households with full (part) time working women and those with not working women in our sample. Furthermore, we assume an average hourly wage of 18.40 DM.[23] We determine working time in a part- or full-time job from the distribution of female working hours. Part-time is roughly defined as the lower peak value at 5 hours per day, full-time as the higher peak value at 9.5 hours (see Figure 5.4).

Table 5.5: Net effect of female labor market participation on household home production time (in hours per day)

	not working woman vs. woman working ...part time		...full time		woman working 1 h more	
change in household home production time	-1:28	(-2.16)**	-3:28	(-5.08)***	-0:27	(-13.09)***

Note: t-values in parentheses. ***/** denote significance at the 1%, 5% level. The underlying Null hypothesis is that the respective linear combination of coefficients is equal to zero.

The first (second) column contains the difference in home production time between a household with a not working woman and one with a part respectively full time working woman: it amounts to a considerable one and a half respectively three and a half hours per day. In the third column, we calculate the effect of one additional work hour which reduces the home production time of the household by 27 minutes. Thus, female market work results in a statistically significant reduction in home production time. The reduction is larger, the more hours a woman works.

Hence, our findings suggest that: (1) The more the spouses work, the less time is spent on home production in the household. (2) This effect is almost double as large for women than for men, and it is sizeable: One additional hour in market work crowds out almost half an hour of household home production time.

[23] This number is computed from the IAB-Beschäftigtenstichprobe 1992.

We will only briefly comment on the results for the other household and personal characteristics, since they are not at the center of our attention. We cannot find evidence of a direct effect of education on home production time, that would be due to education-specific attitudes and tastes etc. We also do not find a strong relation between age and home production. We additionally include month and weekday dummies into our estimation to capture seasonal effects in home production. For example, the positive significant coefficients for June and July indicate that households might save some outdoor home production tasks for the summer, e.g., repairing the house or doing some gardening. Furthermore, descriptive evidence suggests that significantly more home production is done on weekends than during the week. This intertemporal substitution of home production can be explained by weekend shopping and weekend do-it-yourself activities. This result is not echoed, however, in our regression analysis where working time and other covariates are controlled for. The weekday dummies SAT and SUN have significantly negative estimated coefficients, so that the intertemporal substitution seems to work the opposite way. The weekend seems to be mainly reserved for leisure activities. In additional robustness checks, we accounted for potential substitution effects by interacting a weekend dummy with the participation dummy to see whether working women do more home production on weekends than their not working counterparts, and found no evidence in favor of the substitution hypothesis.

5.3.4 Does more market work result in more outsourcing?

In the preceding chapter, we analyzed the link between market work and the time spent on home production. We found that more time spent on market work is associated with less time spent on home production. In this section, we use the data on "help received by the household" described in Section 5.3.2 to study the link between market work of household members and the demand for these services.[24] The idea is that at least part of a household's home production can in principle be outsourced. Our measure "received" help does certainly not cover all components of outsourcing, e.g., it excludes child care outside households (kindergartens, nurseries, etc.), eating out, bringing clothes to the dry-cleaner, having them ironed and sewed and so forth. Furthermore, only 7.6% of our sample households report to have received paid help. This low percentage is most likely due to underreporting. In Germany, many household aids are employed without official registration, as this would imply the duty to pay social security contributions and taxes on both sides, employer and employee.[25] For these two reasons, we regard our analysis as a lower bound of the impact of labor market participation on the demand for household services and the like.

[24] Throughout this section, we aggregate the four categories of received help under the label "outsourcing".

[25] According to Brück, Haisken-DeNew, and Zimmermann (2003),pp.4, there are about 40.000 officially registered employees in the household sector in Germany. Estimates, on the contrary, point to about 500.000 employees in the domestic service sector.

We estimate the effect of households' labor market participation on their demand for paid services that substitute for home production. We use the same specification as in equation 5.17, just substituting received help rh for home production hp. Since only 7.6% of the households in our sample actually report to receive paid help, we have a dependent variable that is censored at zero. Simplifying equation 5.17 for illustrative purposes, we get: $rh_j^* = x_j'\beta + \epsilon_j$ where the error term is normally distributed, $\epsilon_j \sim N(0, \sigma^2)$, and $rh^* \mid x_j \sim N(\beta' x_j, \sigma^2)$. The censored variable can be characterized as:

$$rh = \begin{cases} rh^* & \text{if} \quad rh^* > 0 \\ 0 & \text{else} \end{cases} \tag{5.18}$$

The probability of observing positive outsourcing is: $P(rh > 0) = P(rh^* > 0) = \Phi(\frac{\beta' x_j}{\sigma})$. Hence, the Likelihood for the censored regression model is:

$$L = \prod_{j=0}^{n} \left[\Phi \left(\frac{x_j'\beta}{\sigma} \right) \right]^{-1} \cdot \frac{1}{\sigma} \cdot \phi \left(\frac{rh_j - x_j'\beta}{\sigma} \right) \tag{5.19}$$

Table 5.7 reports the regression results of this censored Tobit model. A woman's labor force participation has a strongly significant effect on the household's probability to receive paid help. Working time of women (in minutes per day) also has a significantly positive effect. The effect of men's working time is about as large. Again, we exclude men's labor force participation for lack of variation in that variable. Income and the number of children aged 0 to 5 positively affect the amount of paid help. Other significant control variables are education, urbanization of the place of residence, and regional GNP per capita. The sample size prohibits the sample split into households with and without children done in Section 5.3.3.[26]
In order to get an idea of the magnitude of these effects, we calculate the impact of changes in female market work on purchased hours of home help (Table 5.6). We use the same computation method as in Section 5.3.3. The first (second) column displays the effect on the outsourcing of housework when the woman enters the labor market and works part (full) time. The overall effect is an increase by roughly one hour per week, or +263%, in the case of a switch towards a part time job. The effect of taking up a full time job is slightly smaller. This unexpected result arises because outsourcing is a hump-shaped function of women's working time. The hump's peak is between 5 and 6.5 working hours per day. This finding is robust with respect to different specifications (polynomials of different order, splines). An increase in the woman's daily working time by one hour raises the household's outsourcing by 12 minutes per week (+18%) (third column). In absolute terms, the effects may seem small. However, the numbers represent averages over the whole sample of which 92.4%

[26] As a further robustness check, we also estimated a Heckman selection model and got very similar results. Our identifying assumptions were that labor force participation only affects the decision of whether or not to hire a home help while working time only affects the extent to which a home help is engaged. Other variables that entered only the selection equation were urbanization of the place of residence, regional GNP per capita, and the size of the regional service sector. These latter variables affect the regional availability of household services.

do not make use of any paid help at all. Furthermore, our data contain only a fraction of tasks that could possibly be outsourced. For example, we do not have information on outsourcing of food preparation (going to restaurants, pizza service), drinks delivery, cleaning and ironing of clothes, kindergartens, nurseries, and other services that are rendered outside the household.

Table 5.6: Net Effect of Female Labor Market Participation on Help Received (in minutes per week)

	woman switches from not working to working		woman works
	...part time	...full time	1 h more
change in received help			
absolute	+66:44	+66:02	+11:47
relative	+263%	+260%	+18%

Table 5.7: Regression Results

dependent variable: paid help received by the household (in minutes per day)		
	participation and minutes of work	
λ_f	64.57	(4.12)***
ω_f	0.2226	(2.48)**
ω_f^2	-0.0003191	(-2.15)**
ω_m	0.1663	(2.16)**
ω_m^2	-0.0001385	(-1.43)
	household characteristics	
Inc	0.03040	(2.49)**
Inc^2	-3.43e-7	(-0.39)
$Kids$0-5	56.63	(6.27)***
$Kids$6-18	3.428	(0.58)
Age_{Avg}	0.6968	(1.52)
$SchoolYrs_{Avg}$	10.89	(3.71)***
$TrainYrs_{Avg}$	7.007	(2.03)**
	regional characteristics	
$Urban$	31.66	(3.38)***
GNP	-0.002338	(-3.33)***
$TertSec$	1.308	(1.55)
$Weekend$	50.80	(2.82)***
$Constant$	-890.6	(-9.69)***
Observations	4392 (of which 338 uncensored, 4054 censored)	

Note: t statistics in parentheses. *, **, *** denote significance at 10%, 5%, 1%.

In summary, these results strongly corroborate the theoretical predictions from Section 5.2. An increase in market work implies that households have less time and more money. The increase in income can be expected to entail a roughly proportional increase in total expenditures. But this increase is not proportional across different goods. Household income (and thus total consumer expenditures) increases by roughly one third, when the woman takes up a full-time job. At the same time, the demand for household services and other types of paid help rises by more than 260%. As these services are mostly rendered by unskilled workers, the relative demand for unskilled labor increases in the wake of increases in working time or labor force participation.

5.3.5 Is there a link between labor market participation and unemployment in the OECD?

In the preceding sections, we looked at micro data and found that the empirical link between market work, home production and outsourcing behavior of households is in line with our theoretical model. In this section, we investigate whether the macroeconomic evidence is consistent with our theory. We directly look at reduced form the relation between labor market participation and unemployment in OECD countries between 1980 and 2003. Appendix 5.5.2 describes the coverage and sample statistics of our unbalanced panel of 23 OECD countries.[27]
Our theoretical model predicts that over time and across countries, higher degrees of labor market participation lead to lower unemployment. Labor market participation in our model encompasses a higher labor force participation, longer weekly work hours, or a prolonged work life, caused, e.g., by a higher retirement age. As data on average retirement age are not available, we use the labor force participation of workers aged 55 to 64 years instead. Additionally, we use a set of control variables. These are (i) union density, (ii) employment protection legislation, and (iii) GDP growth.[28]

Potential endogeneity of the key variables of interest, namely the two labor force participation variables, can be present for various reasons: Unemployment and labor force participation both vary over the business cycle. Both increase in economic downturns. The counter-cyclicality of labor force participation has become known as the "added worker" effect: Women enter the labor market in recessions when their husbands' incomes decrease or when the husbands loose their jobs. This effect potentially biases our estimates towards zero. Therefore we include GDP growth in the regression to control for business cycle effects. Another source of endogeneity might be the belief of some governments that shorter working hours and early retirement schemes can be used as a cure to fight unemployment. If these policy measures are realized, then we expect shorter working hours and lower labor force participation (especially of the elderly) in countries and years, in which the unemployment problem is more severe. This would bias our estimates away from zero. Therefore, we control for country fixed effects and use lagged values of the explanatory variables. These fixed effects additionally control for all time-invariant unobserved country heterogeneity. In addition, take

[27] For Turkey, data on working hours are not available.
[28] See Blanchard and Wolfers (2000) for a more detailed discussion of the institutional determinants of unemployment rates especially in European countries.

first differences of all variables in order to avoid problems of spurious correlation. As the value of the dependent variable, the unemployment rate, must always lie within the unit interval, we use a logistic specification:

$$UR = \frac{e^{\beta_0+\beta_p\cdot\lambda^{all}+\beta_{55}\cdot\lambda^{55+}+\beta_h\cdot\omega+\sum_k\gamma_k\cdot x_k}}{1+e^{\beta_0+\beta_p\cdot\lambda^{all}+\beta_{55}\cdot\lambda^{55+}+\beta_h\cdot\omega+\sum_k\gamma_k\cdot x_k}} \tag{5.20}$$

where UR is the unemployment rate, λ^{all} is the rate of labor force participation in the entire population, $Part^{55+}$ is the participation rate of persons aged 55 to 64 years, ω are average yearly working hours, and x_k denotes one of a set of k additional regressors. In order to estimate this non-linear relation with linear estimation methods, we transform the dependent variable into:

$$UR^{logistic} = \ln\left(\frac{UR}{1-UR}\right) = \beta_0 + \beta_p\cdot\lambda^{all} + \beta_o\cdot\lambda^{55+} + \beta_h\cdot\omega + \sum_k\gamma_k\cdot x_k. \tag{5.21}$$

Table 5.8: Regression results

dependent Variable: unemployment rate (logistic)				
	(1)		**(2)**	
Participation (all)	-5.465	(-4.18)***	-7.274	(-5.07)***
Participation (55-64 years)	-0.245	(-0.38)	0.605	(0.88)
Working Hours	-12.845	(-3.39)***	-7.647	(-2.00)**
GDP growth p.c.			-2.615	(-7.06)***
Employment Protection Legislation			-0.017	(-0.15)
Union Density			0.010	(1.25)
Constant	0.003	(0.33)	0.007	(0.76)
No. Obs. (No. Countries)	437	(23)	354	(21)
Adj. R^2	0.01		0.16	

Note: t statistics in parentheses. **,*** denote significance at 5%, 1%. All variables are in first differences; explanatory variables are lagged. In all specifications, we estimate fixed-effects models.

Table 5.8 displays the regression results. We estimate two specifications: (1) contains the variables of interest only, and (2) additionally includes a set of control variables, namely per capita GDP growth, an index of employment protection legislation, and union density rates. Both columns show a highly significant link between total labor force participation and working hours and the unemployment rate. This is consistent with our theory. Labor force participation of older workers turns out insignificant. One explanation might be that many OECD countries have or had generous pre-retirement schemes in place such that at least those still participating beyond age 60 are a strongly selected group.[29] If increases in the participation rates of the elderly arise from a tightening of social security systems, then this may induce less skilled

[29] For example, those who did not spend many years on earning a degree or getting tertiary education, started their working life early and can retire earliest—at least in Germany.

and less wealthy people to work longer. If this is the case, then we do not expect substantial increases in outsourcing or sizeable reductions of the unemployment rate. We also conducted robustness checks using additional explanatory variables like the degree of wage inequality, and the replacement rate of unemployment benefits, and estimated a specification without lagging the explanatory variables. Our results turn out to be robust with respect to these alternative specifications.

5.4 Conclusions

In this chapter, we introduce a new argument into the debate about the employment effects of labor market policy measures targeted at increasing working time and labor force participation: We develop a general equilibrium model showing that positive employment effects for the unskilled can arise from general increases in labor market participation.

The mechanism how these jobs might accrue works through the goods market. We argue that changes in labor market participation of individuals entail changes in the composition of their consumer demand. Longer working hours and higher labor force participation imply that workers have higher incomes and less time for leisure and home production. As a consequence, home production decreases, and the demand composition shifts towards those goods and services that substitute for home production. As the goods and services that can be produced by everyone at home require few skills, the relative demand for unskilled labor rises. If the relative wage does not adjust perfectly to changes in relative labor demand, unemployment among the unskilled falls.

In the second part of the chapter, we produce empirical evidence that corroborates our theoretical results. We use a time use survey conducted in West German households in 1991/92 to explore the main mechanism of the model empirically: The link between labor market participation and home production and the link between labor market participation and outsourcing of household services and other home-producible goods and services. We find quantitatively relevant effects of labor force participation and work hours on both, time spent on home production by the household and outsourcing of these tasks among working age couples. One additional hour in market work of the woman crowds out 27 minutes of the household's home production per day. Accordingly, outsourcing rises by 12 minutes per week (+18%). Switching from not working to working full time results in a reduction of home production time of about 3 and a half hours per day. As a consequence, outsourcing rises by more than one hour (+260%). These effects imply that increases in market work can have large positive effects on the demand for unskilled labor.

At the macroeconomic level, we additionally investigated the link between labor market participation and unemployment rates directly. Controlling for some institutional determinants of unemployment rates, we find a strongly significant and negative relationship for 23 OECD countries from 1980 to 2003. We take this as further evidence in favor of our model.

5.5 Appendix

5.5.1 Proofs

Proof of Proposition 1

At $p = 0$, the right hand side (RHS) of equation (5.15) is larger than the left hand side (LHS):

$$\frac{e^{1+\chi}}{1+\chi} \cdot \xi = RHS\,(0) \qquad \geq \qquad LHS\,(0) = \begin{cases} 0 & \Leftrightarrow \quad \rho > 0 \\ \frac{1}{3} \cdot \frac{e^{1+\chi}}{(1+\theta)\cdot(1+\chi)} \cdot \xi & \Leftrightarrow \quad \rho = 0 \\ \frac{e^{1+\chi}}{(1+\theta)\cdot(1+\chi)} \cdot \xi & \Leftrightarrow \quad \rho < 0 \end{cases}$$

The limit of the right hand side for $p \to \infty$ is smaller than the limit of the left hand side:

$$-\infty = \lim_{p\to\infty} RHS\,(p) \qquad < \qquad \lim_{p\to\infty} LHS\,(p) = \infty$$

Both sides of the equation are continuous in p. Therefore, at least one p must exist that makes both sides equal. This establishes the existence of the general equilibrium.

As stated in Section 5.2.4, we only consider parameter constellations for which production in both sectors is strictly positive. This requires for the relative goods price: $p \in [1, e^{\chi}]$. Within these limits, aggregate demand for good 2 is increasing in the relative price of good 1, p, while aggregate supply of good 2 is decreasing in p. Thus, if an equilibrium price p exists, it must be unique.

Proof of Proposition 2

The equilibrium condition is $C_2\,(p\,(\xi)\,,\xi) = Y_2\,(p\,(\xi)\,,\xi)$. Let $\eta_{u,v} = \frac{\partial u}{\partial v} \cdot \frac{v}{u}$ denote the relative effect of u on v. Comparative statics with respect to ξ yields:

$$\eta_{p,\xi} = -\frac{\eta_{Y_2,\xi} - \eta_{C_2,\xi}}{\eta_{Y_2,p} - \eta_{C_2,p}}$$

The denominator is negative (see the proof of uniqueness in Appendix 5.5.1). How about the numerator?

$$\eta_{Y_2,\xi} = 1 \quad \text{and} \quad \eta_{C_2,\xi} = 1 - \frac{\frac{(p\cdot\alpha)^{\frac{1}{1-\rho}}}{1+\left(1+p^{\frac{\rho}{1-\rho}}\right)\cdot\alpha^{\frac{\rho}{1-\rho}}}}{C_2}$$

so that

$$\eta_{Y_2,\xi} - \eta_{C_2,\xi} = \frac{\frac{(p\cdot\alpha)^{\frac{1}{1-\rho}}}{1+\left(1+p^{\frac{\rho}{1-\rho}}\right)\cdot\alpha^{\frac{\rho}{1-\rho}}}}{C_2} > 0$$

which implies that

$$\eta_{p,\xi} = -\frac{\overbrace{\eta_{Y_2,\xi} - \eta_{C_2,\xi}}^{>0}}{\underbrace{\eta_{Y_2,p} - \eta_{C_2,p}}_{<0}} > 0$$

Proof of Proposition 3

From Lemma 1 we know that unemployment is decreasing with the relative goods price p. Together with Proposition 2 this implies that a reduction in market work ξ leads to an increase in unemployment $\tilde{j}$.

Next, we have to show that the effect of market work ξ on unemployment $\tilde{j}$ is stronger, the smaller is the elasticity of substitution between consumption and leisure σ :

$$\frac{\partial \left|\eta_{\tilde{j},\xi}\right|}{\partial\sigma} < 0 \quad \Leftrightarrow \quad \frac{\partial\left(\eta_{\tilde{j},\xi}\right)}{\partial\sigma} > 0$$

Market work ξ affects unemployment only through the relative goods price p (see equation 5.8):

$$\eta_{\tilde{j},\xi} = \eta_{\tilde{j},p} \cdot \eta_{p,\xi}$$

The effect of the relative goods price p on unemployment $\tilde{j}$ does not depend on the substitution elasticity σ (see Lemma 1):

$$\frac{\partial\left(\eta_{\tilde{j},\xi}\right)}{\partial\sigma} = \underbrace{\frac{\partial\left(\eta_{\tilde{j},p}\right)}{\partial\sigma}}_{=0} \cdot \underbrace{\eta_{p,\xi}}_{<0} + \underbrace{\eta_{\tilde{j},p}}_{<0} \cdot \frac{\partial\left(\eta_{p,\xi}\right)}{\partial\sigma} \overset{?}{>} 0$$

It suffices thus to show that $\frac{\partial\left(\eta_{p,\xi}\right)}{\partial\sigma} < 0$.

$$\frac{\partial\left(\eta_{p,\xi}\right)}{\partial\sigma} = -\frac{\frac{\partial\left(\eta_{Y_2,\xi}-\eta_{C_2,\xi}\right)}{\partial\sigma} \cdot \left(\eta_{Y_2,p} - \eta_{C_2,p}\right) - \left(\eta_{Y_2,\xi} - \eta_{C_2,\xi}\right) \cdot \frac{\partial\left(\eta_{Y_2,p}-\eta_{C_2,p}\right)}{\partial\sigma}}{\left(\eta_{Y_2,p} - \eta_{C_2,p}\right)^2} \overset{?}{<} 0$$

From Appendix 5.5.1 we know that $\eta_{Y_2,p} - \eta_{C_2,p} < 0$, $\eta_{Y_2,\xi} - \eta_{C_2,\xi} > 0$ and that

$$\eta_{Y_2,\xi} - \eta_{C_2,\xi} = \frac{\frac{(p\alpha)^{\frac{1}{1-\rho}}}{1+\left(1+p^{\frac{\rho}{1-\rho}}\right)\alpha^{\frac{\rho}{1-\rho}}}}{C_2} = \frac{p\alpha}{\xi p\alpha \ln\left(\frac{\theta}{1+\theta}\frac{\chi p^{\frac{1+\chi}{\chi}}+e^{1+\chi}}{p(1+\chi)}\right) + \frac{\chi p^{\frac{1+\chi}{\chi}}+e^{1+\chi}}{(1+\theta)(1+\chi)}\xi + (1-\xi)\,p\alpha}$$

independent of $\sigma = \frac{1}{1-\rho}$. Therefore $\frac{\partial\left(\eta_{Y_2,\xi}-\eta_{C_2,\xi}\right)}{\partial\sigma} = 0$.

All that remains to be shown is that $\frac{\partial\left(\eta_{Y_2,p}-\eta_{C_2,p}\right)}{\partial\sigma}<0$. From equation 5.6 follows that $\frac{\partial\left(\eta_{Y_2,p}\right)}{\partial\sigma}=0$.

$$\eta_{C_2,p}=\frac{\partial\left(\frac{(p\cdot\alpha)^{\frac{\rho}{1-\rho}}}{1+\left(1+p^{\frac{\rho}{1-\rho}}\right)\cdot\alpha^{\frac{\rho}{1-\rho}}}\right)}{\partial p}\frac{p}{\frac{(p\cdot\alpha)^{\frac{\rho}{1-\rho}}}{1+\left(1+p^{\frac{\rho}{1-\rho}}\right)\cdot\alpha^{\frac{\rho}{1-\rho}}}}+\frac{\partial\Lambda}{\partial p}\frac{p}{\Lambda}$$

where $\Lambda=\left(\xi\cdot p\cdot\alpha\cdot\ln\left(\frac{\theta}{1+\theta}\cdot\frac{\chi\cdot p^{\frac{1+\chi}{\chi}}+e^{1+\chi}}{p\cdot(1+\chi)}\right)+\frac{\chi\cdot p^{\frac{1+\chi}{\chi}}+e^{1+\chi}}{(1+\theta)\cdot(1+\chi)}\cdot\xi+(1-\xi)\cdot p\cdot\alpha\right)$ does not depend on ρ.

$$\frac{\partial\left(\frac{(p\cdot\alpha)^{\frac{\rho}{1-\rho}}}{1+\left(1+p^{\frac{\rho}{1-\rho}}\right)\cdot\alpha^{\frac{\rho}{1-\rho}}}\right)}{\partial p}\frac{p}{\frac{(p\cdot\alpha)^{\frac{\rho}{1-\rho}}}{1+\left(1+p^{\frac{\rho}{1-\rho}}\right)\cdot\alpha^{\frac{\rho}{1-\rho}}}}=\frac{\rho}{1-\rho}\cdot\frac{1+\alpha^{\frac{\rho}{1-\rho}}}{1+\left(1+p^{\frac{\rho}{1-\rho}}\right)\cdot\alpha^{\frac{\rho}{1-\rho}}}$$

It suffices to show that

$$\frac{\partial\left(\eta_{C_2,p}\right)}{\partial\sigma}=\frac{\partial\left(\frac{\rho}{1-\rho}\cdot\frac{1+\alpha^{\frac{\rho}{1-\rho}}}{1+\left(1+p^{\frac{\rho}{1-\rho}}\right)\cdot\alpha^{\frac{\rho}{1-\rho}}}\right)}{\partial\sigma}>0$$

With $\frac{\rho}{1-\rho}=\sigma-1$:

$$\frac{\partial\left(\eta_{C_2,p}\right)}{\partial\sigma}=\frac{1+\alpha^{\sigma-1}}{1+\left(1+p^{\sigma-1}\right)\cdot\alpha^{\sigma-1}}-(\sigma-1)\frac{\left(\ln\alpha+\left(1+\alpha^{\sigma-1}\right)\cdot\ln p\right)\cdot(\alpha\cdot p)^{\sigma-1}}{\left(1+\left(1+p^{\sigma-1}\right)\cdot\alpha^{\sigma-1}\right)^2}$$

For $\sigma\leq 1$ (with $\alpha>1$), the right hand side is unambiguously positive:

$$\frac{\partial\left(\eta_{C_2,p}\right)}{\partial\sigma}>0$$

For $\sigma>1$, this inequality can only be established numerically because the relative goods price p is endogenous and cannot be expressed as an explicit function of the exogenous parameters.

Numerical simulations for $\alpha\in[1,10]$, $\chi\in[0,10]$, $\mu\in[0,1]$, $\rho\in[0,1)$ (implying $\sigma\in[1,\infty)$), and $\xi\in[0,1]$ confirm that the inequality also holds for $\sigma>1$.

This completes the proof:

$$\frac{\partial\left(\eta_{p,\xi}\right)}{\partial\sigma}=-\frac{\overbrace{\frac{\partial\left(\eta_{Y_2,\xi}-\eta_{C_2,\xi}\right)}{\partial\sigma}}^{=0}\cdot\overbrace{\left(\eta_{Y_2,p}-\eta_{C_2,p}\right)}^{<0}}{\left(\eta_{Y_2,p}-\eta_{C_2,p}\right)^2}+\frac{\overbrace{\left(\eta_{Y_2,\xi}-\eta_{C_2,\xi}\right)}^{>0}\cdot\overbrace{\frac{\partial\left(\eta_{Y_2,p}-\eta_{C_2,p}\right)}{\partial\sigma}}^{<0}}{\left(\eta_{Y_2,p}-\eta_{C_2,p}\right)^2}<0$$

and therefore:

$$\frac{\partial\left(\eta_{\tilde{j},\xi}\right)}{\partial\sigma} = \underbrace{\frac{\partial\left(\eta_{\tilde{j},p}\right)}{\partial\sigma}}_{=0} \cdot \underbrace{\eta_{p,\xi}}_{<0} + \underbrace{\eta_{\tilde{j},p}}_{<0} \cdot \underbrace{\frac{\partial\left(\eta_{p,\xi}\right)}{\partial\sigma}}_{<0} > 0$$

5.5.2 Description of the data

This Appendix contains a description of the variables used in Section 5.3, sample statistics and a description of the unbalanced panel of OECD countries.

Table 5.9: Description of the Variables

Time Use Survey (Zeitbudgeterhebung) 1991/92	
HP	total household home production (in minutes per day)
OC	paid help received by the household (in minutes per week)
λ	employment status (= 0 if not employed, = 1 if employed)
ω	time spent on gainful employment (in minutes per day)
$Kids0-5$	number of children in the household aged $0-5$ years
$Kids6-18$	number of children in the household aged $6-18$ years
$SchoolYrs_{Avg}$	average years of schooling of wife and husband
$SchoolYrs_{Diff}$	difference in schooling years between husband and wife
$TrainYears$	years of vocational training
Inc	household income
Inc^2	household income squared
Age_{Avg}	average age of wife and husband
Age_{Diff}	difference between the husband's and the wife's age
Mid	region dummy (North Rhine-Westphalia, Hessen)
$South$	region dummy
	(Rhineland-Palatinate, Baden-Wuerttemberg, Bavaria)
$Urban$	degree of urbanization of the region
GNP	per capita gross national product in the region
$TertSec$	employment share of the tertiary sector
$Weekend$	weekend dummy (= 1 if the interview was on a weekend)
$Unemp_R$	unemployment rate in the region
OECD Data 1980-2003	
Participation (all)	Participation rate (Labor Force 20-65/Population 20-65)
Participation (55-64 yrs)	Participation rate (aged 55-64)
Working Hours	Share of average annual working hours in total annual hours (8760)
GDP growth p.c	GDP growth per capita
Employment Protection Legislation	EPL index, ranging from 1 to 20 (20=strictest regulation)
Union Density	Share of union members among dependent workers (in %)

Sources: OECD Labour Force Statistics, World Development Indicators

Table 5.10: Data coverage in the unbalanced panel of OECD countries

Australia	Austria	Belgium	Canada	Denmark	Finland
1980 - 2003	1997 - 2003	1985 - 2003	1980 - 2003	1985 - 2003	1980 - 2003
France	Germany	Greece	Iceland	Ireland	Italy
1980 - 2003	1993 - 2003	1985 - 2002	1993 - 2002	1985 - 2003	1980 - 2003
Japan	Luxembourg	Netherlands	New Zealand	Norway	Portugal
1980 - 2003	1985 - 2002	1989 - 2003	1989 - 2003	1980 - 2003	1988 - 2003
Spain	Sweden	Switzerland	Turkey	United Kingdom	United States
1980 - 2003	1980 - 2003	1993 - 2003	–	1986 - 2003	1980 - 2003

Table 5.11: Descriptive Statistics: OECD Data

	Sample mean	Sample minimum	Sample maximum
Unemployment Rate	0.076	0.015 (LUX, 1991)	0.240 (ESP, 1994)
Participation Rate (all)	0.709	0.576 (NL, 1980)	0.866 (ICE, 2000)
Participation Rate (55-64 years)	0.484	0.222 (BEL, 1990)	0.887 (ICE, 1995)
Working Hours	0.195	0.153 (NOR, 2003)	0.242 (JAP, 1980)
GDP Growth Rate p.c.	0.022	-0.069 (FIN, 1991)	0.010 (IRE, 1997)
Union Density Rate	40.204	8.600 (ESP, 1984)	87.40 (SWE, 1994)
Employment Protection Rate	2.119	0.200 (USA, all yrs)	4.800 (POR, all yrs)

5.5.3 Income

In the Time Use Survey, income is recorded in the form of a range card question, where the respondents are to report their income in predefined intervals instead of giving precise amount. This survey design is often chosen to get a higher response rate (Juster and Smith 1997; Winter 2002). In order to assign the household a continuous income, we combine the information about the lower and upper limits of the respective income intervals with additional information on household and personal characteristics. Interval-coded data can then be treated like an ordered response, where the cut-points are already known. We define a latent (continuous) variable income $Inc^* = x\beta + e$ where $e|x \sim N(0,1)$. If $\alpha_1 < Inc^* \leq \alpha_2$, the observed income class is for example $Inc = 2$ with the limits α_1 and α_2, and so forth. The parameters α and β can be estimated by maximum likelihood. In the case of interval-coded data, the cut-points α are already known, so that only the parameters β have to be estimated. The standard normal assumption made above changes to $Inc^*|x \sim N(x\beta, \sigma^2)$ where $\sigma^2 = Var(Inc^*|x)$ is assumed not to depend on x. The parameters β and σ^2 can then be estimated by maximum likelihood (Wooldridge 2002).

Table 5.12 (a) and (b) reports the regression results for men's and women's income. We use these results to assign each household member its predicted continuous income given her characteristics and her income bracket. Then, we add these individual incomes up to obtain the household's income. Using this method, we improve upon the common method of choosing the midpoints as the income measure. However, like the midpoint approach, this more sophisticated method does not take into account the standard errors of the regression when predicting the continuous income. When we use our generated income regressor in the estimation of home production time and paid help, the usual OLS assumption that ϵ is uncorrelated with the x suffices for consistency in Sections 5.3.3 and 5.3.4. The inference on the contrary will generally be invalid because we ignore the sampling variation in $\widehat{Inc}$, i.e. the uncertainty in the estimate should be accounted for in the regression of interest. See Wooldridge (2002), chapter 6 for a discussion of generated regressors and chapter 14 for a general framework for handling these problems. In our case, the sampling variation in $\widehat{Inc}$ is very small. First, it is considerably lower than when using the midpoints, because we do not only use the bracket information, but also the information of the explanatory variables x about the income. Second, we observe relatively narrow income brackets which alone are already good income predictors. Furthermore, the survey contains a detailed set of individual information that we can exploit. For these reasons, we do not adjust the inference in the second step.

Table 5.12: Regression results for (a) women's and (b) men's income, ordered probit with known cut-points

	(a) women's income				(b) men's income		
λ_f	875.2491	(31.0389)	***	λ_m	1556.869	(98.0401)	***
ω_f	0.3683918	(0.210427)	*	ω_m	-0.4184731	(0.242961)	*
${\omega_f}^2$	0.0022576	(0.000346)	***	${\omega_m}^2$	0.001157	(0.000312)	***
AGE_f	7.46488	(13.0302)		AGE_m	190.3022	(20.9186)	***
${AGE_f}^2$	0.0264209	(0.157244)		${AGE_m}^2$	-1.864858	(0.240832)	***
$SchoolYrs_f$	358.8041	(173.604)	*	$SchoolYrs_m$	1611.079	(247.493)	***
${SchoolYrs_f}^2$	-12.46794	(7.89796)		${SchoolYrs_m}^2$	-63.22272	(11.3045)	***
$TrainYrs_f$	-38.19013	(29.2201)		$TrainYrs_m$	62.36355	(61.7495)	
${TrainYrs_f}^2$	32.3933	(6.07455)	***	${TrainYrs_m}^2$	38.92703	(11.1501)	***
$Urban$	7.497551	(23.0143)		$Urban$	162.3689	(33.4240)	***
GNP	0.006536	(0.001982)	***	GNP	-0.0021455	(0.002851)	
$Unemp_R$	6.404296	(7.63808)		$Unemp_R$	-40.27372	(10.9568)	***
$Weekend$	276.2312	(30.4882)	***	$Weekend$	122.3447	(55.5153)	*
$Constant$	-3070.687	(981.37)	***	$Constant$	-12639.47	(1395.91)	***
Observations	4200			Observations	4368		

Standard deviations in parenthesis. * significant at 10%; ** significant at 5%; *** significant at 1%.

Bibliography

Abel, A. B. (2001). Will bequests attenuate the predicted meltdown in stock prices when baby boomers retire? *Review of Economic Studies 83*, 589–595.

Abel, A. B. (2003). The effects of a baby boom on stock prices and capital accumulation in the presence of social security. *Econometrica 71*, 551–578.

Aguiar, M. and E. Hurst (2004). Consumption vs. expenditure. *NBER Working Paper 10307*.

Akerlof, G. A. and J. L. Yellen (1988). Fairness and unemployment. *American Economic Review 78*(2), 44–49.

Akerlof, G. A. and J. L. Yellen (1990). The fair wage-effort hypothesis and unemployment. *Quarterly Journal of Economics 105*(2), 256–283.

Ando, A. and F. Modigliani (1963). The 'life-cycle' hypothesis of saving: Aggregate implications and tests. *American Economic Review 53*, 55–84.

Attanasio, O. and G. Weber (1995). Is consumption growth consistent with intertemporal optimization? evidence from the consumer expenditure survey. *Journal of Political Economy 103*(6), 1121–1157.

Auerbach, A. and A. Kotlikoff (1987). *Dynamic Fiscal Policy*. Cambridge, MA: Cambridge University Press.

Banks, J., R. Blundell, and A. Lewbel (1997). Quadratic engel curves and consumer demand. *Review of Economics and Statistics 79*, 769–88.

Banks, J., R. Blundell, and S. Tanner (1998). Is there a retirement-savings puzzle? *American Economic Review 88*(4), 769–788.

Barro, R. J. and X. Sala-I-Martin (1995). *Economic Growth*. New York: McGraw-Hill.

Beblo, M. (1999). Intrafamily time allocation: A panel-econometric analysis. In J. Merz and M. Ehling (Eds.), *Time-Use Research - Data and Policy*, pp. 473–489. Baden-Baden: Nomos.

Becker, G. (1965). A theory of the allocation of time. *Economic Journal 75*(299), 493–508.

Berkel, B. and A. Börsch-Supan (2004). Pension reform in germany: The impact on retirement decisions. *Finanzarchiv 60*(3), 393–421.

Bernheim, D. B., J. Skinner, and S. Weinberg (2001). What accounts for the variation in retirement wealth among US households? *American Economic Review 91*(4), 832–857.

Birg, H. (2001). *Die Demographische Zeitenwende - Der Bevölkerungsrückgang in Deutschland und Europa*. München: Beck.

Blanchard, O. and J. Wolfers (2000). The role of shocks and institutions in the rise of european unemployment: The aggregate evidence. *Economic Journal 110*, 1–33.

Bloom, D. E. and J. D. Sachs (1998). Geography, demography, and economic growth in africa. *Brookings Papers on Economic Activity 2*, 207–295.

Bloom, D. E. and J. G. Williamson (1998). Demographic transitions and economic miracles in emerging asia. *World Bank Economic Review 12*(3), 419–455.

Blundell, R. (1988). Consumer behaviour: Theory and empirical evidence - a survey. *The Economic Journal 389*, 16–65.

Blundell, R., M. Browning, and C. Meghir (1994). Consumer demand and the life-cycle allocation of household expenditures. *Review of Economic Studies 61*(1), 57–80.

Blundell, R., P. Pashardes, and G. Weber (1993). What do we learn about consumer demand patterns from micro data? *American Economic Review 83*(3), 570–597.

Blundell, R. and I. Walker (1986). A life-cycle consistent empirical model of family labor supply using cross-section data. *Review of Economic Studies 53*, 539–558.

Boeri, T., A. Börsch-Supan, and G. Tabellini (2002). Pension reform and the opinions of european citizens. *American Economic Review Papers and Proceedings 92*(2), 396–401.

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

Börsch-Supan, A. (2003a). Labor market effects of population aging. *Review of Labour Economics and Industrial Relations 17*(Special Issue), 5–44.

Börsch-Supan, A. (2003b). *Life-Cycle Savings and Public Policy: A Cross-National Study of Six Countries*. San Diego: Academic Press.

Börsch-Supan, A., L. Essig, and C. Wilke (2005). *Rentenlücke und Lebenserwartung - Wie sich die Deutschen auf den Anstieg vorbereiten*. Köln: Deutsches Institut für Altersvorsorge.

Börsch-Supan, A., F. Heiss, A. Ludwig, and J. Winter (2003). Pension reform, capital markets, and the rate of return. *German Economic Review 4*(2), 151–181.

Börsch-Supan, A., F. Heiss, and J. Winter (2004). *Akzeptanzprobleme bei Rentenreformen - Wie die Bevölkerung überzeugt werden kann*. Köln: Deutsches Institut für Altersvorsorge.

Börsch-Supan, A., S. Kohnz, G. Mastrobuoni, and R. Schnabel (2004). Micromodeling of retirement decisions in germany. In D. Wise and J. Gruber (Eds.), *Social Security Programs and Retirement Around the World: Micro-Estimation.* Chicago: Chicago Press.

Börsch-Supan, A., A. Ludwig, and M. Sommer (2003). *Demographie und Kapitalmärkte.* Köln: Deutsches Institut für Altersvorsorge.

Börsch-Supan, A., A. Ludwig, and J. Winter (2005). Aging, pension reform, and capital flows: A multi-country simulation model. *forthcoming Economica*.

Börsch-Supan, A., A. Reil-Held, R. Rodepeter, R. Schnabel, and J. Winter (2001). The german savings puzzle. *Research in Economics (Ricerche Economiche) 55*, 15–38.

Börsch-Supan, A., A. Reil-Held, and R. Schnabel (2001). Pension provision in germany. In P. Johnson and R. Disney (Eds.), *Pension Systems and Retirement Income Across OECD Countries*, pp. 160–196. Cambridge, London: MIT Press.

Börsch-Supan, A., R. Schnabel, S. Kohnz, and G. Mastrobuoni (2004). Micromodeling of retirement decisions in germany. In J. Gruber and D. A. Wise (Eds.), *Social Security Programs and Retirement Around the World*, pp. 285–343. Chicago: The University of Chicago Press.

Börsch-Supan, A. and C. B. Wilke (2004). The german public pension system: How it was, how it will be. *NBER Working Paper 10525.*

Börsch-Supan, A. and J. Winter (2001). Population aging, savings behavior and capital markets. *NBER Working Paper 8561*(8561).

Brines, J. (1994). Economic dependency, gender, and the division of labor at home. *The American Journal of Sociology 100*(3), 652–688.

Brooks, R. (2000a). Population aging and global capital flows in a parallel universe. Technical Report 00/151, IMF working paper.

Brooks, R. (2000b). What will happen to financial markets when the baby boomers retire? *IMF Working Paper WP/00/18.*

Browning, M., T. F. Crossley, and G. Weber (2003). Asking consumption questions in general purpose surveys. *The Economic Journal 113*, 540–567.

Browning, M., A. Deaton, and M. Irish (1985). A profitable approach to labor supply and commodity demands over the life-cycle. *Econometrica 53*(3), 503–544.

Brück, T., J. P. Haisken-DeNew, and K. F. Zimmermann (2003). Creating low skilled jobs by subsidizing market-contracted household work. *IZA Discussion Paper 958.*

Bundesministerium für Gesundheit und Soziale Sicherung (2003). *Nachhaltigkeit in der Finanzierung der Sozialen Sicherungssysteme - Bericht der Kommission.* Berlin: Bundesministerium für Gesundheit und Soziale Sicherung.

Cahuc, P. and A. Zylberberg (2004). *Labor Economics*. Cambridge, Massachussetts: The MIT Press.

Calmfors, L. and M. Hoel (1988). Work sharing and overtime. *Scandinavian Journal of Economics 90*(1), 45–62.

Calmfors, L. and M. Hoel (1989). Work sharing, employment, and shiftwork. *Oxford Economic Papers 41*(4), 758–773.

Christensen, M. L. (2004). Demand patterns around retirement: Evidence from spanish panel data. *unpublished*.

Coale, A. J. and E. M. Hoover (1958). *Population Growth and Economic Development in Low-Income Countries*. Princeton: Princeton University Press.

Collins, S. M. (1991). Saving behavior in ten developing countries. In D. B. Bernheim and J. B. Shoven (Eds.), *National Saving and Economic Performance*, A National Bureau of Economic Research Project Report, pp. 349–375. Chicago: University of Chicago Press.

Cooper, R. N. (1999). Should capital controls be banished? *Brookings Papers on Economic Activity 1*, 89–126.

Corneo, G. G. (1995). Distributional implications of a shorter working week: An unpleasant note. *Journal of Economics 62*(1), 25 – 31.

Deaton, A. (1986). Demand analysis. In N. Holland (Ed.), *Handbook of Econometrics*, pp. 1767–1839. Amsterdam: Griliches, Z. and Intriligator, M.

Deaton, A. (2000). *The Analysis of Household Surveys*. Baltimore: Johns Hopkins University Press.

Deaton, A. and C. Paxson (1994). Intertemporal choice and inequality. *Journal of Political Economy 102*(4330), 437–467.

Dilnot, A., R. Disney, P. Johnson, and E. Whitehouse (1994). *Pensions Policy in the UK: An Economic Analysis*. London: IFS Report No. 45.

Dooley, M. P., J. A. Frankel, and D. J. Mathieson (1987). International capital mobility: What do saving-investment correlations tell us? *IMF Staff Papers 34*(4), 643–680.

Fair, R. C. and K. M. Dominguez (1991). Effetcs of the changing u.s. age distribution on macroeconomic equations. *American Economic Review 81*(5), 1276–1294.

Fehr, E. and S. Gächter (2000). Fairness and retaliation: The economics of reciprocity. *Journal of Economic Perspectives 14*(3), 159–181.

Feldstein, M. and C. Horioka (1980). Domestic saving and international capital flows. *Economic Journal 90*, 314–329.

Frankel, J. A. (1992). Measuring international capital mobility: A review. *American Economic Association - Papers and Proceedings 82*(2), 197–202.

French, K. and J. M. Poterba (1991). Investor diversification and international equity markets. *American Economic Association - Papers and Proceedings 81*(2), 222–226.

Fry, M. J. and A. Mason (1982). The variable rate-of-growth effect in the life-cycle saving model. *Economic Inquiry 20*, 426–442.

Greenstein, T. (2000). Economic dependency, gender, and the division of labor in the home: A replication and extension. *Journal of Marriage and the Family 62*(May 2000), 322–335.

Gronau, R. (1977). Leisure, home production, and work - the theory of the allocation of time revisited. *Journal of Political Economy 85*(6), 1099 – 1124.

Gustman and Steinmeier (1999). Effects of pensions on savings: Analysis of data from the health and retirement study. *Carnegie-Rochester Conference Series on Public Policy 50*, 271–324.

Hamermesh, D. S. (1984). Consumption during retirement: The missing link in the life cycle. *Review of Economics and Statistics 66*(1), 1–7.

Hank, K. (2001). The employment of domestic help and women's labor force participation in western germany. *Schmollers Jahrbuch 121*(1), 105–121.

Heathcote, J. (2002). Home production and retirement. Georgetown University.

Higgins, M. (1998). Demography, national savings, and international capital flows. *International Economic Review 39*(2), 343–369.

Higgins, M. and J. G. Williamson (1996). Asian demography and foreign capital dependence. *NBER Working Paper 5560.*

Higgins, M. and J. G. Williamson (1997). Age structure dynamics in asia and dependence on foreign capital. *Population and Development Review 23*(2), 261–293.

House, F. (2002). *Freedom in the World 2001-2002 - The Annual Survey of Political Rights and Civil Liberties.* New York: Freedom House.

Hullen, G. (2003). *Living Arrangements and Households - Methods and Results of Demographic Projections*, Volume 109 of *Materialien zur Bevölkerungswissenschaft.* Wiesbaden: Bundesinstitut für Bevölkerungsforschung.

Hunt, J. (1999). Has work-sharing worked in germany? *Quarterly Journal of Economics 114*(1), 117 – 148.

Hurd, M. and S. Rohwedder (2003). The retirement-consumption puzzle: Anticipated and actual declines in spending at retirement. *NBER Working Paper 9586.*

Hurd, M. D. and S. Rohwedder (2005). Changes in consumption and activities in retirement. *Michigan Retirement Research Center 2005-096.*

Hussein, K. A. (1998). International capital mobility in OECD countries: The feldstein-horioka 'puzzle' revisited. *Economics Letters 59*, 237–242.

INGENUE Team (2001). Macroeconomic consequences of pension reforms in europe: An investigation with the INGENUE world model. *CEPREMAP Working Paper 2001-16*.

International Monetary Fund (1999). *Annual Report on Exchange Arrangements and Exchange Restrictions 1999*. Washington, D.C.: International Monetary Fund.

Jansen, W. J. (2000). International capital mobility: Evidence from panel data. *Journal of International Money and Finance 19*, 507–511.

Juster, F. T. and J. P. Smith (1997). Improving the quality of economic data: Lessons from the HRS and AHEAD. *Journal of the American Statistical Association 92*(440), 1268–1278.

Kahnemann, D., J. Knetsch, and R. Thaler (1986). Fairness as a constraint on profit seeking: Entitlements in the market. *American Economic Review 76*(4), 728–41.

Kelley, A. C. (1988). Economic consequences of population change in the third world. *Journal of Economic Literature 26*, 1685–1728.

Knack, S. and P. Keefer (1995). Institutions and economic performance: Cross-country tests using alternative institutional measures. *Economics and Politics 7*, 207–227.

Laitner, J. and D. Silverman (2005). Estimating life cycle parameters from consumption behavior at retirement. *NBER Working Paper 11163*.

Leff, N. H. (1969). Dependency rates and savings rates. *American Economic Review 59*(1), 886–896.

Levine, R. and S. J. Zervos (1993). What have we learned about policy and growth from cross-country regressions? *American Economic Review 83*(2), 426–30.

Logeay, C. and S. Schreiber (2003). Evaluating the effectiveness of the french work-sharing reform. DIW Berlin.

Lundberg, S., R. Startz, and S. Stillman (2001). The retirement-consumption puzzle: A marital bargaining approach. *Journal of Public Economics 87*(5–6), 1199–1218.

Malthus, T. R. (1798). *An Essay on the Principle of Population*. Oxford: Oxford University Press (reprinted in 1993).

Mason, A. (1988). Saving, economic growth and demographic change. *Population and Development Review 14*(1), 113–144.

Miles, D. (1999). Modelling the impact of demographic change upon the economy. *Economic Journal 109*, 1–36.

Miniaci, R., C. Monfardini, and G. Weber (2003). Is there a retirement consumption puzzle in italy? *IFS Working Paper W03/14*.

Modigliani, F. and R. Brumberg (1954). Utility analysis and the consumption function: An interpretation of cross-section data. In K. Kurihara (Ed.), *Post-Keynesian Economics*. New Brunswick: Rutgers University Press.

Montiel, P. and C. M. Reinhart (1999). Do capital controls and macroeconomic policies influence the volume and composition of capital flows? evidence from the 1990s. *Journal of Internation Money and Finance 18*, 619–635.

Obstfeld, M. (1995). International capital mobility in the 1990s. In P. B. Kenen (Ed.), *Understanding Interdependence - The Macroeconomics of the Open Economy*, pp. 201–261. Princeton: Princeton University Press.

OECD (1998). *Employment Outlook 1998*. Paris: OECD.

Pemberton, J. (1999). Social security: National policies with international implications. *Economic Journal 109*, 492–508.

Portes, R. and H. Rey (2005). The determinant of cross-border equity flows. *Journal of International Economics 65*(2), 269–296.

Poterba, J. (2001). Demographic structure and asset returns. *Review of Economics and Statistics 83*, 565–584.

Sachs, J. D. and A. Warner (1995). Economic reform and the process of global integration. *Brookings Papers on Economic Activity 1995*(1), 1–96.

Sachverständigenrat Zur Begutachtung der Gesamtwirtschaftlichen Entwicklung (2005). *Erfolge im Ausland - Herausforderungen im Inland*. Wiesbaden: Statistisches Bundesamt.

Schettkat, R. and W. Salverda (2004). Demand patterns and employment growth consumption and services in france, germany, the netherlands, the united kingdom and the united states. *DEMPATEM Working Paper 13*.

Shephard, R. (1953). *Theory of Cost and Production Functions* (1970 edition ed.). Princeton, NJ: Princeton University Press.

Shibata, A. and M. Shintani (1998). Capital mobility in the world economy: An alternative test. *Journal of International Money and Finance 17*, 741–756.

Smith, S. (2004). Can the retirement consumption puzzle be solved? *IFS Working Paper W04/07*.

Taylor, A. M. (1998). Argentina and the world capital market: Saving, investment, and international capital mobility in the twentieth century. *Journal of Development Economics 57*, 147–184.

Taylor, A. M. and J. G. Williamson (1994). Capital flows to the new world as an intergenerational transfer. *Journal of Political Economy 102*(2), 348–371.

United Nations Population Division (2000). *World Population Prospects: The 1998 Revision*. Washington, D.C.: United Nations. (www.undp.org/popin/trends).

Van Deelen, M. and R. Schettkat (2004). Household demand patterns in west germany: 1978–1993. *DEMPATEM Working Papers 5*.

Van der Lippe, T., K. Tijdens, and E. De Ruijter (2004). Outsourcing of domestic tasks and time-saving effects. *Journal of Family Issues 25*(2), 216–240.

Verband Deutscher Rentenversicherungsträger (Ed.) (2004). *Rentenversicherung in Zahlen 2004*, Number 22 in DRV-Schriften, Frankfurt a. Main. Verband Deutscher Rentenversicherungsträger.

Weiss, M. (2004). Skill-biased technological change: Is there hope for the unskilled? *MEA Discussion Paper 45-04*.

Weiss, M. and A. Garloff (2005). Skill-biased technological change and endogenous benefits: The dynamics of unemployment and wage inequality. *MEA Discussion Paper 100-05*.

Williamson, J. G. (2001). *Demographic Shocks and Global Factor Flows*, Volume 46 of *Conference Series*. Boston, Mass.: Federal Reserve Bank of Boston.

Winter, J. K. (2002). Bracketing effects in categorized survey questions and the measurement of economic quantities. *SFB 504 Discussion Paper 35*.

Wooldridge, J. M. (2002). *Econometric Analysis of Cross Section and Panel Data*. Cambridge, Massachusetts: MIT Press.

World Bank (1997). *Private Capital Flows to Developing Countries - The Road to Financial Integration*. World Bank Policy Research Report. New York: Oxford University Press.

Lebenslauf

Persönliche Daten

Melanie Lührmann
Mannheim Research Institute for the Economics of Aging (MEA)
Universität Mannheim
L 13, 17
68131 Mannheim

Tel.: (06 21) 181 1864
E-Mail: melanie@econ.uni-mannheim.de

Geb. am 18. 03. 1974 in Aachen

Ausbildung

seit April 2000	Promotion Universität Mannheim, Fakulät für Volkswirtschaftslehre Betreuer: Prof. Axel Börsch-Supan, Ph.D.
April 2000	Abschluß Diplom-Volkswirtin, Universität Mannheim
1998 – 1999	University of California, Berkeley. Graduiertenprogramm
1993 – 2000	Universität Mannheim: Studium der Volkswirtschaftslehre
1984 – 1993	Erzbischöfl. Suitbertus Gymnasium Kaiserswerth, Düsseldorf – Abschluß: Abitur
1980 – 1984	Grundschulen Altwarmbüchen (Isernhagen) und Johann-Peter-Melchior-Grundschule (Ratingen)

Aktuelle Tätigkeit

seit 01.04.2000	Wissenschaftliche Mitarbeiterin Universität Mannheim, Fakulät für Volkswirtschaftslehre Mannheim Research Institute for the Economics of Aging

Vorherige Tätigkeiten

1995 – 2000	Wissenschaftliche Hilfskraft. Universität Mannheim, Lehrstuhl für Volkswirtschaftslehre, insbes. Makroökonomik und Wirtschaftspolitik