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Is Human Capital the Solution to the Ageing and Growth Dilemma?¹

Thomas Lindh

Institute for Futures Studies – Uppsala University

1. Introduction

When the population of industrialized countries is greying and the retired share of the population increases economic growth will most likely be retarded. The fiscal problem of providing for the elderly with a diminishing tax base may therefore be exacerbated by a decreasing growth potential. This paper discusses the potential to remedy this by increasing the level of human capital in these economies. The conclusion is that growth levels can probably be preserved by a broad approach consisting not only of increased education but also intensified and lengthened utilisation of available human capital combined with labor imports and increased fertility. Nevertheless the basic redistribution problem remains to be dealt with and cannot automatically be solved through growth promoting policies nor by pension reforms.

2. Ageing, Redistribution and Growth

There are obvious reasons why an ageing population should put downward pressure on economic growth rates. First, the increasing share of elderly will be expected to decrease the relative labor supply. Second, an increasing share of elderly will put pressure on budget deficits and should according to the life cycle hypothesis depress private savings in the economy. Thus, a downward pressure on

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the supply of both labor and capital could result in negative growth effects. But there are also more subtle ways in which an ageing population can depress growth. On the demand side an ageing population will tend to shift demand towards services rather than goods and in most countries this also entails a shift toward more public services. There are well known reasons (Baumol's disease) why a more service oriented economy may have a slower productivity growth. Public services as well as many transfers to the elderly are generally tax financed and thus the excess burden of tax wedges may increase. A shift towards more labor intensive services coinciding with decreasing labor supply would also be expected to raise compensation for labor relative to capital. With a booming labor market for relatively simple service jobs there is a risk that the demand for education becomes weaker, and thus eventually the human capital content of labor is reduced and further aggravates the slowing growth trend. The danger of getting into a negative feedback spiral through some or all of these mechanisms is not very far-fetched.

Furthermore, there is by now plenty of empirical evidence that the productivity slowdown in the 1970s to some extent can be linked to the ageing of the population that took place in most Western countries at that time and with a considerable lag hit Japan in the 1990s.² Large dependency ratios correlate with low growth, but there is little consensus on how different mechanisms will interact nor indeed on the quantitative impact of potential counteracting forces like longer working life as people become more healthy at higher ages, labor scarcity is eased by immigration, capital imports by ever more globalized capital markets, etc.

The purpose of this paper is not to build an extensive model of this complicated nexus, but to discuss the quantitative scope for rational policies to counteract the negative feedback pressures that may arise in an ageing economy. The second purpose is to argue that growth is a second order problem when facing the future ageing problem. The real challenge is the redistribution pressure that rising dependency ratios necessarily imply. While growth is still important in order to ameliorate the conflicts that this pressure gives rise to, the central dilemma will still be how to maintain a socially acceptable standard of living for the elderly and still invest sufficiently in the young.

The plan of this paper is to first lay out some theoretical points that I find important to keep in mind when discussing human capital and growth. That is done in Section 2. In Section 3 some quantitative exercises illustrate the empirical order of magnitude of the ageing problem. In Section 4 the redistribution dilemma is discussed in more detail. Section 5 finally concludes and summarizes.

²See Lindh and Malmberg (1999), Bloom and Sachs (1998), Bloom et al. (2000) for some examples. Kelley and Schmidt (1999) provide an overview and general discussion.

3. Human Capital and Productivity Growth

First of all, let us state the obvious. Without people there is no human capital. There is no such thing as raw labor, this is only a convenient abstraction for what is considered a common basic level of human capital possessed by all (or nearly all) adults. The exact meaning of adult may, however, differ considerably between cultures, time periods and even the specific productive activity. Thus, giving birth to and raising a child to a level where it can support itself is actually an act of human capital investment. The duration and requirements of bringing up and educating a child to a self-supporting individual are strongly dependent on the social context as well as the technology of production. Some of these costs are borne by the parents (maybe with some consumption motive being an important offset but also as a major part of the intergenerational transfer system), much of it by household production outside the market economy. In modern societies we generally find that a substantial part of the young child's education is financed and in general also provided by the public sector. By taxation of income this later yields a return that is sufficient to keep financing the system. If that was the complete story there is really no reason why the education of children could not be financed through ordinary credit markets. There would be no need for the public sector to intervene in this relation and some tax wedge inefficiencies could be avoided. Yet, almost universally we observe public provision of at least primary education, often also the secondary and in quite a lot of cases even important parts of the tertiary education.

Some kind of externality or market imperfection in the provision of education is therefore a natural hypothesis.³ One such imperfection could be credit constraints, which have received a major part of the attention in the literature trying to explain how less inequality could be associated with higher growth (Aghion et al.1999). Indeed it is quite difficult to approach your local bank manager with a proposition for a loan to finance education putting up the child's future income as collateral. Thus, a major part of the population would be excluded from education if parents had to pay the costs up front. But there have also been other suggestions of schooling externalities, such as the fostering of discipline, culture and generally civilized behavior, creating an environment where productivity may grow faster through a variety of potential mechanisms such as higher investment in both capital and human capital because of generally smaller risks, or by the cumulative effects of increasing knowledge production and technological change, or by creating virtuous circles where better health, political stability and so on permit individuals to realize their full economic potential. As some authors have suggested (Galor and

³It is conceivable though that social altruism actually extends beyond the parental altruism by protecting children's interest when they come into conflict with parental self-interest. Market failures is thus no *necessary* explanation for public provision of education.

Weil, 2000) a quality-quantity trade-off may become more advantageous once industrialization has started to provide economic opportunities outside the home for women. There are plenty of possibilities and a blossoming literature on how such processes could be started by the correct combination of institutions or even as an evolutionary process favoring families with stronger preferences for child quantity than child quality (Galor and Moav 2002), etc.

This is a fascinating research area in itself but it would lead too far to go into this further here. There is one aspect of the quality-quantity trade-off that is important although we still know rather little about it.

3.1 The Trade-off Between Costs for Investing in Human Capital and Social Return to those Investments

The costs for investing in human capital are shared by individuals and the public sector. The former are mainly in the form of opportunity costs either for the individual himself, abstaining from wage income during higher education, or in household production in the family for the parents while the individual goes through primary education. The latter costs are mainly teaching costs at different levels, sometimes offset to some extent by tuition fees. The private return to the individual accrues to him through wage income later in life (tied more or less tightly to pension benefits in retirement) but there is in general little or no accrual of returns to the parents, save the altruistic utility they get through the success of their children and---in some cultures---an old age insurance for those who happen to outlive their own productive capacity. The social return accrues in part through the direct channel of taxation of the higher income but in part also through positive externalities that educated people may have on their environment and the productivity of other factors of production in addition to the positive effects on their own welfare.

We can measure the income effect of education through its relative wage effect, which in turn depends on a number of other factors, like relative supply and demand for different factors of production. This observation simply means that the observed wages are related to marginal productivity and not average productivity, thus dependent on relative scarcity and comparative advantages as much as or more than its average effect on productivity growth.

To get at the latter effect we need to evaluate the effect at the macroeconomic level. There is by now a large literature following the lead of Barro and Lee (1993) in trying to estimate these effects on cross-country or country panel data. Although results are often ambiguous and there are quite a lot of dissenting voices a rather fair assessment of the literature is (Krueger and Lindahl, 2001) that increasing the average years of schooling in the population will give positive effects on growth as big as private returns or larger but with a non-linear effect with a maximum around

8 years of schooling. The size of these effects and whether the returns actually cover the costs is still an unresolved issue since it is far from clear to what extent the coefficients catch a correlation due to reverse causation. Bils and Klenow (2000) concludes from a simulation experiment that only about a third of the effect is causal from schooling to growth the rest is causal from growth to schooling. Most of the correlation is due to being able to afford more schooling rather than to its enhancing effect on growth.

Anyway, there is not much hard evidence that tertiary education in developed countries has any major positive causal effects on general productivity growth. That is not particularly surprising since a simple thought experiment immediately tells us that there must be decreasing returns in the length of education for an individual. Suppose somebody increases years of education up to the end of life. Obviously the cost of this is not offset by any income and thus the pecuniary return must necessarily be negative.⁴

From this we cannot draw the conclusion that education is no longer profitable in developed countries. But it seems to me that more sophisticated empirical approaches are needed in order to actually quantify the effects.⁵ This is not the place to deepen that discussion, however, and I only use the state of research as a motive to attack the question in the title of this paper from another angle than direct measurement.

4. The Quantitative Impact of Human Capital on Growth

Instead of trying to answer the question how much impact years of education actually have, I approach the question what impact we would need in order to make the transition to the grey economy more painless. Thus I will treat a hypothetical question under a number of simplifying assumptions as a vehicle towards a better understanding of the possibilities inherent in a human capital approach to ageing problems.

It is instructive to start the investigation by looking at how the ratio of elderly 65+ to the working age population set to 20-64 is forecasted by the UN medium variant to develop up till 2050. I have chosen eight, as I believe, representative European countries in order not to clutter the graphs too much. Apart from Japan the rest of the developed world have less serious ageing problems than the worst European countries. The selection here therefore gives a fairly representative

⁴Two different qualifications should be noted. One is that human capital is also accumulated by learning-by-doing, a mechanism which may be self-financing. The other is that for some individuals a life of education may be welfare enhancing although it can never be so for all individuals.

⁵Better measurement is an important first step, as shown by de la Fuente (2004).

picture of the spread in forecasted elderly dependency ratios for the developed countries in the next 50 years.

The general trend in chart 2 is crystal clear, there will be fewer working age people available to support each elderly person. However, the magnitude of the problem is vastly different between the European nations I have chosen to illustrate this. While Ireland will do comparatively well, only doubling its dependency ratio between 1950 and 2050 Spain is projected to quadruple it. Expressed in another way there were five or more potential workers to support each elderly person in all these countries in the beginning of the 1950s, the number now lies between 3.3 and 5 potential workers per elderly person, and is expected to go down to 5 workers for two elderly (Ireland) or even down to 5 workers for 4 elderly (Spain). Also note that only a small part of this rise is behind us, most of it still lies ahead. Although this way to illustrate is crude, taking no account of actual participation rates, it gives the general flavor of the problem. Of course, not everybody between 20-64 can be expected to work, and there are a few people outside these age brackets that actually do work. Furthermore, the flattening out of the curves towards 2050 are based on UN assumptions that fertility will eventually rebound from its current low levels in these countries⁶.

⁶These are the UN (2000) assumptions for the medium variant: Fertility in low-fertility countries is generally assumed to remain below replacement level during most of the projection period, reaching by 2045-2050 the fertility of the cohort of women born in the early 1960s or, if that information is lacking, reaching 1.7 children per woman if current fertility is below 1.5 children per woman or 1.9 children per woman if current fertility is equal to or higher than 1.5 children per woman.

Chart 1: The Elderly Dependency Ratios (the Population Aged 65+ Divided by the Population Aged between 20-64) as Estimated and Projected by the UN Population Division

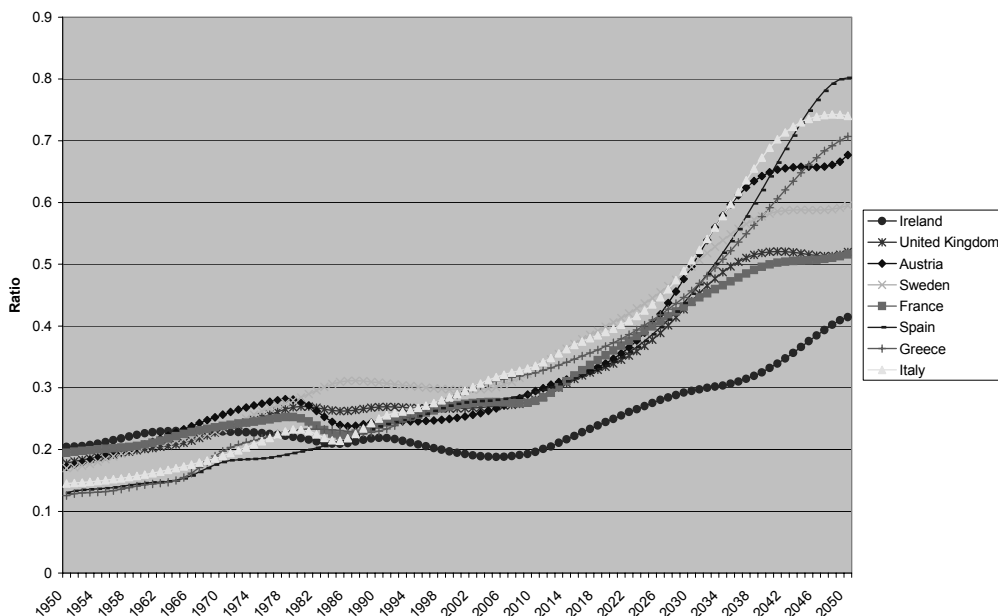
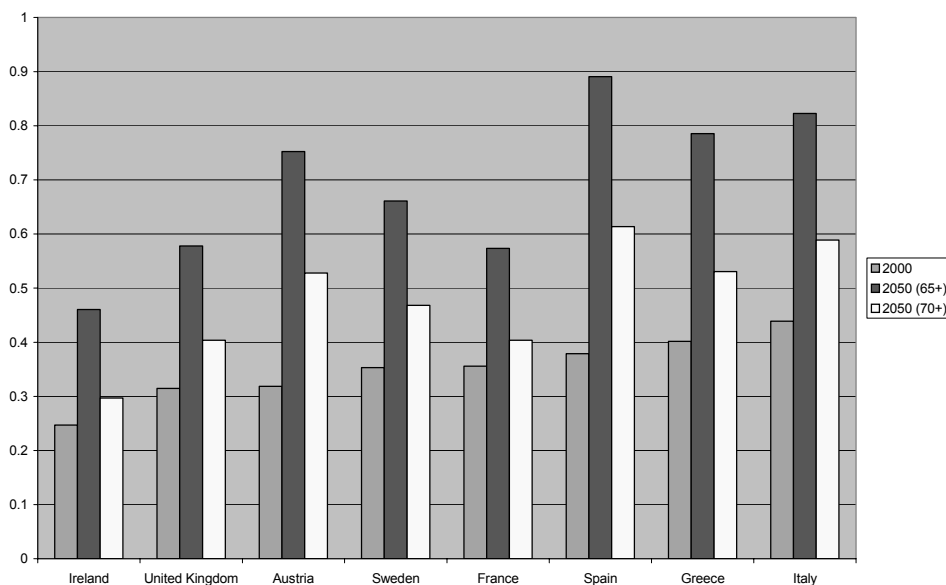


Table 1: Labor Force Active Percentages in Different Age Brackets

Activity rates	Greece	Spain	France	Ireland	Italy	Austria	Sweden	UK
15 to 24 years	38.1	42.9	35.6	51.1	38.1	56.1	40.7	63.6
25 to 34 years	82.9	83.1	87.1	85.7	75.4	86.2	83.3	84.8
35 to 44 years	80.2	79.7	88.1	78.0	78.9	87.9	88.8	85.4
45 to 54 years	69.7	68.8	83.8	70.2	67.5	80.7	88.3	82.0
55 to 64 years	40.6	40.9	31.6	46.3	28.6	31.4	68.4	52.8
65years above	5.4	1.7	1.1	8.0	3.2	3.0	5.0	5.3

Source: Eurostat 2003.

Chart 2: The Ratio of the Population 65+ to Persons Actively Working in 2000 and the Same Ratio in 2050 Assuming 0.9 Activity Rates in Each Age Group between 20 – 64 (Darker Shade) and Extending that Activity Rate up to 69 (Lighter Shade)



Source: UN (2000) and Eurostat (2003).

The next question is whether we can change the message of chart 2 by increasing labor force participation. In table 1 the 2000 activity rates in different age groups for our country sample are reported. Using these rates I convert the age groups in 2000 to labor and report the elderly dependency ratio of 65+ to labor in chart 4 compared to the same ratio in 2050 assuming a violently optimistic 90 percent labor force participation in all age groups 20-64. Even under this assumption elderly dependency rates will increase sharply although less dramatically.

What if we lengthen working life with another 5 years for 90 percent of the age group up to 70? Dependency rates will still increase but more moderately.

These experiments give us an idea of the sheer size of the ageing problem. More realistic assumptions on how labor participation could possibly increase must concede that it would be hard to raise participation among the young very much without interfering with education. Nor can we expect to raise participation in the age intervals above 60 anywhere close to 90 percent, since a substantial part of the labor force is simply worn out at these ages. Thus we must conclude that even massive mobilization of people able to work will only moderate and not

fundamentally change the tendency for increasing elderly dependency ratios.

Now, what about education? How much do we need to increase the *efficient* labor force in order to keep the ratio of population or part of the population to labor units constant? Efficient labor meaning that we multiply the number of persons by a productivity factor making the actual productive capacity of the active population comparable at different points in time.

Now, let us get back to the question of whether human capital accumulation can solve the problem. Suppose that the efficiency of labor increases with education and we manage to achieve a general increase in education of say five years. I will assume that this increase is implemented by letting everybody not yet in active ages have five more years of education starting in 2000 and then go into the work force under the stylized assumption that participation rates remain the same except that the 15-24 rate now holds for the age group 20-29 instead and shifts five years for all other age groups but that working age is still cut off at 65. I.e. those 65 and above that are in fact still working are ignored. After 50 years the effect of this education change has diffused throughout the whole working population. Suppose that those five years of education increases the efficiency of labor by 100 x percent. If we standardize efficiency such that the active population in 2000 has an efficiency factor of 1 in each age group $A_{2000} = E_{2000}$. We then have an efficient labor force in 2050 which is $1 + x$ times the active population and we can solve for the increase in efficiency needed to keep the *efficient elderly dependency rate* constant, i.e. $A_{2000} = E_{2050}$. If A is active population and E is the efficient labor we can solve x from the equation

$$1 + x = \frac{A_{2000}}{E_{2000}} \cdot \frac{E_{2050}}{A_{2050}} = \frac{A_{2000}}{A_{2050}} \quad (1)$$

This ignores that the active population might have an increasing efficiency trend due to already implemented increases in education and thus exaggerates the efficiency increase needed. On the other hand the calculation takes into account only the opportunity cost of education and not the teaching costs, so the numbers still give an indication of how much productive efficiency would have to increase as a result from these five years of education on average over the working life. In the remaining columns we compensate in the other direction by assuming activity rates of 90 percent for everybody 20-64 and 20-69 respectively, thus ignoring that five more years of education is hardly implementable without letting a substantial part of those below 30 to be outside the labor force.

Table 2: Solutions to Equation (1) Tabulating $1+x$ for different assumptions on Participation Rates. Ratio 1 is if Current Participation Rates Hold in 2050 only Shifted 5 Years in the Age Distribution and Worklife Cut off at 65. Ratio 2 is if Participation Rates Increase to 90 Percent in Age Groups 20-64. Ratio 3 also adds the Group 65-69 as active up to Percent

Country	ratio 1	ratio 2	ratio 3
Ireland	1.88	1.45	0.93
United Kingdom	2.16	1.81	1.27
France	2.34	1.80	1.27
Sweden	2.50	2.08	1.47
Austria	2.96	2.36	1.66
Greece	3.43	2.47	1.66
Italy	3.80	2.58	1.85
Spain	3.83	2.80	1.93

Estimates of the return to education varies quite a bit over countries but an average of around 10 percent per year of college education probably gives a rough figure for the average private return (when taxes and subsidies have been factored in) see OECD (2002). Thus the required increase in efficiency for the upper part of the countries in table 2 column 3 makes the private return level sufficient but for the lower part the efficiency increase has to be higher even though participation rates are at unrealistic 90 percent from 20 up to 69 years. Adding some extra years of active work, increasing labor force participation and perhaps increasing worked hours would still require larger efficiency gains than the private returns, and as remarked above this is very unlikely to be the case.

Refining these calculations in various ways, factoring in technical change, increased migration etc., it seems quite possible to bring down the impact of ageing in terms of efficient labor per retiree in various ways. Combining a range of different factors we may very well be able to preserve dependency ratios of efficient labor near today's dependency ratios, although it seems very unlikely that any one factor will do the trick by itself.

From these exercises I draw the conclusion that the answer to the question whether human capital can solve the growth problem just by increasing education is no with a high likelihood, while it does seem possible that in combination with higher utilisation of the human capital and support from higher capital intensity, some labor import and technological change, growth at least can be kept up to such an extent that living standards on average continue to rise in an ageing society.

However, this dodges the real dilemma with ageing. The number crunching exercises above were designed to illustrate the magnitude of the shift in the age

distribution. After all, the standard of living in the ageing countries is so high that even at current productivity levels we would be able to support the (mostly stagnant or decreasing) population at a decent level in relation to what most of the inhabitants of this planet have to settle for. The real dilemma is the distribution of total income over different groups. That is the topic of the next section.

5. Growth and Distribution

There is by now a rather general consensus that ageing is likely to dampen growth rates in the economy for several reasons. A stagnating or decreasing work force in relation to the population will for pure accounting reasons bring down the growth rate of GDP per capita. On top of this we may add an expected decrease in domestic saving, downward pressure on the budget deficit, a shift in demand towards services with lower productivity growth, increasing time spent in education and so on. The debate is not so much about the direction of the ageing effect on growth but rather its magnitude, something that often boils down to a disagreement on what the reasonable rate of growth in total factor productivity might be.

Some formal framework aids in seeing exactly how the redistribution issue works. Let Y stand for GDP, P the total population and A the active working population (or labor force in terms of heads) while D is the dependent population.

$$\widehat{\left(\frac{Y}{P}\right)} = \hat{Y} - \hat{P} = \hat{Y} - \frac{1}{1+\delta}(\hat{A} + \delta\hat{D}) \quad (2)$$

where the hat denotes the logarithmic derivative or growth rate and δ is the dependency ratio. Let g be the growth rate of GDP per capita and y average labor productivity. Then we can rewrite

$$g = \hat{y} + \frac{\delta}{1+\delta}(\hat{A} - \hat{D}) = \hat{y} - \frac{\delta}{1+\delta}\hat{\delta} \quad (3)$$

and it is clear that an increasing dependency ratio will decrease the per capita growth rate at a constant growth of labor productivity. Moreover the difference $\hat{y} - g$ increases with the level of the dependency ratio. In standard specifications of production functions with constant returns

$$y = f(k) \quad \text{and} \quad \hat{y} = \alpha\hat{k} \quad (4)$$

where k is the capital intensity and α is the capital elasticity, a common stylized value being set to 0.3 or sometimes a third. The marginal conditions for optimizing profit are

$$f'(k) = r \quad \text{and} \quad f(k) - kf'(k) = w \quad (5)$$

and $f(\cdot)$ is a decreasing function so in steady state this Solow (1956) specification requires zero growth for a given interest rate, hence a time dependence with an exogenously given rate of growth is generally added (technological change)

$$y = f(k, t) \quad \text{and} \quad \hat{y} = \gamma + \alpha \hat{k} \quad (6)$$

If the active population is stagnating or decreasing very small or no new investment is required to make the capital intensity grow. However, to maintain equilibrium interest rates will have to go down and thus, in most models investment will go down to levels consistent with domestic or international savings decisions. In traditional Cass-Koopmans models where a representative agent optimizes consumption utility over an infinite horizon these savings decisions depend on the intertemporal elasticity of substitution and the difference between the subjective discount rate for future consumption and the rate of interest. While that type of model may be perfectly relevant for the analysis of steady-state economies, they are more or less useless for the analysis when the population age structure is out of balance, which, of course, is the case in ageing economies, and will continue to be the case for the rest of this century.

Overlapping generations models are then much more relevant, although still fairly intractable out of steady state. Blomquist and Wijkander (1994) show in a simple OLG framework that we can expect no stable relation between interest rates and household savings when we allow for baby booms that destabilize the age distribution. The pulse generated by these events will create a highly variable macroeconomic environment that generally disfavor large generations (by lower wages and lower interest rates), i.e. the Easterlin hypothesis (Easterlin 1968). That conclusion is, however, subject to the caveat that intergenerational transfer systems and policy may actually reverse the relation, something which seems to have happened in Sweden for example (Dahlberg and Nahum, 2003) while the original Easterlin hypothesis seems to be valid in the United States (Macunovich, 1998).

In the general pension debate it has been very much emphasized, in line with Samuelson (1958), that funded pension systems generate capital investment, the return of which both boost growth and support the old generation. In contrast PAYG systems only yield a return equal to population growth, which is negative for many developed countries in the future. This conventional view need qualifications in several dimensions. First of all, it is the growth in the labor force that yields the return in the PAYG system, more specifically it is the growth in the

efficient labor force, meaning that human capital investments will increase returns in a PAYG system. Second, in modern economies national savings are actually much more dependent on budget deficits than on household saving, something that substantially weakens the link between private savings and capital investment. Third, in an open economy there is no direct link between national savings and capital investment, even if we empirically observe a home bias in this respect (Feldstein and Horioka, 1980), thus severing the link between national saving and national growth. Fifth, more capital investment is not necessarily growth increasing in a mature economy, it might very well be sub-optimal. In the Solow type model above there is an optimal level of capital intensity in steady state, while we in some of the endogenous growth models have non-decreasing returns to capital implying that capital externalities drive growth. But even in that case it is in general not welfare enhancing to boost capital investment indefinitely. In most endogenous growth models the growth generating mechanisms are furthermore tied to more immaterial investments in knowledge and human capital.

In this context I will therefore not pursue further how capital investment will affect future standards of living for the elderly, but only conclude that the conventional view that more investment is better is not necessarily relevant. Moreover, to the extent that it is relevant it implies that decreasing savings as the boomers retire can be expected to generate even more problems with growth and redistribution. Capital assets, also in the form of pension claims, are very unevenly distributed and capital returns from domestic production has to come out of the current value added anyway, in the form of taxes, decumulation of assets or capital returns. In a closed economy that implies that for capital returns to preserve the relative standard of living for the elderly as their relative numbers grow, the labor share of production need to decrease.

5.1 The Redistributive Dilemma

Let Y_A and Y_D denote the aggregate income that is disposable for consumption and saving for respective group. Note that this is not the conventional disposable income concept, but includes the government consumption and transfers, private and public, of the active population and the dependent population respectively. Thus we have

$$Y_A + Y_D = Y \tag{7}$$

in a closed economy. Using y_A and y_D for the average level of this income we can rewrite this as

$$y_A + y_D \delta = y \tag{8}$$

and denoting the ratio of dependent average income to active average income with $\beta = y_D/y_A$ we get

$$1 + \beta\delta = \frac{y}{y_A} \quad \text{or} \quad \beta\delta = \frac{y - y_A}{y_A} \tag{9}$$

Given that we do not want to change β it follows that an increasing dependency ratio necessarily increases the relative difference between value added per active and the income actually disposed by the active population. This conclusion holds, no matter how fast growth we have since

$$\hat{\beta} + \hat{\delta} = (\hat{y} - \hat{y}_A) \frac{y}{y_A} = (\hat{y} - \hat{y}_A)(1 + \beta\delta)$$

Thus even at much higher growth rates than today we cannot keep the relative standard of living of the dependents constant without decreasing the share that the active population gets from production. In a system where we have pay-as-you-go transfers to dependents this is quite obvious, but it holds also in a funded system in a closed economy where the capital share has to increase at the expense of the labor share. Since it is considered a stylized fact that labor and capital shares should be more or less constant in the long run this may not even be possible in a free market system. Since the dependency ratio may double or even quadruple very large changes in the relative share of income that the active population commands must take place unless we are prepared to accept changes of the same magnitude in the relative living standard of the dependents. In an open economy another way is opened by investing capital abroad today and bring it home again later. I will return to that possibility in more detail below.

Obviously it will in traditional welfare states be much easier politically to increase transfers to the dependents if growth is high enough to support increasing standards of living for everybody. In more liberal economies with less public parts of intergenerational transfers the same reasoning also goes through since increasing capital shares at the expense of decreasing wages are almost certain to lead to social disturbances and labor conflicts. In more traditional economies where intergenerational transfers take place within the family these obligations are much likelier to be honored if income grows fast enough that active earners can improve their standard of living and still support their parents at a reasonable level. In view of the magnitude of the changes in dependency ratios and the likelihood that growth will actually be depressed it does seem rather unlikely that we can wholly avoid increasing conflicts of interest between the young and the elderly but the

intensity of the conflict will undoubtedly depend on the rate of productivity growth.

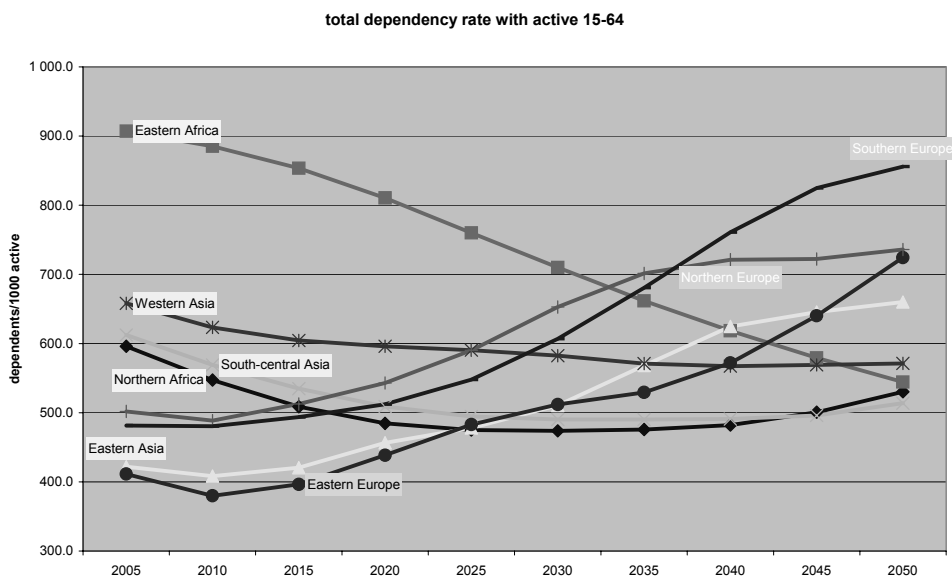
5.2 Open Economies and Financial Markets

Chart 6 shows some regional projections of dependency rates from UN (2000) medium variant using as active population the groups between 15 and 64 years old. While Europe and Eastern Asia have rising total dependency rates due to ageing and in spite of low birth rates the African and Asian regions have decreasing dependency rates due to ageing of the child cohorts and decreasing birth rates. In fact these regions are projected to hit about the same dependency rates in 2050 as we see in Europe today. Drawing on estimates of the correlation between age structure and GDP this can be predicted to generate high growth in regions with decreasing dependency ratios and low growth in the regions with rising dependency ratios (Malmberg and Lindh, 2004).

The figure immediately suggests that the dependency ratio of the world might not change that much and indeed the projection for the world dependency rate is stable between 0.5 and 0.6 which opens for the obvious idea that increased factor flows or trade between the currently developed world and the developing world have a potential for mutual advantages. In a recent article Hatton and Williamson (2003) analyze the case for African labor migration from this kind of perspective. Taylor and Williamson (1994) puts a similar perspective on 19th century capital flows to the US.

Without going into too much detailed modeling of comparative advantages and factor abundance it is rather obvious that during the baby boomer's middle age period we would expect the developed countries to exhibit a relative capital abundance making it advantageous in theory either to export capital to the developing world or exporting capital intensive goods and services in exchange for labor intensive goods or services or accepting labor migrants. What we observe is relatively small capital and labor flows, the former because of institutional instability and lack of financial markets, while the labor flows remain small because they are largely illegal. Thus the equilibration is left to trade which still is littered by trade restrictions from both sides in this exchange.

Chart 3: Regional Total Dependency Rates: the Population 0-14 years old Added to the Population 65+ and then Divided by the Population in Age Groups 15-64



Source: UN (2000).

This issue merits its own full blown study⁷, so I will only note that further globalization and development of the international financial system can be a substitute for domestic investment both in capital and human capital. On the other hand to materialize this escape route may require not only investment in the capital structure of less developed economies but it may be even more important to invest in its human capital both in terms of health and education, see Bloom and Sevilla (2004).

5.3 Increasing Human Capital in the Very Long Run

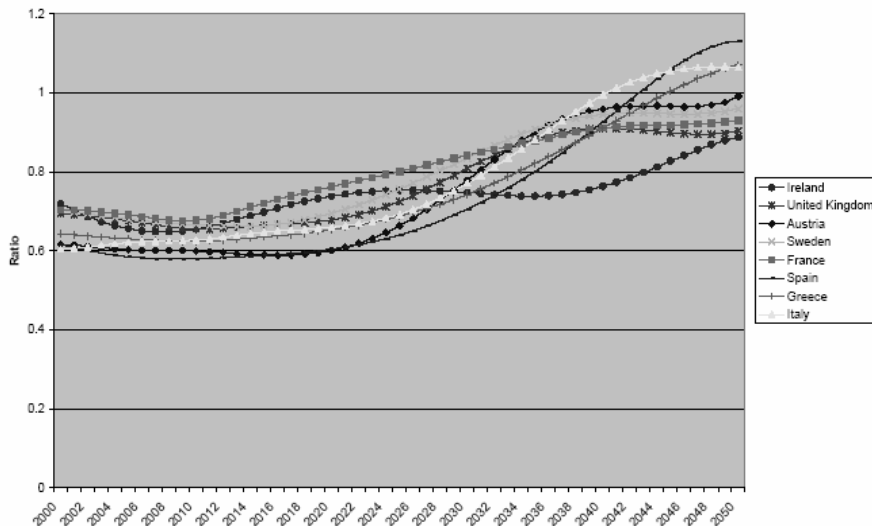
The preceding sections have discussed the scope for ameliorating the problems caused by increasing elderly dependency ratios by human capital accumulation and more intense use of the active human capital by lengthening work life and increasing participation rates. In chart 8 the total dependency rates are graphed for our selection of countries. The total dependency rates are, of course, higher than

⁷There are some studies of current account effects and age structure that are of interest in this connection, see e.g. Higgins 1998. There are also simulation exercises investigating these issues, e.g. OECD (1998) and Brooks (2003).

the elderly dependency rates, but increases less radically than the elderly dependency ratios and also appear much more homogeneous over the country sample since those countries who have the largest shares of elderly in chart 2 also are the countries with the lowest fertility and hence lowest shares of children.

So far I have avoided any explicit discussion of the other end of the dependent population distribution. The UN projections on which the calculations in Section 2 were based assumes that there will be a rebound in fertility as we get closer to 2050, but against the changes in economic life that we envisage as part of the solution to ageing this assumption seems unduly optimistic. If people on average will spend even longer time in education and have higher participation rates in the labor force and get a diminishing share in the production result the opportunity costs of having children are not likely to decrease. Even though it is often claimed that the decision to have children is mainly a question of social norms and have little to do with economic incentives I, as an economist, find it very unlikely to expect fertility to rise unless society increases the transfers and public consumption allowances for families with children. This, however, brings us into another dilemma because such a policy necessarily will have to compete politically with the transfers to the elderly which anyway have to increase, thus putting added pressure on the diminishing share of production that the active population can command.

Chart 4: Total Dependency Ratios (0-19 and 65+ Divided by Population 20-64)



Source: UN (2000.)

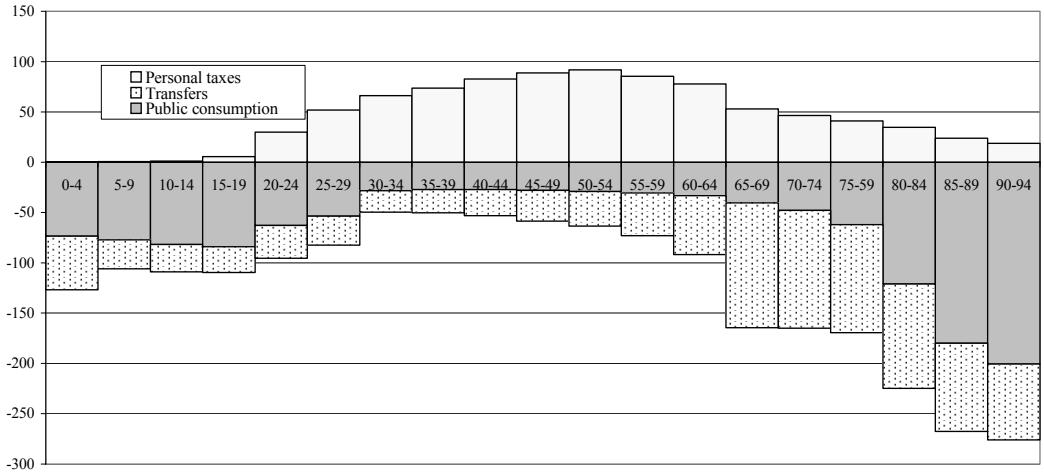
In Sweden intergenerational transfers are to a large extent organized through the public sector and it is instructive to take a look at the age distribution of expenditure and revenues for the public sector in chart 10 (Lindh, 2003). With minor variations the pattern will be similar in most developed economies even if the levels of expenditure and transfers vary. The basic point is that taxes are mainly paid by the active part of the population (personal capital taxes are included here) but expenditure and transfers mainly go to the non-active part of the population. In fact we can compute that around 70-80 percent of all redistribution in Sweden consists of intergenerational transfers. In countries with smaller and less general welfare systems some of these intergenerational transfers are within the family rather than through the public sector and thus are less visible. However, the social strains may be even larger. When people live on average upwards of 80 years and have only one or two children a typical extended family in the future may consist of four living grandparents needing support from one or two households of middle aged pairs in their 50s expected to work at least another decade or two in order to save enough for their own pensions. Due to late births these families may very well have to support teenage children during education at the same time, and it may actually be fairly common to have some grand grandparent still alive.

A crucial question for the future, that I am not aware of any firm answers to, is then whether the rise in longevity actually can be balanced by a longer work life. Post-war history tells us that a considerable portion of potential growth in material well-being has been exchanged for more leisure and shorter work life. There are exceptions like Iceland but work force participation among the elderly has actually been decreasing in step with longer life expectancy. Is that only because pension systems have been designed to give incentives for early retirement? In many cases we can easily analyse existing systems to see that this is the case, but pensioners have in general had a much more advantageous real income growth than other groups. And a lot of them have chosen to retire early. We have little facts to base an assessment of whether this trend will reverse or not. Many are clearly not fit to keep working but exactly how many and to which degree their working abilities have decreased we know little about. More to the point, we really do not have any well founded idea about whether the baby boomers will turn out to be healthier and more long-lasting in work than their parents.

In Global Report on Ageing (Winter, 2004) the European Commissioner for Employment and Social Affairs, Anna Diamantopoulou use table 3 to make the point that the spread in participation rates above 55 is much too large to make it believable that it should not be possible to raise participation rates quite substantially, but whether it can reach Icelandic levels remains to be seen.

Chart 5: Age Distribution of Expenditures and Personal Tax Revenue in Sweden 1998

Public consumption and transfers per capita in age groups 1998 (Source: Nordén and Olsson). Personal taxes per capita in 1997 from the Swedish Income Panel. Recomputed to prices in 2000 by Mats Johansson. Thousands of SEK.



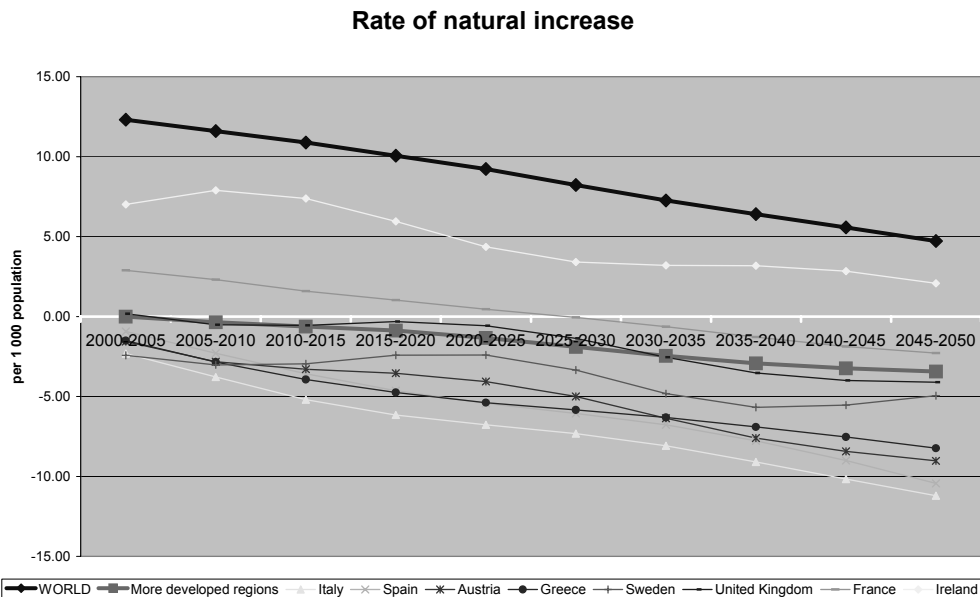
Source: Lindh (2003)

Table 3: Labor Force Participation Rates

	Aged 55-64		Aged 65+	
	1990	1999/2000	1990	1999/2000
Australia	44.1	46.9	4.9	5.7
Canada	49.3	51.2	6.8	6.0
Denmark	57.1	56.6	7.4	1.9
France	38.1	37.2	2.4	---
Germany	---	44.7	---	2.8
Iceland	82.7	87.1	30.5	21.6
Italy	35.9	28.3	3.4	3.4
Japan	64.7	66.5	24.3	22.6
Sweden	70.5	68.6	8.5	7.3
UK	53.0	52.1	5.5	5.4
U.S.	55.9	59.2	11.8	12.8

Source: International Labor Office (ILO), Key Indicators of the Labor Market, 2001-2002, (Geneva: ILO, 2002).

Chart 6: The Rate of Natural Increase in Population Projected by UN 2000, Medium Variant



In spite of the rebound in fertility that the UN projects will take place the rate of natural increase (birth rates less death rates) in the developed countries is trended downward. In chart 12 we see that most of our sample countries have an even stronger trend downwards, i.e. in spite of the projected fertility rebound the population will not be reproduced. In table 4 the total growth of population 2000-2050 is reported according to the medium and high fertility variants of the UN (2000) projections.

Table 4: Population Growth According to the UN (2000) High and Medium Fertility Scenarios

Population growth 2000-2050	Fertility		“Missing active millions” Medium variant
	Medium variant	High variant	
Ireland	39.7%	53.7%	3.206
Sweden	-12.0%	-5.2%	3.983
United Kingdom	-1.0%	7.6%	29.397
Greece	-15.4%	-9.4%	6.294
Italy	-25.3%	-19.9%	32.343
Spain	-21.6%	-16.2%	28.288
Austria	-20.1%	-14.2%	5.491
France	4.0%	13.8%	28.701

Even under high fertility scenarios most countries are projected to decrease their population. With a declining population the demographic momentum that results when smaller cohorts reach reproductive age and give birth to even smaller cohorts combined with decreasing mortality will, for fixed age boundaries of the active population, mean that the elderly dependency ratio will go on increasing in the latter half of this century as well.

Thus immigration becomes an important option to consider. The UN assumptions are very conservative: The future path of international migration is set on the basis of past international migration estimates and an assessment of the policy stance of countries with regard to future international migration flows:

“The future path of international migration is set on the basis of past international migration estimates and an assessment of the policy stance of countries with regard to future international migration flows.”

Migration cannot be any stand-alone solution either to keep dependency ratios stable. The magnitude of migration that would be needed to keep dependency ratios stable only in this way is absolutely staggering--the third column in table 4 indicates the number of millions of people 20-64 which are missing in 2050 to keep the elderly dependency ratio constant, for these eight countries it sums to around 138 million. Because immigrants also grow older and tend to adapt their fertility to the standards of the recipient country the actual numbers of migrants needed are well above these numbers. In fact it can be shown that the migration flows have to be accelerating indefinitely if dependency rates are to be kept constant (Lindh 2004). But there should exist a potential to design migration policies to provide a productive basis for financing an increase in fertility that in the long run leads to a more well balanced population structure. Expressed in other words, import of human capital during an extended period of a few decades could provide the

resources necessary to finance a domestic reproduction and education that in the very long run balances the population structure.

In order to do so, a number of conditions must be fulfilled. First and obviously there must be meaningful employment for the migrants. Importing human capital and support it by welfare is clearly suboptimal. Storesletten (2003) show that even at relatively low participation rates immigrants can be a fiscal bonus since the recipient country have not had to support them during childhood and adolescence.

Second and much more difficult this must be acceptable to the native population. Apart from purely xenophobic and irrational reasons there are at least for some parts of domestic labor reason to fear that unrestricted immigration may hurt them by increasing unemployment and lowering wages.

Third, much research indicates that only after a fairly long period of integration does immigrants reach levels of productivity comparable to the native population. Even if that conclusion still is a matter of debate---productivity measured by wages might as well be a case of discrimination---it is clearly the case that migrants tend to be much younger than the native population, mainly between 20 and 35 and thus it takes at least one or two decades before they reach their top incomes and then contributes the most to the fiscal balance.

Thus timing of migration matters, we would like to import middle aged people but they are not likely to move very much. Hence we should import more human capital a decade or two before the worst fiscal pressures start, presumably when the boomers reach ages around 80 and start to burden the health care system. But that is liable to cost us some supporting institutions that can sustain long-term immigration even at times when there is not full employment in the economy in the hope that they later will be better matched to the labor market.

6. Conclusions

Will growth be saved in the ageing society by increasing human capital investment? In the narrow sense of human capital investment, i.e. by increasing years of education this paper argues that it will only be a minor part of the solution since any realistic increase in efficiency through education falls far short of what is needed to keep relative living standards of the dependent and active population at anything near current levels. By focusing on the dependency ratio it is emphasized that the problem of ageing is not so much a question of the GDP level per se but of redistribution. No matter what the growth rate is, we either get a decrease in the relative standard of living of the elderly or we have to redistribute a sizable part of productivity growth from the active generation to the elderly. The point of having higher growth in that context is that it makes it easier and more acceptable to achieve the redistribution.

But we could take a broader approach to human capital formation and recognize that there are several margins at which it can be increased. First, by increasing utilization of the existing stock of human capital we can both redefine how productive the active generation is per capita and most important by lengthening work life we also redefine (and decrease) the dependent group. This is important especially if we allow education to become longer, since that in turn also increases the group of dependents.

Second, we can import human capital by immigration. By itself it is no long-term solution but with sensible policies it could help further in alleviating the fiscal problems of ageing. Unfortunately immigrants also get older and if they are really integrated into society (which is important in order to really help with the fiscal problems) they cannot very well be sent back to their home countries when they become dependent. Although long run on the usual time scale of economics, it is therefore still only a temporary remedy at the time scale of demography.

Third, the basic production of human capital starts with children and in the very long run a sustainable society where longevity into a dependent state of life has become a rule, and not an exception as previously in history, it becomes necessary to have a fertility high enough to reproduce labour (and the tax base) if the economy shall be able to support such massive cohorts of dependents. Fertility rates need not for the foreseeable future reach reproduction rates, since it can be combined with other measures, but in the very long run and at a global scale it should get much closer to total fertility rates around two than it is today in most developed countries.

Fourth, by taking advantage of the international division of labor and capital, national economies can become more independent of the domestic demography and thus ensure capital incomes even if profitable investment in diminishing economies with diminishing demand dries up. By allowing free movement of both capital and labor global differences in demography can be another important part of the solution of the ageing problem.

However, economic research on these issues today is hardly empirically precise enough to provide a reliable guide for the quantitative trade-offs between different measures that can be taken. Considering that the ageing that follows from the demographic transition and the continuing upward drift in longevity already is built into the world's demographic structure these are problems that will certainly not go away. Hopefully I have succeeded in demonstrating that ageing has only started.

The demographic momentum will not only disfavor the currently developed countries in this century but it will certainly favor some of the emerging and less developed economies to an extent that is likely to tip the economic power balance of the world. One would therefore expect this to be one of the defining issues of 21st century.

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