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ABSTRACT

Gerontocracy in Motion? European Cross-Country Evidence on the Labor Market Consequences of Population Ageing*

Taking a European cross-country perspective, this paper addresses the most important issues in the nexus of population ageing and labor markets. We start from a descriptive overview of the demographic change currently shaping European societies. The subsequent section intensively discusses the potential consequences of these demographic processes for and interdependencies with the labor market situation in Europe. We place particular emphasis on the issue of non-competitive wage setting. In our empirical application we demonstrate that moderately large birth cohorts seem to experience lower employment rates, but also that education investments might be able to mitigate these consequences, and that the relative economic success of large cohorts might even be disproportionately positive. Finally, in the concluding section we review possible policy options for coping with the consequences of population ageing.

JEL Classification: J11, J21

Keywords: demographic change, cohort size, unemployment

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1. Introduction

European economic and political integration and an intense immigration experience have been important factors in the development of European societies in the second half of the past century. Undoubtedly, though, the most dramatic influence on European demographics has been exerted by post-war baby booms and the subsequent baby busts, leading to massive changes in the population age structure of all European countries. Yet, while the baby boom cohorts have moved through the age pyramid like a tidal wave, declining fertility has caused a stable trend, population ageing.

Throughout the last decades, and recently at an accelerating pace, this phenomenon has transformed the composition all European societies to a considerable extent. Without exception the demographic change associated with population ageing induces long-term societal challenges for all European countries, albeit with some heterogeneity regarding their precise timing. In this context, Germany provides a particularly an interesting case study. According to World Bank projections (see BOS ET AL. (1994)) Germany will soon have the highest share of older people in all industrialized countries. The proportion of elderly (i.e. beyond age 65) relative to the labor force is projected to rise from 21% in 1995 to 36% in 2035, due to a pronounced decline in fertility rates and a simultaneous rise in life expectancy. Other European countries following suit are Greece, Italy, and Spain.

Most directly this demographic change will have an impact on national pension systems and their financing. With defined benefits and a rising old-age dependency ratio, the prevailing pay-as-you-go systems of social security have necessarily come under pressure. Ever rising contribution rates and increasing uncertainty regarding the overall sustainability of the system into the future have already eroded the previous consensus about the modern welfare state. Furthermore, it is clear that the whole spectrum of social security systems, not only old-age security, but also, especially the public health care system will be affected directly by these developments. Typically, medical expenditures rise drastically in old age, and an increasing proportion of elderly will tend to generate a more than disproportionate cost push to health care. Barring fundamental reform, most European countries finance the bulk of these expenditures through worker's wage-related contributions, which will have to rise accordingly.

However, the discussion frequently overlooks a series of similarly important consequences of population ageing. After all, an ageing society tends to imply a decline in the relative labor supply of younger as compared to older workers, not only a simple reduction of overall labor supply and an increasing old-age dependency ratio. Thus, the age structure of the work force is going to be altered as well. Moreover, since neither school leaving age nor the age of retirement are fixed, population ageing might affect the level and composition of the labor force in a much more intricate way than is often recognized. In contrast to the US, in Europe these issues have to be discussed within the framework of imperfectly competitive labor markets, shifting the attention from wages to employment and unemployment rates. In essence, the relative shift in labor supply associated with an ageing work force might impinge upon a variety of different aspects pertaining to individual and societal welfare, among which particularly the labor market outcomes are of interest.

Taking a cross-country perspective, this paper addresses the most important issues in the nexus of European population ageing and Europe's labor markets. To this end, in the second section we provide some key characteristics of the demographic change which currently affects virtually all European countries. The subsequent section intensively discusses the

potential consequences of these demographic processes for and their interdependencies with the labor market situation in Europe. We place particular emphasis on the issue of non-competitive wage setting. Furthermore, to investigate the issue more deeply, in section 4 we provide some own empirical evidence on the relationship between changes in the population age structure and individual employment probabilities. Finally, in the concluding section we review possible policy options for coping with the consequences of population ageing.

2. Demographic Processes and Population Ageing

This section documents how similar demographic trends shape the population age structure of all European countries. **Table 1** clearly demonstrates that most of the EU-15 countries experienced a remarkable decline in birth rates during the 1970s. The Mediterranean countries Greece and Spain and also Ireland were affected by declining birth rates somewhat later, in the 1980s, whereas the birth rates of Portugal decreased considerably during both the 1970s and the 1980s. The Nordic countries Finland and Sweden (also Norway which is not included in this analysis) experienced this decline rather late in the 1990s.

Table 1: Live Births per 1,000 People, 1970-2000

COUNTRY	1970	1980	1990	2000
Austria	15.2	12.1	12.0	9.6
Belgium	14.7	12.7	11.7	11.2
Denmark	14.4	11.2	13.1	12.5
Finland	14.0	13.2	13.3	11.0
France	16.7	14.9	12.9	13.2
(West) Germany	13.4	10.1	10.0	9.4
Greece	16.5	15.4	10.0	11.7
Ireland	21.8	21.9	14.5	14.3
Italy	16.8	11.3	9.9	9.3
Luxembourg	13.2	11.3	13.2	13.1
The Netherlands	18.3	12.8	13.0	12.7
Portugal	20.0	16.3	11.4	11.8
Spain	19.6	18.0	9.9	9.8
Sweden	13.7	11.7	14.2	10.2
United Kingdom	16.3	13.4	13.7	11.4

Source: United Nations Demographic Yearbook, various volumes.

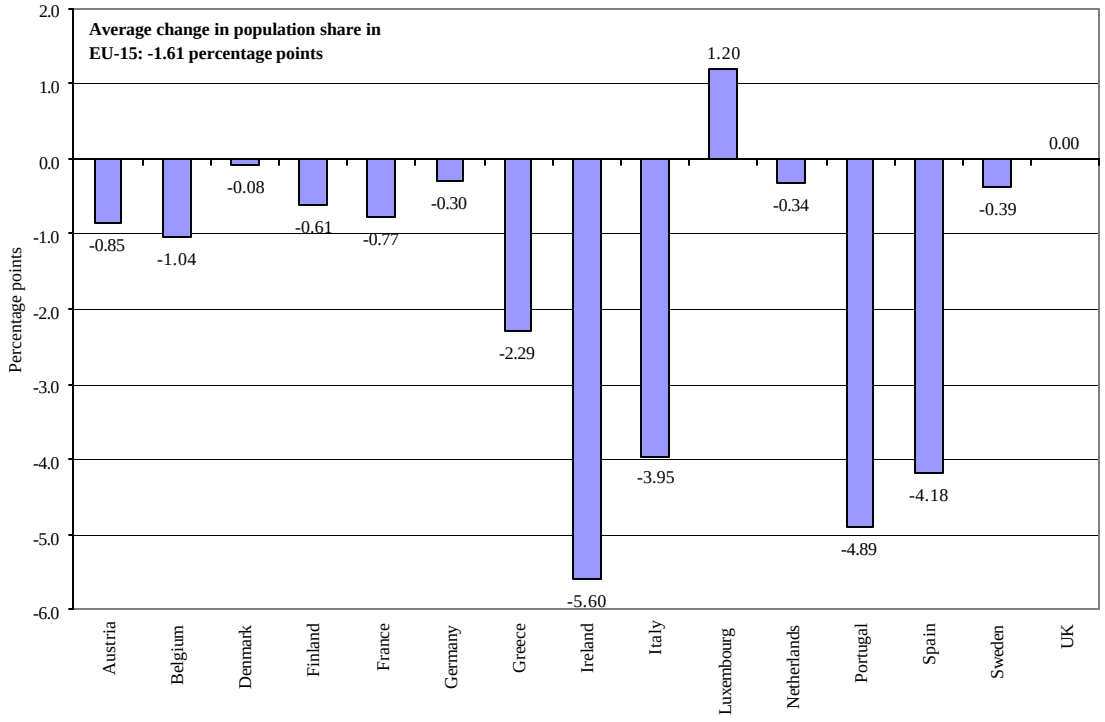
The most pronounced decline in birth rates happened in Ireland and Spain during the 1980s where the number of live births per 1,000 people fell by between about one third and even one half, albeit from relatively high levels. A similar observation holds for Italy and Portugal, yet over a larger time span already starting in the 1970s. A complete exception to this process, but arguably quantitatively negligible, is Luxembourg where birth rates declined during the 1970's but recovered again in the 1980's and remained stable afterwards. Certainly, it is intellectually quite challenging to study the reasons for these developments. While this cannot

be the topic of this paper, the heterogeneity in the timing suggests that an explanation relying on changes in the technology of birth control alone might not suffice.

During this period, these European countries also experienced a steady decline in child and old-age mortality rates and, correspondingly, a continuous rise in life expectancy. This progress fell much more uniformly on the various countries. Together, the decline in birth rates and rising life expectancy have generated a considerable shift in the population age structure throughout Europe. Most notably, the population share of younger cohorts declined remarkably. **Figure 1** documents the changes in the population shares of under 20 year olds in the EU-15 countries for the most recent decade. It demonstrates that the population of the youngest cohorts in all EU-15 countries – except Luxembourg and the United Kingdom – decreased during the 1990's. Greece, Ireland, Italy, Portugal and Spain experienced an especially pronounced decline ranging from more than two percentage points in Greece to nearly 6 percentage points in Ireland.

Most importantly, nothing in recent fertility trends suggests that we are likely to see a recovery of the population shares of the young in the future. To the contrary, these shares will remain low in the decades to come. This development together with the still increasing life expectancy of older cohorts lead to sharp increases in the predicted old-age dependency ratios for almost all European countries (see e.g. WORLD BANK (1999)).

Figure 1: Changes in Population Shares of Under 20 Year Old in EU-15 Countries During the 1990's

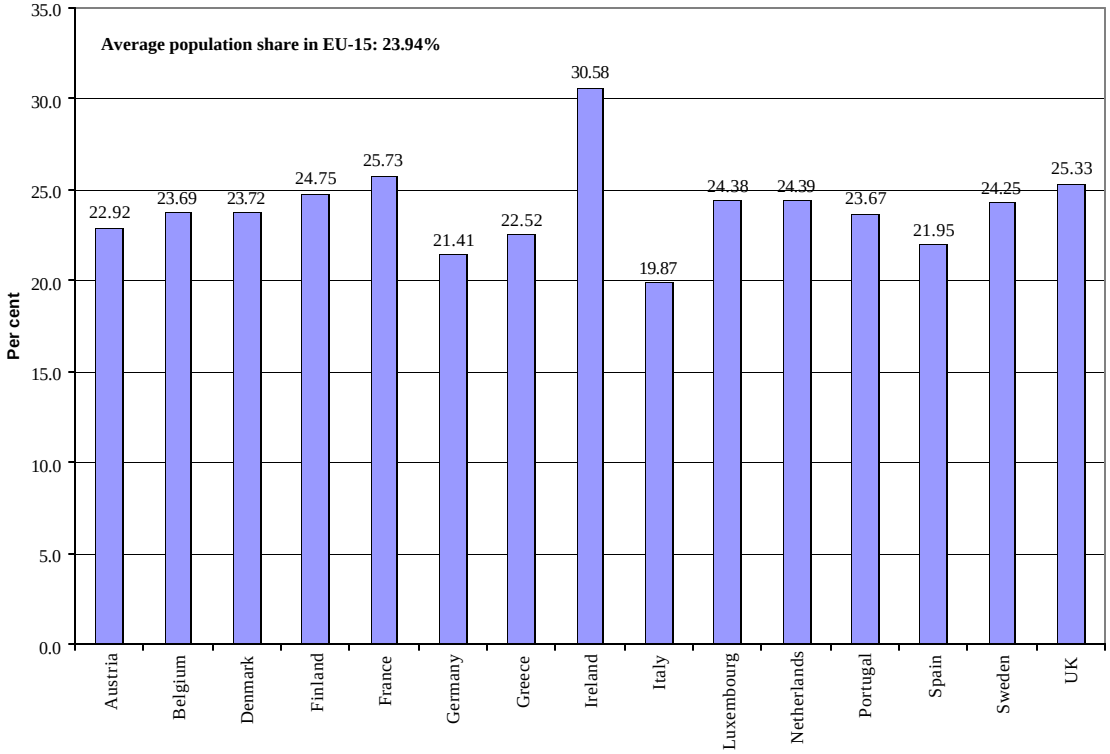


Source: United Nations Demographic Yearbook, various volumes.

While virtually all European countries share the experience of declining population fractions of the young, there is still considerable heterogeneity across the EU-15 regarding the relative size of these fractions and thus the stage already reached in the ageing process. To illustrate this point, **Figure 2** reports the population shares of individuals younger than 20 years of age in the EU-15 countries for 1999. The relative size of this cohort varies by more than 10 percentage points across European countries with Italy (19.9%) displaying the lowest and Ireland (30.6%) the highest share. The average share of under 20 year-olds in the EU-countries is approximately 24%.

Within the EU-15 countries, Ireland plays an exceptional role since this country still displayed a very large proportion of the young at the end of the last century, despite the documented (see **Figure 1**) sharp decline in this age group during the 1990's. Another striking feature is the below-average population fraction of the young throughout all Mediterranean countries. Since these southern countries have been emigration regions for a long time and emigrants typically leave the country in younger years, to some extent this might be the result of selective emigration. In essence, upon elimination of the Irish and the Mediterranean figures from the graph, cross-country heterogeneity of the population fraction of the very young would be limited.

Figure 2: Population Shares of Under 20 Year-Olds in EU-15 Countries, 1999



Source: United Nations Demographic Yearbook.

In the modern era, the age structure of any population is shaped not only by natural demographic processes, i.e. fertility and mortality, but also by migration. By contrast to the countries of Europe's southern border, since the end of the second World War almost all other European countries experienced substantial net immigration. In recent years, this experience has been shared by the Mediterranean countries as well. Overall, Europe as a whole

underwent a transition process from an emigration to an immigration region. In confirmation of this assessment, **Table 2** documents that many EU-countries currently display a large stock of immigrants. A substantial fraction of this stock of immigrants comprises so-called second-generation migrants, i.e. the offspring of immigrants born in the country of residence.

From **Table 2** it becomes transparent that foreign (-born) individuals comprise a substantial share of the population and the labor force especially in Austria, Belgium, France, Germany and, unsurprisingly, Luxembourg. However, these figures do not reveal the important and often neglected effect of immigration on birth rates and, therefore, population growth during the last decades. Since migrants are typically young, in their prime child-bearing age and display higher fertility rates than the native population, these immigration movements have also had a rejuvenating impact on the population of the destination country. SCHMIDT (2000C), for instance, estimates that population growth rates in Germany would have been around 0.5 percentage points lower if there were no immigration during the 1960's and 1970's. In consequence, it is very likely that higher immigration rates in the future can indeed (moderately) contribute to an alleviation of the demographic burden.

Table 2: Foreign (Born) Population and Labor Force in 1996

	FOREIGN POPULATION		FOREIGN LABOR FORCE	
COUNTRY	Thousands	% of Total Population	Thousands	% of Total Labor Force
Austria	728	9.0	328	10.0
Belgium	912	9.0	341	8.1
Denmark	238	4.7	84	3.0
Finland	74	1.4	19	0.8
France	3,597	6.3	1605	6.3
Germany	7,314	8.9	2559	9.1
Ireland	118	3.2	52	3.5
Italy	1096	2.0	332	1.7
Luxembourg	143	34.1	118	53.8
The Netherlands	680	4.4	218	3.1
Portugal	173	1.7	87	1.8
Spain	539	1.3	162	1.0
Sweden	527	6.0	218	5.1
United Kingdom	1,972	3.4	878	3.4

Source: OECD (1998). Figures for France are for 1990. Figures for Greece not available.

In our description of the European ageing process, we have relied on the population fractions of the young, since they are indicative of both trends and timing. In our empirical application we need a more comprehensive approach in order to disentangle typical life cycle patterns from the consequences of generational crowding. Therefore, in addition to other control variables, we utilize relative cohort sizes for five-year intervals as explanatory variables for the individuals' labor market status. **Figure 3** displays the distribution of these cohort sizes across all EU-15 countries. These figures document the considerable heterogeneity in relative

cohort sizes across Europe, holding the promise that our empirical analysis will be able to isolate the labor market consequences of demographic changes.

Figure 3 (Part I): Relative Cohort Sizes in EU-15, 1999/2000

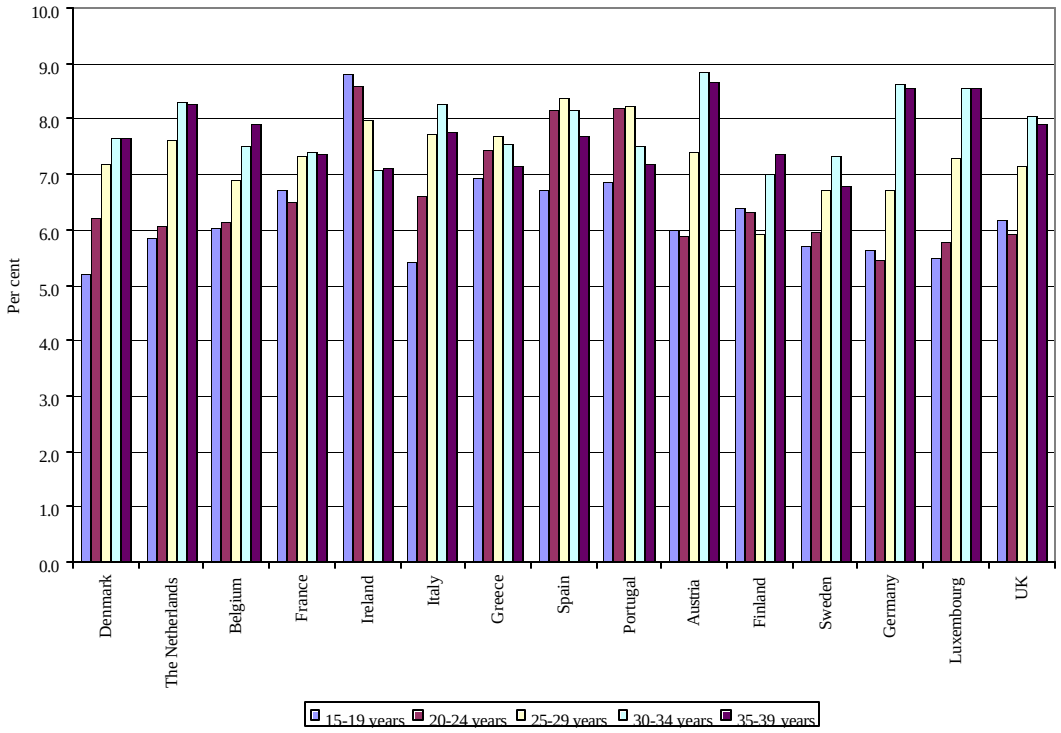
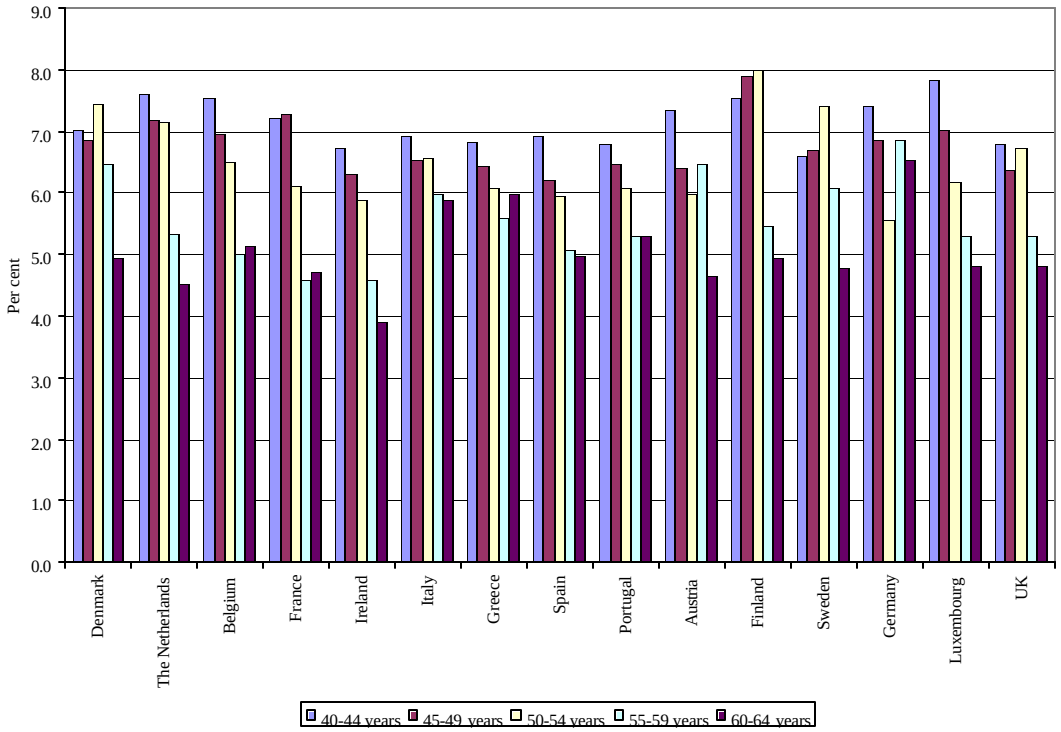


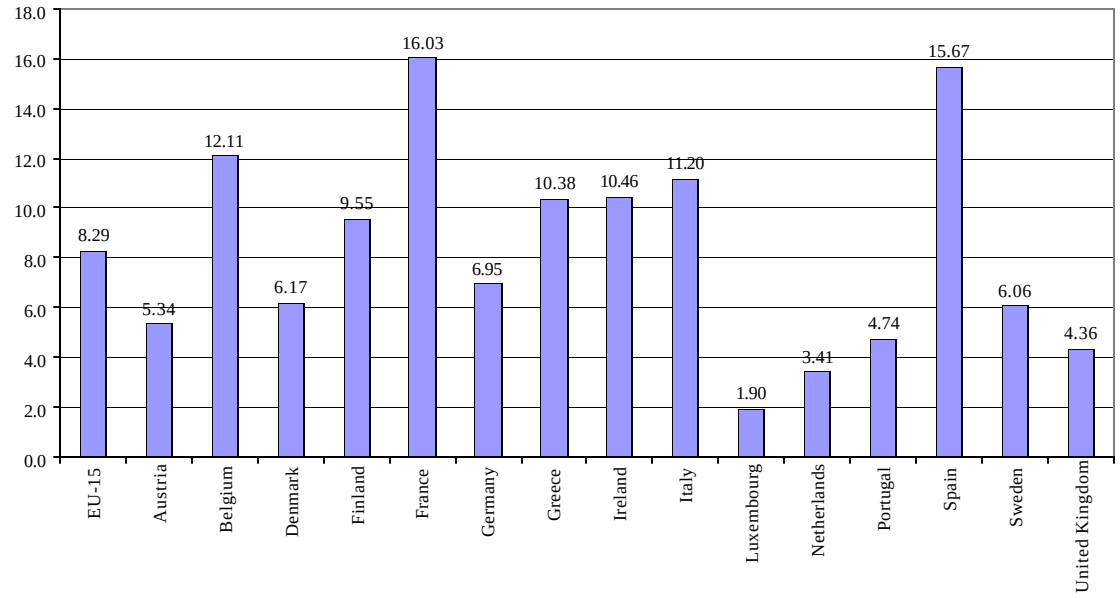
Figure 3 (Part II): Relative Cohort Sizes in EU-15, 1999/2000



Before we proceed to discuss the nexus of population ageing and (imperfectly competitive) labor markets in detail, with a focus on (un-) employment, the next few paragraphs provide a brief overview on the current labor market situation in the EU-countries. It is certainly fair to argue that the connection between the particular stage of the ageing process characterizing each of these countries, and their respective unemployment burden is not obvious. Thus, to reveal the effect of changes in the age structure a thorough multivariate analysis is indispensable.

The labor market situation in almost all EU-countries is characterized by rather high and persistent unemployment (see e.g. SCHMIDT (2000A) and (2000b) for France, Germany and the United Kingdom). **Figure 4** depicts unemployment rates for the economically most active group of 20-40 year olds as reported by the *ILO*[1]. In many European countries these rates exceed 10%, indicating a large excess supply of labor. However, at the same time we also observe considerable excess demand for specific kinds of labor in some sectors and countries (see e.g. ZIMMERMANN ET AL. (2002) for the case of Germany). This excess demand mainly applies to higher qualification levels, though. Consequently, if we do not want to miss out on a crucial labor market aspect, our discussion needs to address the issue of qualification and skills as well.

Figure 4: Unemployment Rates of 20-40 Year-Olds in EU-15, 1998



A sizeable macroeconomic literature analyses the causes for the European unemployment problem, attempting to isolate the roles played by institutions and country-specific adverse shocks, and by the interactions between these two. The most promising empirical attempts take an explicit cross-country perspective, and relate outcomes to candidate explanatory factors such as union power and corporatism, labor law, and the system of unemployment support (an early seminal paper is CALMFORS AND DRIFFILL (1988), another seminal contribution is NICKELL (1997)). In their analysis of European cross-country data, BLANCHARD AND WOLFERS (2000) augment the approach of NICKELL (1997) by considering interactions between shocks and institutions and conclude that the combination of these two

[1] Data from the ILO *Laborsta Database* (www.laborsta.ilo.org).

factors is decisive for a country's poor labor market performance. Generally, this literature suggests that the key to improvement might lie in encompassing institutional reforms of the labor market, including a dismantling of employment protection.

The dismal labor market situation motivated many European policy makers to intensify their use of measures of active labor market policy (ALMP), with the explicit aim to reduce unemployment. One important set of strategies which also aims at reacting to the excess demand of skilled workers relies on providing the unemployed with further vocational qualifications. However, international experiences with the effectiveness and efficiency of *ALMP* measures are rather disillusioning (see SCHMIDT ET AL. (2001) for an international comparison of measures and results, and particularly KLUVE AND SCHMIDT (2002) for a European perspective). Therefore, one should not put too much hope into measures of *ALMP* as a solution of European labor market problems. These two issues, encompassing labor market and institutional reform, and discretionary policy measures will play a prominent role in our discussion as well.

3. Population Ageing and Labor Markets

In terms of its economic repercussions, population ageing is first and foremost equivalent to a decline of (i) the labor supply of younger relative to that of older workers, and also to (ii) the number of workers relative to that of retirees. It seems safe to argue that this latter aspect has a direct effect on the social security systems, especially the pension systems but also the health and old-age care insurance (see e.g. BÖRSCH-SUPAN (1999) for the case of Germany). This is the principal reason for the attention given both in the public discussion and the academic literature to the effects of demographic processes on old-age dependency ratios. The alterations of the population shares of workers and retirees also holds direct and sizeable implications for aggregate labor productivity, depending on capital accumulation (see BÖRSCH-SUPAN 2003).

Yet, ageing also effects the composition of the active population, and thus exerts important influences beyond the much-discussed hike of the pay-as-you-go social security contribution rates. Thus, even if members of large birth cohorts displayed the same life-cycle behavior regarding human capital acquisition and labor supply as members of small birth cohorts, would their prevalence tend to alter their economic prospects, and perhaps the aggregate outcome. However, it is more than likely that this process will also display indirect effects via behavioral responses of individuals. To provide an overview, this section addresses the various labor market aspects emanating from changes in the age structure of the population and the labor force.

We discuss the following labor market outcomes in their potential response to population ageing (in parentheses: the central adjustment mechanism under investigation):

- the structure of wages and the income distribution (relative scarcities),
- the level and structure of (un-) employment (imperfect competition),
- human and physical capital accumulation and labor supply (behavioral responses), and
- the organization of work and the structure of product demand (market effects).

These various direct and indirect effects are intimately related and might exert repercussions on demographic change itself, i.e. specifically on family formation and fertility. The

remainder of this section outlines the state of the scientific discussion – theoretically as well as empirically.

The Structure of Wages and the Income Distribution

To organize ideas, we first discuss the consequences of population and labor force ageing for the benchmark case where individuals take their life-cycle decisions regarding human capital acquisition and labor supply irrespective of the (relative) sizes of their own or other birth cohorts. Clearly, when relatively few workers contribute to the economic activity of a large, mature population, per-capita income will be relatively low, if higher capital accumulation does not compensate for labor scarcity. Generally, since the number of active workers is low the level of wages will tend to be high, though. Consequently, ageing is a phenomenon driving a wedge between wages and per-capita income. The income distribution is then determined by the capital ownership structure as well.

Yet, population and labor force ageing are typically highly correlated. Thus, ageing also affects the relative structure of labor market outcomes among workers, not only the wages of workers relative to per-capita income. In more formal terms, it might be instructive to view each birth cohort as a different factor of production, as compared to the more homogeneous production factor *capital*[2]. As a birth cohort passes through the natural life-cycle, it is engaging in human capital acquisition and labor market entry when young, concentrating on household and labor market production in medium age, and at some point it is exiting the labor market. Large birth cohorts will tend to experience generational crowding throughout their lives, unless a high-fertility period or the large-scale immigration of a subsequent birth cohort counteracts this pattern. This is basically what we observe for the baby boom generation. In particular, in light of current population trends, it seems very unlikely that current baby boomers will be followed by even larger birth cohorts in the absence of a massive pro-immigration shift in policy.

At any point in time, age and birth cohort go hand in hand. Most prominently, post-WWII baby boomers, now being in their late thirties or early fourties constitute a large fraction of the population in many European countries. Similarly, the relatively small subsequent baby bust generation is now around their late twenties. Due to the distinct and well-researched life-cycle patterns of labor market activity and success, the focus of much of empirical labor economics has been on age-related heterogeneity of relevant outcomes. From this perspective, variations in the size of birth cohorts, through their influence on the fate of a generation as it passes different ages, tend to alter age-related outcome profiles in the cross-section. This is exactly the perspective taken in this paper, following many important earlier contributions to the issue. Thus, for the purposes of our analysis, we are identifying demographic change with those alterations of the age structure associated with cohort size.

Consequently, we distinguish workers of different age as different factors of production, and then focus on the relative prevalence of different age groups. In the cross-section, age and birth cohort are related one-to-one. The fundamental identification condition that we maintain throughout, is that the one and only important characteristic of any birth cohort is its *relative size*. It seems sensible to think of these factors – workers of different ages – as imperfect substitutes in production. Changes in relative cohort size of an age group directly translate in shifts of relative labor supply of these different factors of production. Large birth cohorts lead to relatively abundant labor supply when they enter any age bracket, and to a corresponding

[2] A sizeable literature discusses the heterogeneous productivity of different vintages of capital items, but this is not of any relevance to our argument.

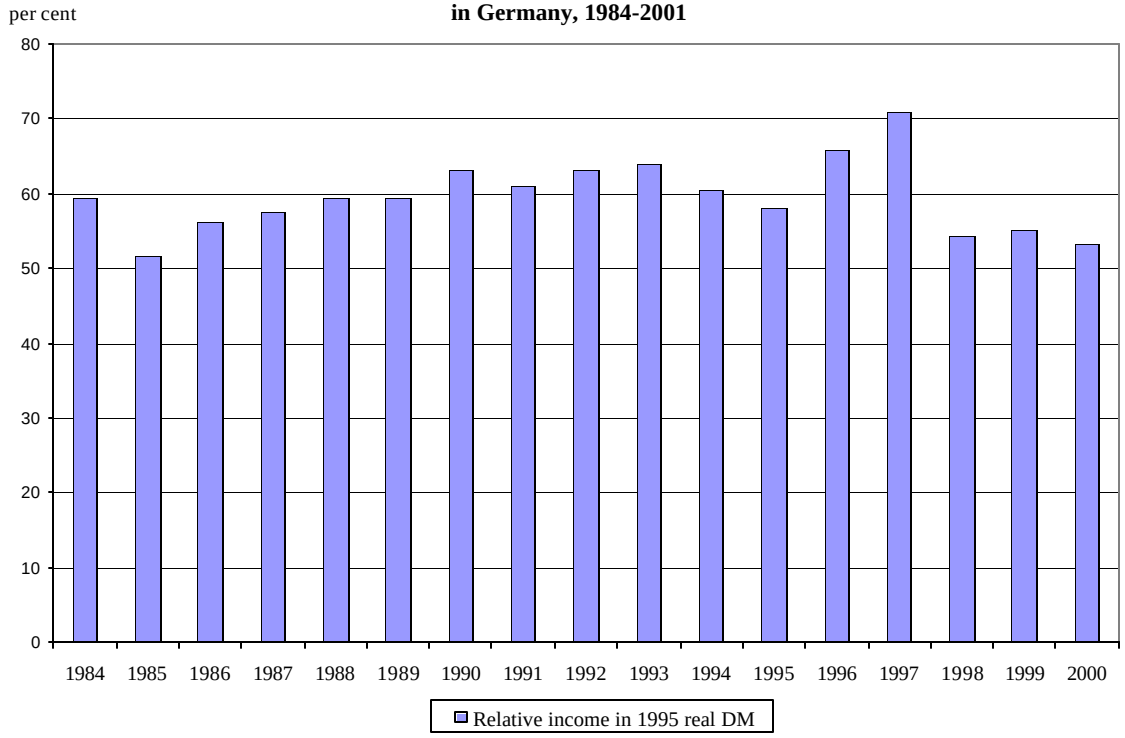
reduction when they exit this bracket again. For instance, currently the production factor *medium-aged workers* is relatively abundant all across Europe, due to the widely-experienced post-WWII baby boom.

In general, in a competitive setting all factors are fully employed. In equilibrium, more abundant factors command relatively low marginal productivities. Thus, the relative shift in labor supply induced by an ageing population might have an effect on the relative wages of younger and older workers and, therefore, on the income distribution of a society. All other things equal, as the population is ageing the production factor *young workers* becomes scarcer and the relative wages of young workers should rise. The precise extent to which wages of the young increase decisively rests upon the degree of substitutivity between different age groups in the production process and the institutional framework of the labor market. If, as we would presume, younger and older workers are not perfect substitutes in production and labor markets were to work without significant frictions (see below), the relative wages of younger cohorts will rise. Since labor income is the principal income source for most individuals and families, these altered age-earnings or age-wage profiles then translate into a higher per-capita income in the young generation.

As an empirical point of departure, this focus on relative changes of labor supply across different age groups calls for an augmentation of standard wage regressions with measures of current cohort sizes. A large body of literature analyzing the United States baby boom cohorts (see e.g. CONNELLY (1986), FREEMAN (1979) and WELCH (1979)) already documents a corresponding response of wages to a relative shift in labor supply, with larger cohorts experiencing lower wages. The empirical evidence for European countries is rather slim, though, and no clear picture emerges. WRIGHT (1991) provides evidence for the case of UK that larger cohorts have lower earnings, when they are young but that this effect does not persist as the cohort ages. KLEVMARKEN (1993) reports no significant cohort size effects for Swedish data. However, DAHLBERG AND NAHUM (2003), utilizing alternative data for the case of Sweden, find significant effects of cohort sizes on earnings. According to their results, these estimated effects vary across education levels.

For Germany, despite the rather strong decline in birth rates in the 1970s and the corresponding decline in relative cohort sizes of the young, no obvious effect on the relative income position of younger cohorts emerges (see **Figure 5**). Rather, the relative income of young workers fluctuates considerably in a fashion that seems to be related to a variety of factors. In addition to cohort size, changes in the intensity and duration of education and correspondingly, labor supply seem to be prime candidates for a deeper analysis. Moreover, aggregate economic developments may confound the picture even further. Yet, in a corporatist country such as Germany, we would hardly expect the relative wages of employed workers to reflect these altered factors directly. Rather, the wage setting process will amalgamate relative factor scarcities, the bargaining power of different generations, and the desire to rely on a stable wage structure. These aspects and their implications for wage structure rigidity will be addressed below.

Figure 5: Relative Income of Full-Time Working 18-21 Year-Olds in Germany, 1984-2001



Source: Own calculations from the *German Socio-Economic Panel*.

The Level and Structure of (Un-) Employment

In a corporatist economy the wages of different workers and, thus, the entire wage structure are bound to reflect factor scarcities at least partially in the long run. Skills, for instance, are the staple of any modern production process, and the wage premium for skills – the return to education – has been rising in the last decades in step with the growing importance of formal education. Yet, by contrast to a perfectly competitive labor market, in a labor market characterized by strong employer associations and unions, relative wages are not adjusted quickly to altered scarcities, perhaps not even completely in the long run. Rather wages tend to be rigid, and the wage structure is likely to reflect non-economic factors, such as the bargaining power of different factions in the bargaining associations.

Unions led by a gerontocracy of functionaries, for instance, might not be in favor of a change in the relative wage structure to the disadvantage of older workers, even though due to demographic fluctuations mature workers might be extraordinarily abundant – and, thus, less productive – and young workers unusually scare – and, thus, more productive than before. Such a policy is more sustainable in times of strong economic growth, when employment rates are high, such as in the "golden era" (CRAFTS AND TONIOLO (1996)) of economic growth during the early post-WWII decades. Stable demographics do also help, since young workers can rely on growing into the stronger bargaining position eventually themselves.

In times of lacking economic growth, or in an era of demographic change, sustaining such a stable-wage-structure policy will be more difficult, though. In particular, groups of workers whose wages – with respect to their relative scarcity – are set relatively high, in our example older workers, tend to experience high unemployment rates and, once unemployed, low

transition rates out of unemployment. Incidentally, this description appears to fit many continental European labor markets at the turn of the new century. In such an environment, keeping the age profile of wages stable despite high old-age unemployment is the more sustainable, the more generous is the system of unemployment support. Is wage rigidity indeed favoring older workers, additional support for these otherwise unsustainably high wages might be created artificially by the state, in the form of early retirement programs, or by seniority rules regarding layoffs.

That is, the availability of programs designed to alleviate the unemployment burden of workers being close to retirement – or, more precisely, the confidence that a high unemployment rate of these workers will suffice to muster enough political support for their creation – can be central to a bargaining strategy that rewards their work disproportionately highly. Under such circumstances, employers and their associations will support this policy as well, since early retirement programs can be used as an inexpensive work force management tool. Moreover, bargaining every year over the percentage adjustment of the stable wage structure is much less complicated and costly than calling its shape – i.e. the relative wages of young and old workers – into question as well. The taxpayer, not the bargaining parties will pick up the bill for maintaining a rigid seniority-wages relationship.

A stripped-down theoretical model embodying many of these ideas has been developed in SCHMIDT (1993). In this setup, a monopoly union represents different age groups of workers whose relative prevalences vary over time. For simplicity, think of labor supply at each age bracket as being inelastic, and consider workers of different ages as imperfect substitutes in production, with the structure of relative labor demand being stable over time. This implies, specifically that the only other production factor, capital, is not reflecting the type of workers it is producing with. Rather, the only changes we concentrate on here are the fluctuations of relative labor supplies.

If the monopoly union maximizes the wage bill, the wage of each age group does not reflect its relative scarcity. What fluctuates over time, though, are the (relative) (un-) employment rates of the different age groups of workers. As this stylized model suggests, with unionized wage bargaining, (un-) employment rates might be affected more strongly by the relative shifts in labor supply associated with population ageing than wages. If the relative shift of labor supply does *not* translate (fully) into rising relative wages of younger workers, their relative employment rates might fall and their relative unemployment rates decrease while that of older workers might improve.

However, by contrast to the stylized model in Schmidt (1993), labor supply is presumably not inelastic for all groups of workers. While this presumption might approximate the labor market behavior of core-age workers quite accurately, in times of high unemployment young workers can easily extend their investment into education and older workers can exit the labor market into early retirement. Women, in particular, have displayed a much more complex labor supply behavior than men in all advanced economies, evidenced by a large literature on the labor supply of married women (form a seminal source see KILLINGSWORTH AND HECKMAN (1986)). In times of high unemployment home production is becoming relatively attractive, and reduced labor market participation might be the safety valve to mitigate the consequences of generational crowding.

These arguments call for a concentration of the empirical analysis on employment rates instead of unemployment rates. This is exactly the route followed by our own empirical study discussed in the next section. It seems clear, though, that several confounding developments,

most importantly the rising secular trend towards higher labor force participation associated with the higher education and lower fertility of more recent generations of women will need to be disentangled empirically from the effects of generational crowding. These complication call for pursing a cross-country perspective, and for basing the analysis on micro data, since this permits taking educational attainment into account.

In essence, if rigidities prevent the wage structure from adjusting completely to variations in relative factor scarcities, the consequences will arise in terms of employment and unemployment. Previous literature placed its attention on age-specific unemployment rates. The empirical evidence on the relationship between cohort sizes and unemployment is very mixed. KORENMAN AND NEUMARK (2000) examine the effect of changes in the population age structure on youth employment and unemployment rates utilizing time-series data for 11 European countries as well as Australia, Canada, Japan and the US for a period covering 1970-1994. Their results suggest that large youth cohorts lead to increases in the youth unemployment rate, but, if, any modest effects on the employment rates of youths. The authors also report weak evidence that labor market institutions that decrease flexibility lead to more pronounced responses of youth (un-) employment rates to changes in the population age structure.

SHIMER (2001) uses data from all states in the US for the period from 1978 to 1996 to investigate the reaction of the (youth) unemployment and labor market participation rate to changes in the population age structure. The results of his instrumental variable approach suggest a rather large *negative* effect of an increase in the relative size of younger cohorts on the unemployment rate of younger *and* older workers, i.e. the larger the relative size of younger cohorts the lower are the unemployment rates of both age groups. Furthermore, the author also reports an increase in labor market participation rates for younger and, although less pronounced, for older workers in response to an increase of the relative size of younger cohorts.

SCHMIDT (1993) analyzes the effects of the changes in the age composition of Western Germany on the incidence of unemployment in different sex-age groups (see also ZIMMERMANN (1991)). The German wage setting process appears to be characterized by the presence of a strong union movement that hampers flexible wage adjustments. Thus, age structure variations can be expected to lead to fluctuations in age-specific unemployment rates. In general, this intuition is confirmed by the estimates presented by the author. However, a strong positive relationship between the size of a cohort and its relative unemployment experience can only be established formally for a few sex-age groups.

The stylized model of a monopoly union maximizing the wage bill is only a point of departure for a deeper analysis of the bargaining process, though. Consequently, the question of how alterations of the population age structure influence the bargaining process and its outcomes is more intricate. Specifically, it might well be that larger cohorts can exert an influence which mitigates the adverse effects of generational crowding. A theoretical model which embodies such a political economy consideration is left to further research. Yet it is already clear that any empirical analysis should take account of the possibility that in a corporatist setting cohort size might influence employment rates and economic prosperity negatively as well as positively.

Human and Physical Capital Accumulation and Labor Supply

Alterations of the age-earnings profile and on the income distribution across generations might have indirect effects through behavioral responses as well. For instance, such a shift in the income distribution in favor of younger cohorts might even provide an additional incentive for earlier retirement of older and for a larger labor market participation of younger workers. Furthermore, increased labor market participation of the young together with the improvement of their income position could then impinge upon reproductive behavior of these young people and induce a further decline in birth rates. The link between economic prosperity and fertility lies at the heart of population economics, but both theoretically and empirically this issue is far from resolved. Here we concentrate on educational attainment of the shrinking young generations and the accumulation of physical capital, leaving fertility decisions to further research.

The shift in the structure of the economically active population towards a higher share of older workers might impinge upon the level and structure of savings as well as the returns to stocks and bonds. Some observers attribute the substantial rise in US asset prices during the 1990s to the increased asset demand by baby boom cohorts entering their prime earning years. Consequently, asset prices are predicted to decline as soon as this population group reaches retirement age and begins to reduce its asset holdings. Theoretical models (see e.g. ABEL (2001)) support this view, but they also demonstrate that many and rather strong assumptions have to hold for this conclusion to be reliable. However, if such a relationship between the age structure of the population and asset returns exists, this might have an impact on the rate of return of investment and, therefore, via capital accumulation on growth, wages, and (un-) employment rates.

The existing empirical evidence on the relationship between the population age structure and asset prices is rather mixed. POTERBA (2001) analyzes the association between the age structure of the population and the returns to stocks and bonds in the US. Using age-wealth profiles from repeated cross-sections of the *Survey of Consumer Finances* for the period 1983–1995, he demonstrates that wealth rises sharply when households are in their thirties and forties but the decline is much less pronounced as soon as they enter retirement. Furthermore, this paper also analyzes time series data on the population structure and real returns on different financial assets for Canada, the United Kingdom and the United States. It does not find any robust evidence on the response of asset returns to changes in the population age structure. Therefore, one should be hesitant to predict large changes in asset values due to demographic change.

Hence, it is rather unlikely that the relative decline in labor supply due to population ageing will be compensated by a higher capital intensity in the production process (see BÖRSCH-SUPAN (2003)). Thus the growth in per-capita income will suffer, even though domestic capital may flow increasingly to more labor-abundant investment opportunities abroad. Therefore, to keep growth rates of aggregate output at their current levels, a higher human capital accumulation of younger cohorts is indispensable. Population ageing might act as an additional incentive for younger cohorts to invest in human capital, if the relative shift in labor supply results in a rise of young workers' wages, since for this age group the returns to education will increase. All other things equal, this should lead to higher human capital accumulation by the young. However, it is also conceivable that a shrinking labor force which reduces labor market competition might counterbalance this effect, so that the net impact of population ageing on the human capital acquisition of younger cohorts is ambiguous. Empirically, this phenomenon is quite well researched for the United States (see e.g.

CONNELLY (1986), CONNELLY AND GOTTSCHALK (1995), and STAPLETON AND YOUNG (1988)). These studies demonstrate that due to the decline in the private returns to education in response to larger relative cohort sizes, the human capital accumulation of relatively large cohorts decreases.

FERTIG (2003b) analyzes this relationship for the case of Germany. Utilizing data for birth cohorts entering the German labor market during the 1980s and 1990s the author demonstrates that relative own cohort sizes display a negative impact on different indicators (highest schooling and highest professional degree) of human capital accumulation of younger workers in Germany. Furthermore, the structure of the cohorts with respect to the average educational attainment of the parent generation impinges upon these indicators as well. However, there is also considerable heterogeneity in these effects for cohorts before and after the sharp drop in birth rates at the beginning of the 1970s. Therefore, this paper documents the intricate relationship between demographic change and human capital accumulation.

The Organization of Work and the Structure of Product Demand

During the ageing process across the life cycle individual physical ability might decline and human capital investments made in the past will gradually depreciate. Numerous empirical studies in the received literature document that there exists a robust and inversely u-shaped relationship between an individual's age and earnings and, thus, presumably productivity (see also our empirical application below). Thus, population ageing might also have a negative impact on aggregate productivity, since the productivity of older, more prevalent cohorts is waning. This is exactly the idea of presuming stable life-cycle profiles of labor income.

We have seen above that life-cycle profiles might be twisted by relative scarcities when the age composition of the labor force changes. We have also argued that young generations can emphasize these changes by high investments into human capital. If the productivity decline of older workers cannot be offset by higher human capital accumulation of the young, then the ageing process might have a negative impact on an economy's output level, its growth rates and employment levels. BÖRSCH-SUPAN (2003) argues that this effect will be quantitatively less important for per-capita incomes than the massive rise of the old-age dependency ratio, though.

However, there might be alterations of these profiles which reflect more than the usual relative scarcity calculus. The negative impact of a large cohort size might be (partially) offset by the way higher labor market experience is rewarded as technological progress unfolds. Specifically, there might be factor-induced technical change (ACEMOGLU (2002)) in the sense that the productivity of experienced workers, then the more abundant factor, rises disproportionately. Consequently, the net effect of ageing on individual productivity is *a priori* not clear. An interesting, but up to now in the scientific literature mostly ignored issue is the extent to which firms are able to cope with this phenomenon by adequate measures of organizational change, inducing disproportionate increases of the productivity of more prevalent generations.

Finally, there might be an additional effect of population ageing on labor markets via changes in the level and structure of product demand due to a higher share of elderly in the population (see BÖRSCH-SUPAN (2003)). If during the process of ageing preferences for specific goods and services change, it is likely that the structure of employment across different sectors of the economy is affected by this phenomenon as well. This is certainly an even more

predominant factor in rather closed economies. However, due to the similarities in the demographic change in almost all industrialized economies one would expect that open economies will be affected by changes in product demand as well.

From the above discussion it should have become transparent that the consequences of population ageing for European labor markets are not fully understood. Theoretical models deliver conflicting hypotheses on this phenomenon, especially regarding the impact of an ageing population on (un-) employment. The next section, therefore, presents some empirical evidence on the relationship between population ageing and the probability of being employed – i.e. for employment rates – for individuals living in the EU-countries.

4. Cohort Size and Unemployment – European Cross-Country Evidence

In our empirical application, we utilize the 1999 wave of the *European Community Household Panel* (ECHP) for all EU-15 countries except Luxembourg[3]. We restrict the analysis to the economically active population, i.e. all 15-64 old individuals not being in school any longer. The dependent variable in our analysis is the individual employment status, taking the value of 1 if the individual is regularly employed (works 15 hours or more per week) and zero otherwise. We analyze this variable in a discrete choice framework (*Probit* model). In this endeavor, we jointly employ three different sets of explanatory variables: (i) individual characteristics, (ii) variables measuring the demographic change, and (iii) a full set of country indicators. **Table A.1** in the Appendix provides a brief description of all variables and **Table A.2** reports some descriptive statistics.

The first set of explanatory variables, i.e. individual characteristics, comprises the individual's gender, his/her level of educational attainment, and a variable indicating whether or not an individual has any chronic physical or mental health problem, illness or disability. This first subset of variables also includes the individual's age (in years). In our Probit regressions, we allow age and age squared to exert different effects for three different age groups. The first age group comprises young adults aged 15-29 years, the second group comprises the "prime earning years" 30-55, and the third age group contains all individuals older than 55 (i.e. 55-64). For each of these employment-age profiles we would expect to find a concave, i.e. inversely u-shaped, relationship. This pattern is bound to reflect a large number of influences, among them the initially increasing and later declining individual productivity over the life cycle, as well as education, family formation, and retirement decisions. Overall, these variables are supposed to control for individual characteristics impinging upon individual employment chances in a pragmatic fashion.

The second subset of exploratory factors is measuring demographic change. This set contains the relative own cohort size and its square, measured as the share of individuals in each five-year age-brackets (i.e. 15-19, 20-24, …, 60-64) relative to the total population. These two variables are intended to capture the independent effect of belonging to a large or small cohort, given each individual's age. If wages do not (fully) respond to changes in cohort size, we will expect a negative relationship between the individual probability of being employed and the size of one's own cohort. If, on the other hand, political economy effects come into play, these relations might be more intricate.

[3] Luxembourg had to be dropped due to missing observations for one of our explanatory variables.

Furthermore, this set of variables comprises the education structure of each individual's own cohort, measured as the share of highly educated individuals in each cohort. With this variable we intend to capture the effect on individuals of responses in a generation's average human capital accumulation to changes in its relative cohort size. Specifically, we expect human capital accumulation to counteract generational crowding. If the secular trend towards increasing education confounds the negative effects of cohort size, in particular for the baby boomers and the subsequent smaller birth cohorts, the separate inclusion of the educational stance of each cohort will allow the separate identification of cohort size effects.

Finally, our explanatory variables comprise a full set of country indicators acting as country fixed effects in our estimations. These country indicators are supposed to control for unobservable country-specific peculiarities which, on average, equally impinge upon the employment probability of all individuals living in this country. Among these country-specific aspects, one might think of wage bargaining systems or behavioral differences in labor market participation. Since these variables are merely country-specific constants, their interpretation is difficult and we will abstain from placing any structural interpretation on their estimates. The only purpose of these variables is to prevent the estimates for all other variables from being contaminated by such country-specific idiosyncrasies.

Table 3 reports the results of our *Probit* model for the full sample of 98,568 individuals and the results for a restricted sample of 48,172 men. This restricted analysis explicitly takes the differences in the labor market participation behavior between men and women into account. By isolating questions of participation from the impact of demographic change on individual employment probabilities, the restricted analysis portrays the effects of generational crowding for those workers with low labor supply elasticities.

Table 3: Probit Estimation Results – Dependent Variable: Employed (yes/no)

VARIABLE	Complete sample		Restricted sample - Men	
	MARGINAL EFFECT	T-VALUE	MARGINAL EFFECT	T-VALUE
	Individual characteristics:			
Age (at 24) [1]	0.1175	39.29	0.1391	30.99
Age (at 40) [1]	0.0105	9.63	0.0122	6.99
Age (at 60) [1]	-0.1468	-30.85	-0.1605	-24.41
Female	-0.2690	-80.80	-	-
Medium education	-0.1294	-24.04	-0.0702	-10.47
Low Education	-0.1782	-35.45	-0.0509	-8.14
Disability	-0.1721	-38.21	-0.2287	-39.19
	Variables measuring demographic change:			
Relative own cohort size (at sample mean, in %) [1]	0.0410	5.80	0.0382	3.55
Share of highly educated in own cohort (in %)	0.0022	8.16	0.1925	6.08
	Country indicators (base category is UK):			
Germany	0.0923	6.77	0.0739	4.79
Denmark	0.1678	12.42	0.0946	6.06
The Netherlands	0.0919	5.71	0.0885	5.07
Belgium	-0.0207	-1.59	-0.0198	-1.22
France	0.0071	0.55	-0.0244	-1.57
Ireland	0.0543	3.62	0.0818	5.05
Italy	-0.0436	-2.58	-0.0214	-1.07
Greece	0.0022	0.14	0.0689	4.08
Spain	-0.0730	-5.26	-0.0090	-0.55
Portugal	0.1639	10.86	0.1215	7.45
Austria	0.1187	7.18	0.1033	5.89
Finland	0.0960	7.91	0.0408	2.81
Sweden	0.1415	11.49	0.0714	4.98
	Diagnostics:			
Pseudo R-squared	0.21		0.26	
Number of observations	98,568		48,172	

Notes: 1: Specification contains the variable and its square.

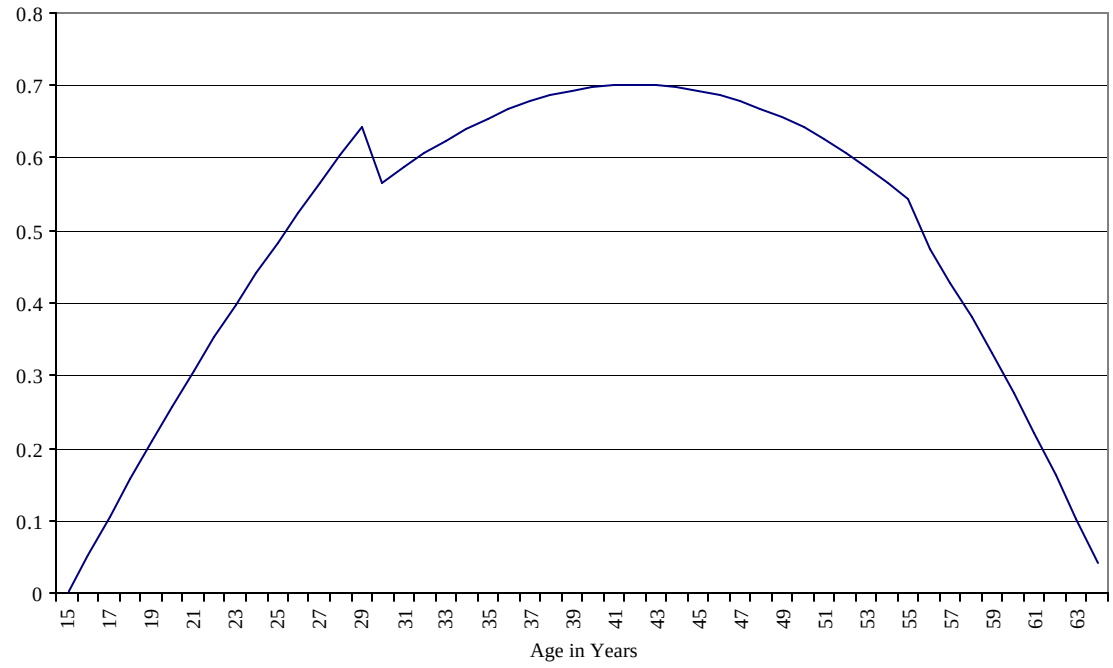
For each of our explanatory variables we report marginal effects and their associated t-values. The marginal effects can be interpreted straightforwardly as the percentage-point change in the probability to be regularly employed in response to a unit-change in the respective explanatory variable, holding all other explanatory variables, including indicator variables, at

their mean values[4]. The associated t-values provide an assessment of the statistical reliability of the estimated marginal effects, with t-values greater than 1.96 indicating statistically significant estimates at a 95% confidence level.

Before we address the issue of generational crowding, we briefly discuss our results regarding the included covariates. Throughout the EU women display considerably lower employment rates, with a point estimate of nearly 27 percentage points. Clearly, highly educated individuals are much more likely to be employed than individuals with medium or even low education. These discrepancies are less pronounced for men, providing an indication for the relevance of participation issues for the labor market behavior of women. Similarly, disabled men experience disproportionately low employment rates. This pattern is quite consistent with a voluntary withdrawal of women from the labor force in case of health problems.

Regarding the life-cycle profile of employment rates, our estimates indicate that an initial phase of increasing employment propensities – individuals finalizing their human capital investments and entering the labor market – is typically followed by a plateau phase of labor force participation and employment during core-age years and then by a pronounced decline in employment probabilities for the oldest age-group (55-64 years). This estimated life-cycle pattern is depicted graphically in **Figure 7**.

Figure 7: Age-Emplyoment Probability Profile



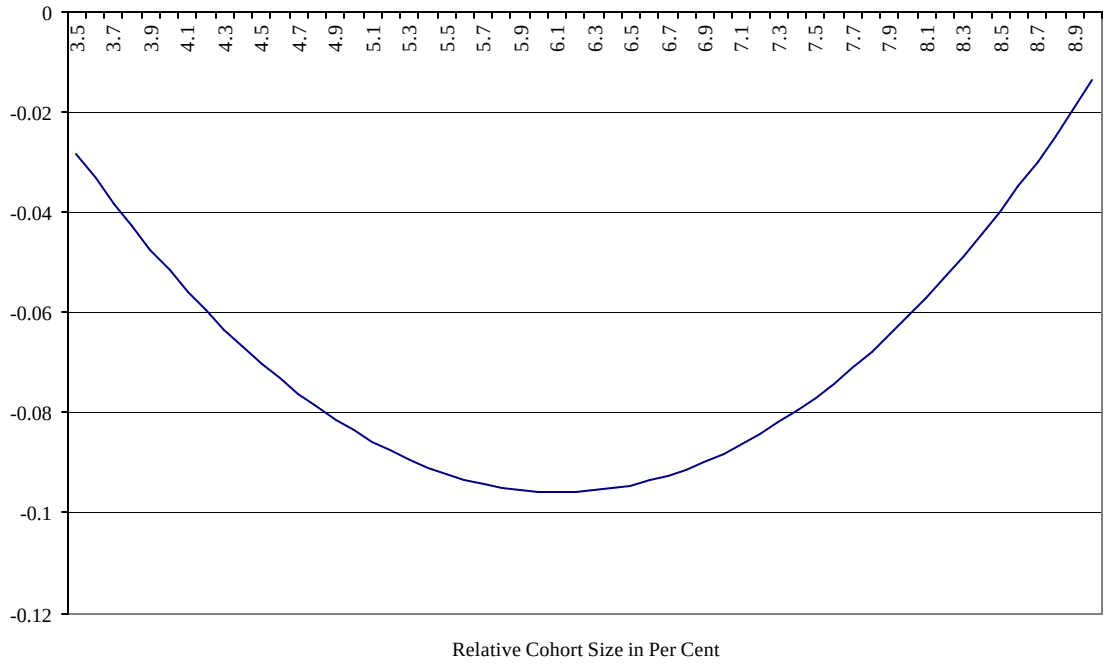
Our emphasis is on the variables measuring demographic change, reported in **Table 3**. Regarding the independent effect of cohort size, our estimation results differ considerably for different cohort sizes. While the marginal effect of increasing cohort size on employment propensities is strongly negative when cohort size is small, it increases with growing cohort

[4] For the continuous regressors, such as cohort size or age, a unit-change is a percentage point or a year, respectively. For indicator variables, the corresponding unit-change is the hypothetical switch from zero to one.

size. At the mean cohort size (around 7%), the employment probability is rising by 0.04 percentage points for each 1 percentage point increase in cohort size (for the complete sample). Overall, the estimates suggest an u-shaped relationship between the individual employment probability and the size of one's own cohort.

Within our sample relative cohort sizes vary between 3.9% and 8.8%. **Figure 8** depicts the relationship between cohort sizes and employment probability for cohort sizes from 3.5% to 9%. This figure indicates that for small cohorts the employment probability is falling with increasing cohort size but for cohorts larger than approximately 6% of the total population it increases again. This, at first glance, rather striking result indicates that larger cohorts are able to exert enough influence or otherwise unfold activities to mitigate the negative labor market consequences of generational crowding. The precise nature of these processes will certainly present an interesting area for further research.

Figure 8: Cohort Size-Employment Probability Profile



If we had not controlled for the education structure of the cohort of each survey, respondent, our results regarding the effect of cohort size would have been –0.06 (marginal effect for complete sample [5]). Indeed, the educational structure of one's owncohort has a significant and positive impact on employment probabilities. A 1% increase in the share of highly educated individuals in one's own cohort increases the individual probability to be regularly employed by slightly more than 0.002%, all other things equal. This positive effect indicates that a change in the population age structure provides a motive for further human capital accumulation. This behavioral response then impinges upon individual employment probabilities.

[5] Full results for the specification without cohort structure are available from the authors upon request.

5. Policy Options

Changes in the population age structure have the potential to affect the economic prosperity of individuals considerably. Measured over the complete life cycle, members of large cohorts apparently tend to experience lower wages and incomes, and lower employment rates than small cohorts under otherwise identical circumstances. The available evidence suggest that small cohorts even tend to invest relatively intensively into human capital, and that the productivity of small cohorts might be lifted further by disproportionate complementary accumulation of physical capital. Viewed from this perspective, the secular trend to a significantly older, and shrinking society seems to entail serious advantages for subsequent generations.

Yet, this prediction is far from conveying the complete picture. A first reason of uncertainty lies in the nature and extent of technological progress. Throughout the modern era, subsequent generations have tended to experience considerably higher economic prosperity during their life times than their predecessors, as a consequence of the fast and steady accumulation of human knowledge. While this tendency has slowed down in recent decades, in lifetime perspective its effects benefit the baby boom generation of the 1960s in comparison to the smaller post-WWII generation. The nature of technological progress does not need to be neutral, though (see ACEMOGLU 2002). It is conceivable that many technological and organizational advances throughout the next decades might enhance the productivity of the large baby boom generation disproportionately, which is by then a generation of older workers.

Thus, the market itself might mitigate the disadvantages of generational crowding. A related phenomenon concerns questions of political economy. Particularly in the corporatist economies of continental Europe, we might expect large cohorts to experience relatively favorable outcomes, since they can influence the working of the market to their advantage. Our own empirical application provided evidence on employment rates which are consistent with this argument. In consequence, whether subsequent, smaller cohorts will indeed experience relative economic prosperity *because* of their scarcity, is quite uncertain.

The real problem for the smaller generations of the future are the intergenerational linkages that characterize every society. From the vantage point of aggregate welfare, it is the income per capita, not the income per worker which is of central interest. Indeed, current generations of workers have a vital interest in a high productivity of subsequent smaller generations – otherwise it will be difficult to sustain prosperity growth for the population as a whole, children, workers, and retirees alike. Needless to say, the informal, intra-family and institutionalized, anonymous forms of redistributing labor income lie at the heart of the issue. A high level of income taxes, for instance, might ensure that the disproportionately high income of young workers is partially translated into infrastructure and health services benefiting retirees.

The most direct way of intergenerational redistribution is the system providing old-age income security. In most European economies, it currently rests to a large extent on a pay-as-you-go idea, re-distributing income perpetually from the currently active generation to retirees, maintaining this principle from generation to generation. These systems' central parameter in times of rapid demographic change is certainly the replacement rate. A high replacement rate ties the income of retires generously to the income of workers, necessitating this generation to contribute a larger chunk of their product to the system when its population

share is small. This is exactly the root of the current political debate surrounding the pension system.

Yet, it has become clear in our discussion that the structure of labor market outcomes is affected in a similar fashion by institutional arrangements. A prime example is an age-earnings profile which historically is held stable intertemporally by the employer associations and unions in their overall wage bargain. More generally, a problem will typically arise whenever institutions are put into place with the current age structure in mind. When these institutions face different demographic circumstances, they are in danger of failing or – with the same outcome – lose their consensus support. This principle holds for systems of old-age security and labor market institutions alike.

Two types of – mutually non-exclusive – remedies can be employed to ward off the demographic challenge. One avenue might be to tackle the demographic change directly. A contentious and probably not extremely promising strategy is the implementation of programs intending to foster fertility. They are usually not too promising, because the incentives serious enough to alter this key decision in the lives of most adults would have to be quite generous. They are contentious, since they address the voluntary decisions of people, after all. At best, the desired alleviation of the demographic problems of social security will only arise in the long run, since societal preferences do only change slowly over time.

A similar strategy would be to take both the demographic change and current systems of old-age incomes security as given, but to ensure that labor force participations rates increase at the beginning and at the end of the workers' career. That is, spells of education should become shorter, perhaps by introducing education fees, raising cost awareness in publicly provided education systems. Also, early retirement programs should be abolished. To the contrary, the mandatory retirement age should be adjusted upward to reflect the rising life expectancies of more recent generations. Similarly, one could aim at an increasing labor market participation of married women, by providing better and more widely available child care facilities, or by programs designed to facilitate a smoother return to the labor market after a phase of home production.

Finally, one might opt for more immigration to alter the age and skill structure of the population. It has been demonstrated conclusively (see e.g. BÖRSCH-SUPAN (2002)) that immigration provides a route for relieving the demographic pressure currently inflicting old-age security systems of the pay-as-you-go mold, but also that this does not provide a solution in the long run. Young adult immigrants quickly grow themselves from being a rejuvenating factor to being mature members of the population. This leaves their main demographic impetus to be their enhancing effects on future fertility (SCHMIDT (2000C)). Moreover, new contributors to the system today generate more obligations for the systems tomorrow, implying the need for a constant influx of young adult immigrants to make this alleviation strategy work. Thus, ultimately a reform of the systems of social security cannot be avoided.

The second avenue for policy would be to accept the demographic change, and to engage in reforms of those institutions which are under demographic pressure. Regarding the system of old-age security and other aspects of social security, this strategy would entail the implementation of more elements of self-sufficiency. Specifically, these systems should rest more heavily on funding – to the detriment of pay-as-you-go aspects. First steps in this direction have already been undertaken, for instance by recent reforms of the German pension system. Regarding the functioning of the labor market, it would be important to ensure that wages do increasingly reflect relative scarcities, before the large generation of baby boomers

enters the final decade of their working career. This move might well imply breaking a gerontocratic minimum wage cartel.

In any case, labor markets working more smoothly will be an important prerequisite for satisfactory aggregate growth. Another key aspect for coping successfully with an ageing population is certainly the provision of incentives for higher human capital accumulation. This also applies to older workers, which is difficult, since returns to education decrease with age. But it is particularly important for younger cohorts whose productivity necessarily carries overall economic growth. During the next decades, much will depend on the way that the large baby-boom generation manages to keep abreast of technological and organizational change. What will be needed in terms of social institutions are unions and labor courts embracing the idea of life-long learning and individual accountability, instead of defending mechanical seniority rules in wage setting and in hiring and layoff procedures.

While at the outset it is clear that these two major policy options might complement one another, it is far from obvious which of their elements are most promising. Indeed, many of the potential cures, specifically those accommodating current institutions to the changing age structure, might have repercussions on birth rates and might therefore counteract the original policy measure. Even measures aiming at increasing labor market flexibility, including decentralized wage bargaining procedures to make wages responding to shifts in labor supply, might entail potential repercussions on birth rates via increased income. Similarly, the provision of incentives for higher labor market participation of women might exert feedback effects on birth rates. Finally, it has been a clear, albeit disenchanting message from the literature on active labor market policies that the potential of qualification measures of active labor market policy is limited. Thus, since the effectiveness and efficiency of these policy options is far from being guaranteed, there is an urgent need for evaluation studies accompanying any introduction of such measures.

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Appendix

Table A.1: Description of variables

VARIABLE	DESCRIPTION
	Dependent variable:
Employed	1 if individual is regularly employed (15+ hours per week); 0 otherwise
	Individual charac teristics:
Age in age group below 30	Age of individual in years, if the individual is younger than 30
Age squared in age group below 30	Squared age of individual, if the individual is younger than 30
Age in age group 30-55	Age of individual in years, if the individual is 30-55 years of age
Age squared in age group 30-55	Squared age of individual, if the individual is 30-55 years of age
Age in age group above 55	Age of individual in years, if the individual is older than 55
Age squared in age group above 55	Squared age of individual, if the individual is older than 55
Female	1 if individual is female; 0 otherwise
Medium education	1 if individual has a medium education degree, i.e. second stage of secondary education (ISCED 3); 0 otherwise
Low Education	1 if individual has a low education degree, i.e. less than second stage of secondary education (ISCED 0-2); 0 otherwise
Disability	1 if individual is has any chronic physical or mental health problem, illness or disability.; 0 otherwise
	Variables measuring demographic change:
Relative own cohort size	Relative size of individual's cohort in per cent
Relative own cohort size squared	Squared relative size of individual's cohort
Share of highly educated in cohort	Share of highly educated individuals in own cohort in per cent
	Country indicators:
UK	1 if individual lives in the United Kingdom; 0 otherwise
Germany	1 if individual lives in Germany; 0 otherwise
Denmark	1 if individual lives in Denmark; 0 otherwise
The Netherlands	1 if individual lives in The Netherlands; 0 otherwise
Belgium	1 if individual lives in Belgium; 0 otherwise
France	1 if individual lives in France; 0 otherwise
Ireland	1 if individual lives in Ireland; 0 otherwise
Italy	1 if individual lives in Italy; 0 otherwise
Greece	1 if individual lives in Greece; 0 otherwise
Spain	1 if individual lives in Spain; 0 otherwise
Portugal	1 if individual lives in Portugal; 0 otherwise
Austria	1 if individual lives in Austria; 0 otherwise
Finland	1 if individual lives in Finland; 0 otherwise
Sweden	1 if individual lives in Sweden; 0 otherwise

Table A.2: Summary statistics

VARIABLE	Complete sample		Restricted sample – Men	
	MEAN	STANDARD-DEVIATION	MEAN	STANDARD-DEVIATION
	Dependent variable:			
Employed	0.629	0.483	0.744	0.436
	Individual characteristics:			
Age in age group below 30	6.580	10.623	6.645	10.652
Age squared in age group below 30	156.147	264.464	157.611	265.186
Age in age group 30-55	23.950	21.571	23.870	21.558
Age squared in age group 30-55	1038.878	1020.957	1034.535	1019.714
Age in age group above 55	8.749	21.188	8.644	21.076
Age squared in age group above 55	525.451	1276.645	518.931	1269.245
Female	0.511	0.500	-	-
Medium education	0.318	0.466	0.320	0.467
Low Education	0.474	0.499	0.472	0.499
Disability	0.199	0.399	0.190	0.392
	Variables measuring demographic change:			
Relative own cohort size	6.878	1.027	6.886	1.027
Relative own cohort size squared	48.359	13.852	48.477	13.875
Share of highly educated in cohort	20.97	16.70	20.86	16.51
	Country indicators:			
UK	0.072	0.258	0.068	0.252
Germany	0.098	0.297	0.098	0.298
Denmark	0.034	0.181	0.034	0.181
The Netherlands	0.075	0.264	0.073	0.260
Belgium	0.040	0.196	0.039	0.193
France	0.085	0.279	0.085	0.279
Ireland	0.045	0.207	0.046	0.210
Italy	0.128	0.335	0.130	0.337
Greece	0.072	0.258	0.071	0.257
Spain	0.104	0.305	0.105	0.306
Portugal	0.087	0.282	0.087	0.282
Austria	0.050	0.219	0.051	0.220
Finland	0.063	0.242	0.064	0.244
Sweden	0.047	0.212	0.048	0.215
Number of observations	98,568		48,172	

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