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## The Economic Consequences of Demographic Change: Its Impact on Growth, Investment and the Capital Stock

#### **Gunther Tichy\***

The traditional debate on the real and financial consequences of ageing is based on two assumptions: a deteriorating old-age dependency ratio and declining productivity of an ageing population. Both suppositions are questionable. Relevant for the future burden is not the old-age dependency ratio but the relation of the working to the non-working part of the population, which will deteriorate only slightly as the number of unemployed and of early pensioners will decline as a consequence of the shrinking working-age population. The productivity of an ageing society may increase even if individual productivity shrinks with ageing: this is a consequence of the increasing disability-free life expectancy and of factor-price induced higher capital intensity. The coming problems of ageing are, therefore, less threatening than suspected in the popular and in parts of the professional literature, especially under some supporting labour market policy.

JEL classifications: J14, J11, H55, E21 Keywords: demographic change, ageing society, productivity and saving of the elderly

»Literature on the 'ageing problem' is complex, multifaceted and ill-defined; and the 'solutions' are partial, uncertain, and largely ineffective." (MacKellar 2000: 365). The public and even the professional debate on ageing and the pension problem are replete with definite policy proposals based on static economic conditions and on extrapolations, switching between forecasts and prejudices. Nevertheless wide agreement exists that it will not be possible to finance the public pension system. The important questions, however, are

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rarely posed, and even professional publications appear to be competing in a horror contest of an impending generation conflict and a financial demise of the prevalent pay-asyou-go (PAYG) system (Tichy 2004). The most frequent, but inaccurate, or at least unproven, prejudices are:

- that the young, i. e. persons in the working age, support the old, i. e. persons above working age;
- that the working-age population is identical with the actual labour force;
- that the attitudes and abilities of, say, a 60-year-old remain unchanged as disabilityfree life expectancy increases strongly;
- that the productivity of an ageing society inevitably declines.

Unavoidably severe consequences for the financial future of the pension system are predicted.

This paper does not deal with the problems of pension financing directly but with the basic facts causing these problems. It takes a closer look at the professional literature dealing with the prevailing prejudices and introduces a new perspective: the problems of ageing turn out to be much more complex, the results less clear, less deterministic and more modifiable, and, last not least, the perspectives turn out to be less bleak. Adjusting the pension system to the new conditions is undeniably a major problem (for policy), yet the impact of ageing on a wide range of economic factors is surprisingly small. Given the length of the time horizon and the state of our knowledge, nobody can make reliable forecasts. According to Schumpeter (1950) it is only possible to determine tendencies,<sup>1</sup> to provide a *»probabilistic assessment*« (OECD 1967: 15; emphasis by G.T.), to design <code>>landscapes</code> of the future<br/>suited to guide policy in view of the changing states of the world and repercussions and address the most relevant problems.

This paper attempts to contribute to this task, referring to a wide range of literature and illustrating the results with German and Austrian data. Firstly it highlights the uncertainty of population forecasts. Section two investigates whether the increased life expectancy will rejuvenate the behaviour and attitudes of the elderly. Section three deals with the consequences of ageing on productivity. Section four asks to what extent increased productivity can offset the effects of the shrinking labour force and elaborates the consequences for GDP growth. Sections five and six discuss the effects of the demographic shift on consumption, saving and the stock of physical and human capital. Section seven draws some conclusions.

I »What counts in any attempt at social prognosis is not the Yes or No that sums up the facts and arguments which lead up to it but those facts and arguments themselves. They contain all that is scientific in the final result. Everything else is not science but prophecy.« (Schumpeter 1950, 61).

#### 1. Demography, Demographic Forecasts and the Labour Market

As is widely known, the debate on ageing was prompted by population forecasts predicting a near doubling of the old-age dependency ratio together with the assumption that this ratio indicates the burden the young have to bear in supporting the yold. The dependency ratio, however, does reflect neither the level nor the dynamics of the demographic burden, if the response of the labour market to the shrinking working-age population is accounted for. In addition the reliability of population forecasts is weak, especially as to workingage population.

Demographic forecasts appear not to be immune from prejudices of the general public: as long as fear of an explosion of world population dominated, United Nation's (UN) forecasts of world population growth were on the high side and they have been drastically reduced since public discussion on this subject petered out. The discussion on low fertility rates and drastically shrinking population levels in Europe induced very low extrapolations with major upward revisions subsequently. The Austrian forecast (main scenario) has been turned around completely, since Statistik Austria (the Austrian Statistical Office) now assumes that the population will not shrink drastically as predicted, but continue to grow: the 1999 forecast predicted a reduction of five percent within 50 years (to 7.7 million people), while the 2005 forecast predicts a ten percent rise (to 8.9 million people). The prediction regarding the Austrian working age population was even further off: A predicted decrease of 19 percent in the 1999 was altered to a near stagnation (minus three percent) in the 2005 forecast with a continued rise up to 2020 and a slightly stronger decline afterwards (Tichy 2006a). The revisions were mainly due to the underestimation of immigration and of actual longevity (Martins et al. 2005: table 2.3). In Germany<sup>2</sup> the forecasts of total population have been revised less drastically (between minus 1.5 and plus seven percent), as it was not necessary to change the extrapolation of net immigration. The forecast of working age population in 2050, however, was revised from 33.7 billion people to 40.8 billion people in the 2003 forecast (plus 21 percent) and to 39.1 billion people in 2006 (minus four percent). In international foresight exercises (European Commission 2006, UN 2005) the striking differences between a growing population in Austria and a strongly shrinking one in Germany are less pronounced: European Commission/UN assume Austrian total population in 2050 to be nine/ten percent lower than in the most recent national forecast and ten/twelve percent higher than in the most recent German one (see figure 1, p. 108).

Revising the demographic forecasts necessarily changes the dependency ratio: it fluctuates between about 50 and 60 percent in both countries. The assumption that the old-age dependency ratio predicts the burden the >young< will have to bear in the future – based on the *prejudice that* >young< support >old< –, however, is of even higher relevance for policy con-

<sup>2</sup> The German statistical Office does not mark one of the several variants as the main one explicitly. Detailed data, however, are restricted to a middle version with 200 000 immigrants per year and a pension age of 65 (Statistisches Bundesamt 2000, 2003 and 2006); this middle version is roughly comparable to the Austrian one and was used for the calculations in this paper.



## Figure 1: Revision of Population Forecasts

Sources: Statistisches Bundesamt, Statistik Austria

	Ger	many	Austria		
	2000	2050	2000	2050	
(0) Total population	84,440	73,959	8,110	8,986	
Old-age dependency ratio					
(1) Working age (20–65 years)	51,115	39,071	5,010	4,862	
(2) Elderly (65+ years)	14,066	23,485	1,256	2,458	
Old-age dependency ratio (2)/(1)	27%	60%	25%	50%	
Demographic dependency ratio					
(1) Working age (20-65 years)	51,115	39,071	5,010	4,862	
(3) Below or above working age (0-20 years and 65+ years)	31,326	34,888	3,100	4,124	
Demographic dependency ratio (3)/(1)	61%	89%	62%	85%	
Labour market burden					
(4) Unemployed jounger than 50 years	2,633	1,802	184	64	
(5) Young age retired	8,640	4,461	788	468	
Labour market burden (4+5)/(1)	22%	16%	19%	12%	
Support ratio (total economic burden)					
(6) >Supporters( (1)-(4+5)	39,842	32,808	4,038	4,330	
(7) >Subsidised (0)-(6)	42,598	41,151	4,062	4,656	
Support ratio (7)/(6)	107%	125%	101 %	108%	

Table 1: Demographic versus Economic Burden (Population in 1000)

I Gainfully active persons between 50 and 65 years (assumption of a labour force participation rate of 70 percent).

Source: Germany: Own calculation based on Statistisches Bundesamt 2006, Variante 1W2, and Büttner 2005; Austria: Tichy 2006a

clusions. This assumption is simply wrong, as not the >young< but the actual labour force will have to support *all* non-working persons, not just the >old<. The actual labour force in no way corresponds to the working-age population, which apart from the >old< includes all persons of working age who do not work because they are disabled, unemployed or in early retirement (Tichy 2005). Table 1 collects the latest data and roughly assesses the labour market effects.<sup>3</sup> The estimates suggest that the support ratio,<sup>4</sup> i. e. the >non-working dependency ratio<, will increase only moderately (by less than 20 percent in Germany and by seven percent in Austria) in spite of the fact that the old-age dependency ratio will roughly double in the next 50

3 It assumes a return to former unemployment rates and a participation rate of the 50–65-year population of 70 percent (Scandinavian average).

4 The support ratio is the number of active to dependent population.

years: approximately 8.5 million Germans and one million Austrians had to be supported in 2000 who were either unemployed or retired before the age of 65 years. Therefore, the support ratio was already at about 100 percent in 2000 (table 1). As the working-age population will shrink, an analysis should in no case neglect the *repercussion of ageing on the labour market:* the unemployed, even those of a higher age bracket, will progressively find jobs in the period beyond 2020.<sup>5</sup> The wedge ageing is liable to drive between wages and per capita income will be mitigated considerably by decreasing the funds intended to support children,<sup>6</sup> the unemployed and early retirees. The expectation that most people will be working up to the age of 65 years is supported by the increase in longevity and by stronger incentives to employ the elderly in periods of labour shortages. This is far from certain, however, since the frequency of early retirement and early withdrawal from the labour force appears to have been voluntarily to some – unknown – extent, and came as a consequence of higher life-time income and higher savings on the one hand and reduced relative income among elderly workers on the other (Campbell 1999, Disney 1999).

By way of conclusion, we can be relatively sure that the supply of labour will decrease once the baby-boom generation starts to retire. We do not know for sure, however, to what degree immigration and an increase in the old-age threshold will relieve the resulting pressure on the labour market. We know that the old-age dependency ratio will increase, yet we can expect the resulting financial pressure on the 'young' to be, to a large – but quantitatively uncertain – extent, offset by a reduction of payments to the unemployed and early retirees. We know for sure that the average age of the population will increase, but again we do not know by how much, as the effects of the ageing of the baby-boom generation and the increase in longevity will most likely be mitigated by the immigration of an unknown number of relatively young foreigners.

## 2. Increased Life Expectancy and Attitudes Among the Elderly

The potential change in the characteristics, the attitudes and habits of the elderly is perhaps the most important element in any foresight exercise regarding the consequences of ageing,<sup>7</sup> but it is almost completely neglected in professional work and even more in the public discussion. If life expectancy expands as projected – by seven years up to 2050 in Ger-

The implicit assumption of declining or at least not increasing mismatch is based on the observation that employers restrict their search to overqualified persons in periods of high unemployment and of an improved active labour market policy (training and retraining) in times of labour shortages. It is frequently argued that children are much cheaper than retirees and that children are financed by their parents. The argument neglects the fact that the young are in most cases (and increasingly so) supported up to the age of 20, and that the bulk of costs are not food and clothing but education (and in some countries even housing), which are predominately financed by society. We have no reason to believe that today's 45-year-olds will behave in ten years like today's 55-year-olds when they have had much different lifetime experiences.« (Bosworth et al. 2004) many and eight years in Austria –, will the age specific attitudes and habits of individuals shift upwards accordingly? Figure 2 illustrates the importance of this question: the prime age group consisting of persons aged 20 to 65 years – the dominant group of today in quantitative terms and also the group determining business as well as social life – will shrink to 53 percent and 54 percent in Germany and Austria, and the retired (65 years and over) will increase to 31 percent and 27 percent. Can we expect a rejuvenation of the elderly as a consequence? Will a 70-year-old in 2050 behave and act like a 62-year-old today? Several arguments may suggest an affirmative reply to this question.



Figure 2: Shift in Age Structure

Sources: Statistisches Bundesamt 2006, Variante 1W2; Hanika 2005

The most important argument in support of an upward shift in attitudes is the fact that *disability-free life expectancy* has increased even more than life expectancy in most European countries: life expectancy at birth (Martins et al. 2005: tables 2.3, 2.4) has expanded by 1.25 years per decade in five European countries (two years in Germany and 2.5 years in Austria), disability-free life expectancy by 2.75 years (2.75 years in Germany, no data for Austria). Life expectancy and disability-free life expectancy at the age of 65 years have increased at the same rate and stand now at 10.5 years and 14.5 years. The tendency to a longer healthy span of life has been widely accepted in medical literature under the terms 'compression of morbidity' and 'rectangulation of the survival curve' (Fries 1980). The concept of 'successful ageing' was first described by Rowe/Kahn (1987) who challenged the then prevailing biomedical view that ageing, though a 'normal' (healthy) biological process, still represents a disease. Functional disabilities as a result of chronic diseases have actually been on the decline in the whole last century (Costa 2000), and the trend has accelerated ever

since (Manton/Gu 2001).<sup>8</sup> Activity limitations among the elderly declined by more than one percent annually (Freedman 2004). No data are available for Austria (Riedel/Hofmarcher 2003), but microcensus data reveal that elderly people at least feel increasingly healthier (Doblhammer/Kytir 2001, Doblhammer et al. 2005).<sup>9</sup>

A second argument, which is part of an explanation of the former, is the trend towards a physically less demanding work life. The share of blue-collar workers holding jobs that require hard physical work and enforce early retirement has dropped considerably in favour of desk work. Desk workers, however, are different from manual workers and their attitudes tend to dominate social life. A third argument in favour of a trend towards more prime-age typical attitudes among the elderly is that attitudes and behaviour are to a large part shaped by education, and the new seniors have enjoyed a longer and better (school) education than the present cohort of people over 60 years (who on the other hand have a better education and syounger attitudes than the generation of their parents).

Evidence and common sense suggest that the attitudes and habits of the elderly concerning consumption, continuing education, or free-time activities have already shifted upwards. This has been demonstrated for tourism, where persons who have passed their 45-year mark tend to maintain their generation's travel habits, which were shaped in their formative years (Smeral 2003: 153 f., Lohman et al. 2005). This phenomenon has become apparent in other fields too, however: earlier generations would have been astonished to see grandfather exercising sports, wearing jeans and Adidas shoes, or admitting to still having sex (with grandmother, less so with younger women). As large cohorts typically shape the socially determined attitudes of a period – as did the hard-working, production-oriented World War II generation, the 68-revolutionaries, or today's wellness generation – it is rather likely that the babyboom generation will stick to its mid-life attitudes and transfers them to their elderly life.

Behaviour will also change as a result of the *increasing disparities*, i. e. a polarisation between rich and poor, especially among the elderly. Population ageing as such causes income distribution to shift, as old people typically have lower incomes than younger ones. But among the elderly some additional polarising elements will play a role: most importantly, the growing poverty among elderly people with a history of interrupted and/or part-time employment who are not eligible for a full pension. This is all the more relevant, as the recent reform of the pension system (in Austria as well as in most other countries) increased the importance of long insurance periods as well as the defined-contribution element at the expense of defined benefits. As persons with interrupted job tenure and/or part-time employment have lower incomes and consequently make lower contributions to the pension system, strong polarising forces are at work. These are exacerbated by the observation that

8 The discussion in this paper concentrates on the shifts in attitudes of an ageing population and the impact on productivity. It does not deal with the question whether the increase in life expectancy implies an expansion or compression of morbidity with related effects on health spending. Empirical data tend to be more in support of the compression hypothesis (Bajtlan / Lagergren 2000).

9 The increasing problem of obesity is one of the few counter-arguments against an increase in the overall as well as disability-free life expectancy.

most households, especially poorer ones, do not spontaneously build up savings for their retirement, and if they do, do not save nearly enough (MacKellar 2000: 91).<sup>10</sup> A fourth polarising factor is the growing accumulation of capital: most Europeans lost most of their assets as a consequence of two world wars and the global economic crisis. Wealth has been restored ever since, and the children of the wealthy increasingly gain wealth through inheritance. This has a bearing on the polarisation among the elderly, since the typical heir is rather old: as, on average, people die in their early eighties today (and will die in their late eighties by 2050), today's children at the time of inheritance tend to be in their fifties and will be even older towards the middle of the century. In most cases, the inheritance, therefore, comes as a supplement to the income of retirees (not of families struggling to build a home and support underage children), thus widening the income and wealth gap among the elderly.

## 3. Will Ageing Reduce Productivity?

The ageing of the population confronts the ongoing debate with the widely held belief that productivity inevitably declines in an ageing society, resulting from the prejudice of an agespecific decrease in individual productivity and a fallacy of composition: the confusion of individual and collective ageing (Blanchet 1992: 129). To deal with this prejudice, the following issues must be resolved:

- whether reliable evidence exists that *individual* productivity necessarily decreases with age;
- whether a decrease in individual productivity implies a decrease in *national* productivity;
- and whether the age-productivity curve shifts to the right with increasing life expectancy.

Laymen's conviction that productivity decreases with age appears to be confirmed by the majority of studies on *individual productivity*, at least to some extent. The recent survey of Skirbekk (2005) offers a fair bit of evidence proving that individual productivity actually decreased with age in the past, but some countervailing arguments come up immediately: physical abilities tend to shrink, but they become less significant in a modern economy. Cognitive abilities (reasoning, speed, episodic memory) decline with the age of 50 years (Verhaegen/Salthouse 1997), but targeted training programs may halt the decline (Ball et al. 2002). Persons may become less entrepreneurial and ambitious with age, but they dispose of a greater stock of human capital and (job) experience; they are more reliable and change jobs less frequently (Ell 1995, Champion et al. 1998: 65, MacKellar 2000)." Lucas

Those with high incomes may on the contrary save more than optimal under life-cycle necessities, due to precautionary (fear of illness, possibility of above average length of life) or liquidity motives. "The situation is likely to differ by sector. There are jobs for which physical strength or stamina are important; construction, for example. [...] Note that in others, the balancing factor in the equa(1978) and Feyrer (2008) even find that the elderly are the better managers. Older workers are not considered less productive by their supervisors (Skirbekk 2005). The evidence with regard to unit rates is indecisive,<sup>12</sup> but employer-employee matched data sets measuring the workers' marginal contribution to the firms' value added tend to show an inverted U-shape with a peak in the workers' thirties and fourties. The age-productivity relationship appears to depend strongly on the type of activity.

The ability to produce notable inventions and ideas is strongest in the inventors' fourties today (Galenson/Weinberg 2004, Feyrer 2008), but it has shifted upwards by five to six years in the last century.<sup>13</sup> The innovative potential of those beyond their middle age did not rise in parallel according to Jones (2005), so that the innovative life span has become shorter. Edwards (2004), however, argues that longer lives may facilitate scientific discovery as the elite's life expectancy increased earlier and stronger than average. According to Minetaki et al. (2004), technical progress was positively correlated to the share of educated workers over 40 in the 80's but turned to the negative in the 1990s.

Due to measurement problems the studies on individual productivity are inconclusive. They suggest nevertheless that individual productivity need not decline with age, so that senior employees can remain highly productive in a field they know well and where many years of experience is an advantage. Their productivity may be threatened by the introduction of an entirely new class of technology. Accelerating technical progress increases the importance of learning and puts older employees who may learn at a slower pace at a disadvantage (Baltes/Lindenberger 1997). Companies, however, do not generally view older workers as unsuited for training (OECD 1998: 139) and older workers are not especially reluctant to undertake training.

*Plant-level studies,* beset with methodological problems as well, tend confirm the (rather weak) evidence provided by micro-investigations substantiating a hump shaped (inverted U-shaped) age-productivity profile (Haltiwanger et al. 1999, Ilmakunnas et al. 2004). Controlling for education does not change this result according to Malmberg et al. (2005), but adjustments to accommodate plant-level effects turn the inverted U around. This is due to the fact that older workers tend to be concentrated in older, technically less efficient plants. Similar results have been obtained by Aubert/Crepon (2003) and Aubert et al. (2006). Börsch-Supan et al. (2005) found in a case study of a large car manufacturer that older teams are not less productive than younger ones, but mixed teams are.

tion may not be productivity but physical wear and tear. [...] [T]he elderly bus driver drives just as many passenger kilometers, but suffers more for it.« (MacKellar 2004: 152); in addition they produce fewer accidents (Ell 1995).

<sup>12</sup> Mail sorters and office workers kept productivity stable at higher ages, while factory workers' productivity fell after the age of 55.

<sup>13</sup> Jones (2005) tends to explain this trend as a result of longer education, due to the increasing stock of complex knowledge.

The decline in age-specific individual productivity is certainly smaller than public prejudice assumes, and, if existent at all, varies greatly among the different abilities and persons. Individual productivity, however, cannot be separated from its social context (Malmberg et al. 2005). There is even less evidence substantiating a decline of *aggregate productivity* in an older society. Some studies find that the future age composition of population will have a small, almost negligible negative effect on productivity (Börsch-Supan 2002,<sup>14</sup> Hofer/Url 2005). In Lindh/Malmberg's (1999) regression analysis of OECD countries in the period 1950 to 1990 the influence of the 50 to 64 age group is positive, the influence of those above 65 years is negative, while the other groups have only little influence. Feyrer (2008) also discovered a positive effect in his cross country regressions: total factor productivity (Solow residual) rises with age up to about 50 years and then falls, but is still higher in the old age group than in the youngest one.<sup>15</sup> The negative effect of the youth dependency ratio on total factor productivity found by Kögel (2001) results not from age-related productivity differences, but from an age-dependent savings rate: causality runs from reduced saving of young as well as elderly people to reduced funding of research and development, causing slower growth of total factor productivity.

Professional studies, therefore, do not give much support to recent apprehensions concerning an alarming decrease in productivity growth over the coming years. This is all the more relevant, as none of these studies dealt with the third point raised in the introduction to this section: whether the *age-productivity curve shifts to the right as life expect-ancy increases.* If disability-free life expectancy as well as attitudes and habits of the elderly shift in lockstep with life expectancy, as section 2 indicated, productivity of the future 50 to 65 years cohorts will be higher than of today's. The expectations of increased productivity in the future go hand in hand with the anticipation of labour market shortages, which will accelerate rationalisation, innovation and the diffusion of technical and organisational improvements as well as the use of capital-intensive technologies (Beaudry/Collard 2003). In a smoothly functioning labour market, slower aggregate labour force growth will increase the average wage relative to the rate of return to capital and prompt firms to substitute capital for labour (MacKellar 2000).

Three arguments throw a shadow on these pleasant prospects. Older workers tend to change jobs less often and are geographically less mobile (Champion et al. 1998: 65), an impediment that reduces productivity through higher adjustment costs and less efficient matching. The lower mobility to change jobs may be compensated for by higher functional mobility due to better education. A second argument that supports declining productivity is derived from the potential ageing of plants due to reduced growth in demand, which in turn may entail less investment. The third argument relates to a potential twist of the supply mix towards service industries with low productivity growth. The hypothesis regarding

Feyrer (2008) demonstrates that one quarter to one third of the lower productivity of poorer countries results from the younger age of the workforce.

<sup>14 »</sup>Germany will face [...] severe problems elsewhere, and not through an unproductive old labour force.« (Börsch-Supan 2002: 17).

confined productivity growth in the service industries is far from undisputed,<sup>16</sup> however, and Martins et al. (2005: 5) find no substantial effects of changes in consumption habits on aggregate productivity growth.

#### 4. The Effects of a Shrinking Labour Force on Productivity Growth and GDP

The effects of population ageing are frequently tied in with the effects of a shrinking population and of a shrinking labour force. Each of the three effects is different, however. The effects of ageing on productivity are ambiguous, as section 3 has demonstrated. Population decline tends to increase productivity according to neoclassical growth theory by raising the steady state capital labour ratio, since less people have to be equipped with capital (Solow effect). A shrinking labour force, lastly, tends to augment labour productivity.

Labour productivity will tend to increase in Germany due to the decline in population, but not in Austria as population is projected to grow. While the predicted slowdown in population growth may be too small to be of major relevance for production and per capita growth even in Germany (six percent according to EU, ten percent according to Statistisches Bundesamt), the envisaged shortage of the labour force is probably significant. The EU Economic Policy Committee (EU 2006: 47) projects labour productivity growth to rise from 0.9 percent in 2004 to 1.7 percent in 2010 in Germany and from 1.5 percent to 1.7 percent in Austria; growth of potential GDP will decline to 1.2 percent in both countries. Martins et al. (2005: 5) expect a reduction of the GDP growth rate per capita of 0.2 to 0.3 percent p. a. in a typical European country, with labour supply contributing 0.2 to 0.5 percentage points; the decline in the number of workers will be offset at least partially by an increase in the quality of labour. Cutler et al. (1990), in contrast, estimated for the period 1960 to 1985 that a one percentage point increase in annual labour force growth raised productivity growth by 0.6 percent, which implies a negative contribution of the labour force shrinkage to productivity growth. Beaudry/Collard (2003) also revealed a small positive but insignificant effect of growth in the working-age population (15 years to 64 years) on productivity for a similar period, i. e. 1960 to 1974, but a negative one for the more recent period 1974 to 1996. They attribute the negative correlation to capital-biased technical change, which lowpopulation-growth economies were able to exploit more rapidly, since such economies do not need to constantly tap their savings to equip new labour market entrants. Acemoglu (2002a and 2000b) provides theoretical and empirical evidence for factor-induced, i. e. skillbiased, technical progress in the recent past and in the future. As labour-force skills tend to increase and higher skills become more productive, this implies growing labour productivity as well. Bernanke/Gürkaynak (2001) have shown that the growth rates of total factor

<sup>16</sup> The measurement of productivity in service industries is difficult, due to the problems of measuring quality. It is, therefore, likely that service productivity is underestimated. The productivity differences between the US and Europe are largely due to higher productivity growth in the US service industries, especially trade and finance (Nordhaus 2001, Inklaar et al. 2003). productivity and of the labour force are negatively correlated. Slow growth of the labour force works as an incentive for innovation and efficient (productivity increasing) use of capacities (Habakuk 1962, Cutler et al. 1990).

Altogether, the preceding arguments on productivity reveal that the spectres of a strong decline in labour productivity are indeed greatly overdrawn. It is more likely that growth in labour productivity will accelerate and at least partially compensate for the effects of the shrinking labour force.<sup>17</sup> Assuming a labour productivity growth of 1.7 percent per year, per capita GDP in 2050 will be about 120 percent higher in Germany as well as in Austria (table 2). Even with a mere one percent productivity growth – far below historical experience –, income will be more than 50 percent higher. This implies that the <code>>old<</code> as well as the <code>>young<</code>, the <code>>supporters<</code> as well as the <code>>subsidised<</code>, i. e. those living on transfers, can have a better living in 2050 than today. Not the availability of resources will be the problem, but the distribution and the reform of institutions, enabling a transfer of resources from labour market policy and family support to pension funds.

	Germany		Austria			
	2000	2050	Change in %	2000	2050	Change in %
Productivity +1.7% per year						
GDP (bill.€)	2,030	3,878	+91	207	473	+129
Employed labour force (1,000)	39,842	32,808	-17.5	4,457	4,387	-1.5
GDP/employed labour force (€)	50,951	118,206	+132	46,376	107 731	+132
Population (1,000)	84,440	73,959	-12.5	8,110	8 214	+1.25
Per capita GDP (€)	24,041	52,434	+118	25,519	57 538	+125
Productivity +1% per year						
GDP (bill.€)	2,030	2,708	+33.5	207	335	+62
Employed labour force (1,000)	39,842	32,808	-17.5	4,457	4,387	-1.5
GDP/employed labour force (€)	50,951	82,541	+62	46,376	76,271	+64
Population (,1000)	84,440	73,959	-12.5	8,110	8,214	+1.25
Per capita GDP (€)	24,041	36,615	+52	25,519	40,736	+60

Table 2 : Projection of GDP<sup>1</sup>

1 Assumption about employed labour force see table 1.

Source: Author's calculation

<sup>17</sup> Due to statistical problems all the studies use production per employee as a proxy for labour productivity. This results in an increasing underestimation of productivity growth, as the trend towards part-time employment reduces working hours per employee.

## 5. The Effects of the Demographic Shift on Consumption and Saving

According to the two elements of the demographic shift – ageing of the population and shrinkage of the labour supply – two different types of influences need to be considered: the effects of ageing on saving, consumption levels and the composition of consumption on the one hand, and the effects of the shrinking labour supply on incomes, capital-labour ratio and interest rate on the other.

Ageing affects saving, consumption levels and the composition of consumption, but the effects are far from certain for at least two reasons. Firstly, the basis for an evaluation is shaky, as theory and different types of empirical studies suggest divergent results. *Mainstream theory* predicts that an ageing population will have reduced *savings* and consequently that there will be a reduced savings ratio when the baby-boom generation approaches the retirement age. On the micro-level, the life cycle model (Ando/Modigliani 1963) maintains that rational individuals save while still young in order to maintain a given level of consumption after they cease to receive labour income. On the macro-level, asset theory predicts an accumulation of savings in a young society and an asset sell-off, a melt down of savings, in an ageing one (Schieber/Shoven 1994, Schich 2004).

Secondly, the *observed consumption and saving behaviour may change* over time. The extended period of vitality and health as well as later retirement could move the consumption and saving patterns of retirees closer to those of prime-age workers (Martins et al. 2005: 10), that is towards more consumption and less saving. Higher saving, however, could be prompted by an increase in general uncertainty, and even more with respect to pensions, but also by the need to provide for the increased life expectancy.

The *empirical evidence* is weak. The hypothesis of lower saving rates among the elderly is weakly supported by cross-country time series studies (Auerbach et al. 1991, Deaton / Paxon 1997). Consumption smoothing over the life cycle, however, implies the absence of liquidity constraints and of inheritance motives and is in conflict with the micro-level evidence of household surveys, which do not show any reduction in the stock of wealth during retirement (Kotlikoff/Summers 1981, Attanasio/Weber 1993, Poterba 2001). Hildebrand (2001) finds little evidence for pre-retirement saving in a large share of U.S. households, while Börsch-Supan / Reil-Held (2003) affirm positive financial savings among elderly German households. Bloom et al. (2003) estimate that an increase in life expectancy by ten years increases the savings ratio by 4.5 percentage points. The saving rates of retired persons in a sample of six OECD countries is at approximately 15 percent, even (marginally) higher than those of the cohort aged 40 years to 44 years (Miles 1999: 5). Household surveys, however, may tend to overestimate the savings of the elderly: apart from other problems, they calculate saving as income less consumption<sup>18</sup> so that wealth reduction is not considered to be dissaving (Miles 1999: 6), disregard revaluations of existing assets, and they do not account for the higher life expectancy of the rich whose wealth tends to be reduced when retired (Sabelhaus/Pence 1999).

18 Even small errors in the relatively large aggregates reported income and consumption imply large errors in the rather small aggregate saving.

Similar to life-cycle hypothesis, the theoretical basis for the asset melt-down hypothesis is controversial (Schmitz 2005) and the empirical evidence weak. Historical data give only limited support (Poterba 2001 and 2004) and Fehr et al. (2003) even provide arguments on behalf of a reverse melt-down due to a shortage of capital and strongly increasing rates of return.

Simulations with a calibrated overlapping-generations model demonstrate that

»saving in the longer term is likely to fall well below recent levels, as the proportion of the population aged over 65 rises to levels never before seen. Secondly the impact upon rates of return may be relatively muted because a lower saving rate [...] is likely to be offset by a smaller workforce.« (Miles 1999: 34 f.)<sup>19</sup>

These results are interesting but should not be taken at face value. The model is based on the assumption of the standard hump-shaped productivity pattern which is highly uncertain (see section 3 of this paper), and it excludes uncertainty as well as links between the generations. The author emphasises that uncertainty with regard to labour income will lower saving even more. He neglects to address three additional types of uncertainty, however, which appear much more important and unambiguously increase precautionary saving: the uncertainty about future pension payments as such,<sup>20</sup> as well as about their level,<sup>21</sup> the uncertainty surrounding the length of the remaining life span, which increases as the retirement period becomes longer (as a consequence of higher life expectancy), and, last not least, the uncertainty concerning the cost of illness and nursing at a higher age, intensively discussed lately (»Pflegeversicherung«). Ignoring savings for bequest motives may bias the results heavily downwards as well, as European societies have achieved wealth over two generations,<sup>22</sup> after the losses due to two wars, two serious inflations, and the Great Depression. They are proud of this wealth and keen on keeping it intact. The loud calls for the abolishment of the inheritance tax in Austria are an important indicator for high and probably even increasing savings for bequest motives.23 Taking into account uncertainty and restrictions to consumption smoothing reduces any potential effect of ageing on saving even further (Browning/Lusardi 1996). If there is any negative effect of ageing on saving at all, it is unlikely to be larger than, say, five percent.

Even if the savings ratio remains unchanged, the *forms of saving* may change. The shift from deposits to capital market instruments will most likely continue while the citizens' uncertainty about the future of the pension system will reinforce private saving for old age.

19 Saving rate halved, interest rate falls by 50 basis points

20 The uncertainty regarding the survival of the pay as you go (PAYG) system is reinforced by the continuous reduction of the so called second pillar of defined-benefit (DB) firm pensions.

21 Especially as a consequence of the strong trend from DB to defined cost (DC), shifting the risks from the insurer to the insured.

22 »As impressive as were the gains in life expectancy during the twentieth century, the gains in income per capita were greater still« (MacKellar 2000: 365).

23 In the U.S. gifts and bequests account for one half to two thirds of total wealth.

Instruments suited for this specific motive will gain significance and it is to be expected that the financial industry will invent new forms (OECD 2005).

Just as with productivity, the effects of ageing on saving are highly uncertain, not only quantitatively but also to the sign of the coefficient. The effects of ageing on *consumption* are less uncertain: per capita consumption will drop in an ageing society, as the per capita consumption of elderly persons is below average, mainly due to lower income. Consumption expenditures of the retired in Austria are below those of the non-retired by about one third, adjusted for household income, household size and household composition by about one seventh (Url/Wüger 2005). The disparity may even grow in the future due to the financial pressure on pension systems and the labour shortage-induced increase of the relative wage of the younger cohorts (Blanchet 1992: 127). Within consumption, expenditure for education, transport, leisure and apparel will fall (Martins et al. 2005: figure 3.4, Url/Wüger 2005). The shift in consumption will entail shifts in production and consequently shifts in demand for skills, giving rise to some matching problems, which may reduce productivity. The problems are likely to be insignificant however.

While the effects of ageing on saving are highly contradictory, much more conformity can be found in terms of the *effects of the shrinking labour supply* on incomes, capital-labour ratio and interest rate. With the shortage of labour, capital will turn out as the abundant factor. In a smoothly functioning labour market, slower aggregate labour force growth would increase the average wage relative to the rate of return to capital and prompt businesses to substitute capital for labour (MacKellar 2000: 365, Schmitz 2005).<sup>24</sup> Higher capital intensity increases labour productivity and compensates for the shortage of labour at least in part.

## 6. Ageing and the Capital Stock

If the forecasts for Germany and Austria as well as for most other European countries come true, the labour force will shrink so that capital will be the abundant factor. The capital intensity of production will tend to rise, even if the return to capital falls. Does this imply an over-proportional rise of the stock of physical capital?

Higher capital intensity of *production* does not necessarily imply higher capital stocks. Demand for capital will *de*crease once the increase in the stock of physical capital per worker is overcompensated by the shrinking number of workers. Whether this will happen depends on the form of technical progress, on the development of human capital and on the elasticity of substitution between labour and capital.<sup>25</sup> If Acemoglu (2002a and 2002b) and Beaudry/Collard (2003) are right and demand-driven technical progress in fact dominates,

24 Wages of older workers will fall relative to those of younger ones as a cause of labour force ageing, implying a flattening of the age-earning profile.

25 In a closed economy, investment, of course, is equal to saving by definition. In an open economy goods and capital flows can attenuate the effects of ageing on saving. As a consequence of the home

the human capital stock may become more important than the physical. If capital is less than a perfect substitute for labour, slower growth of the labour force implies a downward pressure on the rate of return to capital (Schieber/Shoven 1994). Empirical evidence from time series data for Canada, the United Kingdom and the United States does not, however, give any sound evidence on the response of asset returns to changes in population age and structure (Poterba 2004). Again we must admit that we know only little about the effects of an ageing population: The demand for capital may rise or fall and the same is true for saving. The ageing-saving relation, whose sign is ambiguous (see section 5) will be influenced by policy as well. A reduction of the PAYG system will increase the uncertainty and boost saving. But any increase in pension wealth will most likely be compensated for, at least partially, by a decrease in other forms of wealth (Gale 1998, Poterba et al. 1997, Kohl/O'Brien 1998). Neither over-saving nor under-saving can be excluded. Whether the one or the other will dominate depends largely on the degree and the type of uncertainty savers and investors feel.

The stock of *human capital* will rise as a consequence of ageing, but the consequences of the shrinking labour force are uncertain. Ageing will increase the stock of human capital as individuals accumulate human capital in the course of their lives, and, at least up to the age of 50 years, depreciation will certainly be smaller than accumulation. The average vintage of knowledge, however, may increase somewhat, slightly reducing capacities to innovate. A shrinking labour force will tend to increase the stock of human capital, as the smaller cohorts entering the labour market will have enjoyed a better education. Research has shown a significant decline in the return to education as cohort size increases (Stapleton / Young 1988, Connelly/Gottschalk 1995, Gottschalk 2001). This implies that the smaller cohorts following the baby-boom generation will obtain higher returns on education and therefore invest more in human capital accumulation. The positive effects on each worker's human capital, however, are mitigated by the smaller number of workers.

#### 7. How to Live With the Uncertain Consequences of Ageing

The paper may appear agnostic in emphasising that all the answers to the key questions regarding the consequences of ageing are ambiguous. If there is such a tendency, it must, however, be seen against the backdrop of a prevailing tendency in the media – but also among experts – to stylise the shrinking and ageing of societies as a decline into ruin and poverty: that Europe will soon be populated with starving coffin dodgers; that the few workingage citizens will not be able to support them, neither financially nor in real terms, as they themselves will have grown old, and that their productivity as well as their innovative capacities will have declined considerably; that capital shortage will impede investment, as

bias, the simultaneous ageing of almost all developed countries, and the lack of save investments in the rest of the world, this effect will be small, however.

the old will dissave and the young cannot save as a consequence of the burden of transfers. The paper's message is that such a scenario cannot be excluded, but that it is highly unlikely. In a nutshell:

- the population forecasts are highly uncertain, and in their latest version are mostly revised upwards;
- within the population, the number of old people will increase and the number of working-age people will decrease; the support ratio will, nevertheless, increase only slightly, as there will be fewer children, lower unemployment and fewer early retirees;
- life expectancy will increase by seven to eight years up to 2050 and the average age by six years, but society's attitudes and habits may not differ much from today's, as expectations are that they will move in parallel to the increase in disability-free life expectancy;
- productivity growth is rather unlikely to decline as the workforce ages due to the increase in disability-free life expectancy;
- continued productivity growth combined with a shift to higher capital intensity of production – a consequence of the expected shortage of labour – may prevent a slowdown of per-capita growth;
- little evidence can be found that the ageing of a society reduces saving.

The evidence provided by scientific literature suggests that the consequences of ageing are in all probability considerably less frightening than is widely believed today. This does not mean that ageing will not pose serious problems. Quite the contrary: which of the potential scenarios will become reality at the end of the day depends highly on policy. However, the problems confronting policy are different from the problems attracting most of the attention today. The most important problem – much more important than the financing of pensions - will be how to raise the age of retirement. The triple effect of a higher retirement age: increase in the number of workers, increase in the contributions to the pension system and reduction of the payments for pensions, can solve both the financial and the real problem of ageing at the same time. Nevertheless, to raise the retirement age will prove a hard job, as the attitude to early retirement is deeply rooted in the employees' and employers' mindset. The second serious problem is the reorganisation of transfers: the support ratio will – contrary to widely held expectations – increase only slightly in the coming 50 years, because fewer children, fewer unemployed and fewer early retirees will at least partly compensate for the higher number of retirees. Funds, therefore, must be shifted from family support and unemployment insurance to pension insurance. This is difficult to implement from a policy point of view, as each of these funds leads a life of its own and strongly tends to compensate any need for lower expenditures by searching for other expenditures or at least reduce contributions.26

26 The administration of these funds is heavily influenced by lobby-groups, family organisations and social partners, for which the employers want to reduce contributions while the labour unions argue for improved benefits.

A third important precondition to warrant success when dealing with ageing is support for the trends that enable the elderly to maintain their productivity. This requires not only lifelong learning, which is widely accepted today but less frequently practised. It also calls for a wide range of organisational changes: from the adaptation of workplaces and the need for older employees or precautionary health care to sustain their ability to work to the timely retraining and transfer of workers to less demanding jobs. A last and very important prerequisite for avoiding a gloomy scenario is the reduction of uncertainty: if everyone believes that ageing will give rise to major problems, that the economy will shrink and their pensions are at risk, everyone will reduce consumption to save individually for old age and will thus inevitably cause the very slowdown of growth they fear. Reducing uncertainty, however, is an extremely difficult task.<sup>27</sup>

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<sup>27</sup> For some points of departure see Tichy (2006b).

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