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THE FUTURE OF PENSION SYSTEMS IN EUROPE: A REAPPRAISAL

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Abstract

In this paper we examine and ultimately challenge the traditional viewpoint on the future of current pension systems in Europe, according to which the effects of the ageing bomb will inevitably bring down our unfunded PAYG public pension systems. First, we claim that the projected dramatic increase in the pension burden in mostly due to labour market problems and the generosity of the system, rather than to demographic factors. Secondly, we conclude that a fully funded system cannot be achieved without a substantial reduction in current pension payments unless it is financed by issuing earnmarked public debt. Finally we claim that a socially efficient pension system should be a mixed one, partly funded and partly PAYG, on the basis of optimal portfolio allocation in a context of uncertain returns to both human and physical capital and on the role of PAYG for financing the accumulation of human capital.

Keywords: Pension Systems, Funded and Unfunded Systems, Human and Physical Capital Accumulation.

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1 Introduction

The debate on the economic effects of the "aging bomb" has been around us for a while now; ongoing demographic, political and economic trends suggest it will stay a while longer. In this paper we examine and ultimately challenge the received wisdom on this topic, according to which the "explosion" of the aging bomb will, and should, inevitably bring down our unfunded pay-as-you-go (PAYG) public pension systems. Avoidance of the disastrous consequences of such a demise requires, again according to the received wisdom, a rapid transition to fully funded, or capitalised, pension plans. We find this recommendation partial and, at the very end, unwise. We tackle the problem head-on, by questioning the basic assumptions, either factual or theoretical, upon which the received wisdom is founded.

To understand the perspective adopted, it may be useful to begin with a simplified, and probably unfair, summary of what we view as the "established consensus" on this matter. With all the apologies of the case, and in order to avoid an excessively long bibliography, we refer to World Bank [1994], BIS [1998] and the literature quoted therein, for a more detailed and precise articulation of such view.

The demographic trends are such that during the next 30 to 50 years, the elderly dependency ratio (which, for the purposes of this paper is defined as the ratio of population aged 60 and older to the population aged 20-59 years) will keep growing and probably double the current, already high, levels. Indeed, this is part of a long run trend, dating back to the second half of the last century. This process has accelerated in the last twenty years and current extrapolations imply a further acceleration during the next three to four decades. Under the pension systems prevailing in the EU, this translates into continuous growth of the pension burden, as measured by the ratio of total pension payments to GDP.

Financial unsustainability is due to the fact that: (i) old-age and survivors pensions represent already a large fraction of GDP (more than 12 percent in the EU, as of 1995); (ii) they are being financed almost entirely with a tax on labor income; and (iii) reasonable projections (see below, Sections 2 and 3 for further details) put the pension burden well above 20 percent of GDP within a few decades. In the EU, the presence of the so-called "Stability and Growth Pact", limiting the size of acceptable deficit to GDP ratios, will force countries to raise taxes in order to finance the increasing pension outlays. Collecting such a large share of national income through social security contributions will raise labor cost dramatically, reduce employment and generate social and political unrest. Further, maintaining alive a PAYG pension system reduces current savings,

thereby damaging the growth of income and employment and increasing the size of the social security tax which the working few will have to pay.

Various reform proposals have been advanced, which are consistent with the previous scenario and try to cope with the problems it envisages (beside the World Bank's and Bank for International Settlements' volumes cited above, see also Davis [1998], Diamond [1997], European Commission [1997], Feldstein [1996], Feldstein and Samwick [1998], Holzmann [1997], Kotlikoff [1995, 1996], Mitchell and Zeldes [1996] among other). A characterising common feature of all these proposals is that, starting with the second decade of the next millennium, old-age pensions should not be financed, as they are today, through a tax on earnings but instead through the annuities generated by financial assets which are titles to the existing stock of productive capital.

The intuition behind this recommendation is straightforward. Total earnings, upon which taxes are levied to finance pension payments, have been growing rather slowly during the last two decades (about 2 percent a year in the EU, since the middle 1970s) and, given current trends, they are bound to grow at a similar pace in the foreseeable future. On the other hand, the growth rate of the market value of private investments, as measured by the growth rate of stock market indexes, has been much higher (around 10 percent a year in real terms in the EU, since the early 1980s) and is not expected to drop in the future. Consequently, working people that are currently planning to provide for their retirement income by means of future public pensions are putting their eggs in the wrong basket. Barring an unlikely sharp increase in future contribution rates, the rate of return they will earn on their social security contributions may be between one fourth and one sixth of the one they would earn by investing their money in the stock market or in an appropriate mixture of stocks and bonds.

According to its proponents, such a reallocation of resources away from PAYG contributions and toward financial assets would eliminate many shortcomings of the current systems. Funded systems have the following advantages. First, demographic oscillations would no longer affect the financial viability of pension payments. Second, political meddling with retirement income would also be eliminated. Third, private saving and investment would receive a boost, thereby fostering economic growth. Overall, a more efficient allocation of resources would be achieved. In particular, Feldstein [1995] provides a list of conditions under which a shift from an unfunded to a funded system should raise social welfare. These are: (i) a positive growth rate of the economy, (ii) a rate of return on capital higher than the growth rate of national income; (iii) a rate of return on capital higher than the rate of time preference. Abundant statistical evidence (see, for example, Table 8 below) shows that conditions (i)

and (ii) are easily satisfied in the EU countries. The large flows of private saving toward financial markets during the last two decades, suggest that (iii) is also likely to be true.

Why, then, is such an efficiency-improving reform proposal in need of further examination? We claim that the "consensus view" just described is seriously incomplete in its diagnosis of the deficiencies of PAYG systems, somewhat biased in its description of the merits of the fully funded ones, and off the mark in identifying the structural factors which are making unfunded systems financially unsustainable. Thus, the first aim of this paper is to point out a number of theoretical and empirical reasons why the "consensus view" is an incomplete and biased description of reality. The second aim is to provide a more complete analytical framework for thinking about social security reforms in Europe.

The idea that a complete shift to a fully funded system would be a blessing is grounded upon the following four statements, which are generally seen either as undisputed facts or obvious theoretical assumptions:

(a) The projected dramatic increase in the pension burden is mainly due to a demographic shock, which can be avoided only by abandoning the PAYG systems.

(b) A transition to a fully funded system can be engineered without a substantial reduction in the pension payments of the currently retired and of the cohorts that are due to retire during the next 30 years.

(c) The growth rate of total earnings is bound to be less than the rate of return on capital for the indefinite future.

(d) Barring the unlikely case of a "dynamically inefficient equilibrium" (corresponding to the situation in which the rate of return on capital is smaller than the growth rate of earnings) a socially efficient pension system should be completely or almost completely based upon a capitalization scheme.

We claim the previous assumptions or stylized facts should be replaced with the following:

(A) The projected increase in the pension burden is due for a 25 percent to demographic factors and to a 75 percent to deterioration of the labor market conditions and growing generosity.

(B) A transistion to a fully funded system cannot be achieved without a substantial reduction in current pension payments unless it is financed by issuing public debt. The gains from such transition would accrue to generations that are not yet born.

(C) It is likely that the growth rate of earnings will continue to be smaller, on average, than the rate of return on capital. By the same token, the standard deviation of the first will remain much lower than that of the second. Also, historical patterns show the two returns are negatively correlated.

(D) A socially efficient pension system should be a mixed one, partly funded and partly PAYG. The relative weights of the two systems should be adjusted slowly, in accordance with the movements of the rates of return on physical and human capital, and their correlation.

To contrast the four pairs of claims (a-A) (d-D), we proceed as follows.

In Section 2 the reader will find data describing the current systems of Social Protection in the EU and, in particular, the Old-age pension plans. We also report demographic and labor market projections, up to year 2050, for each country. Our cursory description of these variables confirms that, *rebus sic stantibus*, current European systems of contributory public pensions are financially doomed. We claim that, beside the demographic, two other factors play a fundamental role: (i) the sharp reduction in labor force participation rates and the increase in unemployment rates over the last two decades; (ii) the practice of increasing outstanding real pensions at the same pace at which labor productivity grows. The simulations of Section 3 provide a quantitative evaluation of how critical the last two factors might be. From these simulations we conclude that (A) is a much more appropriate description of the facts than (a).

Our next finding, developed in Section 4, supports claim (B) over (b). It is based both upon simple logical considerations (developed first in Breyer [1989] and then extended by various authors) and upon the few studies that have began to quantify the implications of a transition from unfunded to fully funded systems (especially Holzmann [1998], Miles [1999], Miles and Iben [1998] and Miles and Timmermann [1999]). The logical reasoning argues that, even if the growth rate of earnings is permanently lower than the rate of return on capital, once a PAYG system is in place it is not possible to shift to a capitalization system and make future generations better off without making at least one of the intermediate generations worse off. This has serious critical implications for those reform proposals, like the one recently advanced in Feldstein [1999], that advocate investing social security contributions in the stock market as an almost painless way of avoiding the future pension burden. Further, the quantitative exercises we just mentioned show that the benefits from a new funded system will accrue only to generations that are barely or not even yet born, while financing the transition requires that large costs be paid by the

generations that are currently alive. This confirms the obvious fact that free lunches are not available, not even in the case of social security reforms. It also suggests that the political viability of a drastic transition is quite low, at least in democratic and politically complex countries like those belonging to the EU. Policies to spread costs and benefits in a homogeneous way across generations should therefore be designed.

The second half of Section 4 considers statements (c) and (C). These are not strictly in contrast to each other. The first stresses that expected rates of return on stocks are higher than the growth rate of GDP, and likely to remain so. The second only reminds us that when investing in risky assets we should check, at the least, first and second moments of the joint distribution of returns. Further, from optimal portofolio theory it recalls that correlations among rates of return are very important in determining the composition of the portofolio itself.

This requires investing in assets other than physical capital to provide for income during old age. In Section 5 we show why human capital (of which future earnings represent total returns) is the first and most natural candidate among such assets. We show how integrated public education and PAYG pension systems can be used to achieve the efficient level of investment in human capital and the accrual of its returns to the old age people who have carried out this investment previously. This simple, but quite general, theoretical model shows that a pension system which is purely based upon capitalization cannot achieve either static or dynamic efficiency. In the light of this, we reconsider Feldstein's [1995] theoretical argument about the Pareto superiority of funded systems. The conclusion is that Feldstein's claim fails not just when the transitional costs mentioned earlier are taken into account, but also when comparing a growth path with a fully funded pension system to one with a mixed PAYG and fully funded system. Hence, even if transition were costless, we would not want to implement a complete shift from PAYG to capitalization.

The logic behind this argument extends to a context of uncertainty and optimal portfolio allocation. This claim is not entirely new. As far as we know, it originates with Merton [1983] and, since then, it has been elaborated by Merton and co-authors in various instances. What is new is the logical and practical connection we establish between public investment in education and payments of future retirement pensions. We argue that a logically correct and socially efficient approach to reforming pension systems takes public financing of education (and not social security contributions) as the investment of which old age pensions represent the due return. Hence our insistence upon the fact that, while the growth rate of earnings may be lower than the rate of return on physical capital, its riskiness is also remarkably lower. Further, the negative

correlation between the two returns suggests that, in a well diversified portfolio, one may want to assign positive weights to both assets. From all this we draw support for statement (D) as opposed to (d).

To summarize, our reappraisal of the future of public pension systems and our rebuttal of, or more properly: improvement upon, the received wisdom proceeds as follows. In Section 2 we describe the current situation and simulate the expected future one, up to year 2050, assuming current trends and legislation do not change. In Section 3 we perform a similar exercise for some alternative scenarios, in all which a PAYG system is maintained but in which labor market conditions are changed and generosity mildly contained. In Section 4 we argue, using contributions from other researchers, that the transition from PAYG to fully funded cannot be strictly Pareto improving and that, in any case, its benefits will accrue only to generations that are not yet born. In Section 5 we propose a general analytical framework, consistent with our previous findings, for thinking about the design of efficient pension systems. The practical and political implications of our overall analysis are elaborated in the conclusions, Section 6.

2 European pension systems: the facts and the current debate

In this section we describe the current situation of pension systems in the EU. First, we briefly describe the relevance of social protection expenditures (SPE, hereafter), emphasizing the prominent role of pensions as the major item in the social budget. Second, we document the demographic and labor market scenarios under which pension systems are expected to operate in the forthcoming decades. Finally, we briefly describe the main institutional features of European pension systems. In particular, we highlight their implications for both the rates of return that PAYG systems may provide to future pensioners and for the ratio between average pension and average labor productivity we should expect, on average, under the current institutional rules.

2.1 Social Protection Expenditures

Social protection expenditure represents a major part of public spending in all EU countries although, as shown in Table 1, there are important differences across countries in its size and composition. Overall, in 1995, SPE amounted to 28.4 percent of GDP and 52.2 percent of total government expenditures in the EU. As a share of GDP, SPE is lowest in the Southern countries and Ireland (around 20 percent), and highest in the Nordic countries (around 35

percent). The level of SPE per capita (measured in PPS units) also varies markedly between Northern and Southern EU countries (from under 2.500 PPS in Greece and Portugal and about 3.000 PPS in Spain and Ireland, to over 6.000 in Denmark, Luxembourg and Sweden). This pattern of variation is broadly in line with the levels of GDP per capita, shown in the fourth column of the table.

Turning to the contribution of old-age and survivors pensions to SPE, the last two columns of Table 1 report the ratio of pension expenditures to SPE and to GDP. Excluding Greece (for which data are not available), pension expenditures in 1995 amounted on average to 42.4 percent of SPE and 12.1 percent of GDP. In all EU countries, except Ireland (where the proportion of elderly people is much lower than elsewhere in the EU), old-age and survivors pensions represent by far the largest component of SPE, ranging from 32 percent in Finland to 63 percent in Italy (the country with the largest proportion of retired population in the EU).[1]

2.2 Demographic and labor market scenarios

2.2.1 The demographic scenario

This section compares the current demographic structure of the EU economies taking into account the evolution of fertility rates and life expectancy over the period 1960–95. Demographic projections of the relevant dependency ratios for the period 1995–2050 are then presented.

Total population in the EU (including Eastern German *Länders*) was 315 millions in 1960. The corresponding figure nowadays is 374 millions, yielding an average annual growth rate of .45 percent. This average growth, however, conceals marked differences across decades: .8 percent in the 1960s, .4 percent in the 1970s, .25 percent in the 1980s and .4 percent again in the 1990s. In spite of the recent slight recovery of population growth rates, mostly due to rising net migration into Europe and to increases in fertility rates in the Scandinavian countries, demographers seem to agree that the prospect is one of a clear deceleration of population growth in Europe.

Current trends in fertility are documented in columns (1) and (2) of Table 2. There has been a large decline in fertility rates which has been the strongest where fertility rates were initially the highest (Ireland, Netherlands, Portugal and Spain). As for life expectancy, columns (3) and (4) show a large increase in the 1960-95 period. As for fertility, there is a negative relation between initial

[1] The figure for Italy is slightly biased upward as it includes the so-called "Compensation for Termination of Contract" ("Trattamento di Fine Rapporto" or TFR), which consists of a lump-sum payment to be received upon dismissal. This kind of payments either does not exist in other countries or is included in other functions of social protection.

levels and successive variations. Thus, dispersion across EU countries in both fertility and life expectancy has decreased noticeably.

Table 3 provides a synthetic comparison of the current demographic structure of the EU countries, along with its future evolution as implied by Eurostat's baseline demographic projections (Eurostat [1996]). The indicators presented are the youth dependency ratio, defined as the ratio of people aged less than 20 to the working age population (people aged 20–59), and the old-age dependency ratio, defined as the ratio of people aged 60+ to the working age population. If we consider the current situation, two groups of countries are recognisable, as well as two outliers, Ireland and Italy. For the first group (Belgium, Greece, France, Spain, Sweden and UK) both dependency ratios are above average, whereas for the second group (Austria, Denmark, Germany and the Netherlands) both are below average. Ireland and Italy are unique cases, the first one because of its relatively high youth dependency ratio and relatively low old-age ratio, and the second one because of its relatively high old-age dependency ratio and relatively low youth dependency ratio. This asymmetry should be kept in mind when considering the simulations that we present later in this paper.

In all countries, old-age dependency ratios are expected to increase substantially relative to their 1995 levels, and nearly double by the year 2050. Youth dependency ratios should instead fall slightly between now and the year 2020, and then come back somewhat. When analysing old-age ratios, Belgium, Finland and Italy are expected to have the largest dependency ratios in 2020, whilst Spain, Italy and Ireland will face the most severe old-age demographic pressure in year 2050, with ratios above 80 percent of the working age population. Changes in the youth ratios are much smaller, with the exception of Ireland, where the dependency ratio is expected to fall by almost 20 percentage points between 1995 and 2020, and then stay at this lower level.

2.2.2 The labor market

We now compare the EU countries in terms of labor force participation and unemployment rates. We look at both indicators by sex and age groups over the 1980–95 period. As shown in Tables 4 and 5, labor force participation rates (LFPRs) among the youth have been decreasing whereas unemployment rates for all age groups have been increasing, resulting in shorter contribution periods to the pension systems. Second, LFPRs among the elderly have fallen substantially, particularly among men. This also shortens contribution periods and increases the demand for pensions. Further, the incidence of unemployment among the elderly is much higher nowadays, which increases the pressure on the pension systems to become a substitute for unemployment benefits as a source

of income for elderly unemployed workers.

A closer look at Table 4 reveals marked differences across countries. Southern European countries have the lowest youth LFPRs, whereas Nordic countries have the highest LFPRs among the elderly. For the central age groups, the main differences arise from the behaviour of women, whose LFPRs are lowest in the Southern countries. As regards the differences in activity rates by gender,we find that the gap between male and female LFPRs is relatively small in the Scandinavian countries, particularly for ages over 45, whilst there still are sizeable differences in Belgium, Ireland and the Southern Mediterranean countries. Figure 1, in turn depicts the probability that a worker of a given age in the range 45–69 will retire within one year. That probability is measured by the slope of the current age-participation profiles. The noticeable presence of peaks at particular ages (typically 60 or 65) is related to the institutional rules governing retirement in the various countries, and, in particular, to the presence of early and normal retirement ages. This effect seems to be particularly strong for France, Germany, Spain, Sweden and the UK. Finally, the unemployment rates in Table 5 do not need much comment, as the incidence of unemployment has increased across the board.

2.3 Early retirement and youth unemployment: Is there any relationship?

In the previous section, we highlighted a general trend towards reduced employment rates among elderly workers. To a large extent, this reflects deliberate government's policies and is probably the single most damaging factor for the long-run financial sustainability of PAYG pension schemes. Besides, it is an important source of differential treatment for similar workers and, therefore, a major tool for political rent-seeking and vote-buying.

Quite often, policies that favor early retirement are supported and promoted with the justification that they may induce a reduction in youth unemployment rates. The basic idea is that since jobs are a scarce resource available in a fixed number,retiring an older worker would "free" the same job for a younger, most likely unemployed, one.

To test this prediction, we have collected various labor market observations for a sample of 260 NUTS II and NUTS III European regions over the years 1986, 1991 and 1996. They represent relatively small areas, which happen to be the territorial units at which the European Commission targets its employment policies and for which national governments tend to devise the early retirement plans we mentioned earlier. Hence one would expect that, if any effect is visible, it should be detectable at this level of geographical disaggregation. Figures 2 and 3 plos, separately for men and women, the relationship between

the exit rates from the labor force of people born between 1931 and 1940 and the changes in the unemployment rates over 1991–96 of people aged between 21 and 30. Under the substitution hypothesis we should expect a negative relationship. Neither for men nor for women,the estimated regression lines turn out to be significantly negatively sloped. For alternative specifications,controlling for cohort effects or using different lags, the results hardly change. Thus,we conclude that early retirement of older workers does not come together with a reduction of unemployment among younger ones.

2.4 The institutional framework

Although pension systems come in a wide variety of forms, they mostly fit into two categories: (i) unfunded PAYG systems, and (ii) funded systems. Within these two categories, plans differ in their coverage and other characteristics. Plans may be designed to cover all citizens, either in need of assistance or not, or only those contributing to a social insurance scheme. As for contributions and benefits, they may be flat-rate (Beveridge formula) or earnings-related (Bismarckian formula) or, as in the Scandinavian countries, of both types. On top of public pensions, many EU countries have also set up supplementary schemes, which may be either voluntary or compulsory, funded or unfunded, and which are often organized according to an occupational, employment-related base. Obviously, retirement income may also be provided through private pension funds, which are regulated and taxed differently in each country. With the exceptions of the UK, the Netherlands and the Scandinavian countries, private pension funds still provide for a very low fraction of total retirement income. Table A1 in the appendix provides a brief summary on the relative weight of the various layers in the current pension systems in the EU countries.

The interaction among the many layers of different pensions systems makes it difficult to characterize their structure. Nonetheless, Table A2 in the appendix provides again a summary the main rules satisfied by earnings-related plans.[2] Public earnings-related pension systems are usually mandatory and cover most employees. Under these schemes, pension benefits are financed by the contributions of employees and employers. The relevant parameters characterising these systems are the contribution rates, the minimum contribution period needed to qualify for benefits, the standard age of entitlement (which, together with life expectancy, determines the duration of benefits), the replacement rate (that is, the ratio of initial pension benefits to final earnings), the indexation rules, and the amount of benefits going to survivors.

[2] A detailed discussion of institutional features is beyond the scope of this paper. We refer the interested reader to European Commission (1997) and the literature quoted therein.

These parameters in Table A2 can be used to compute, for each plan, the internal rate of return (IRR, hereafter) and the ratio between average pension (p) and labor productivity (y), given age, work seniority,. and earnings profiles. When compared to the growth rate of the total wage bill, the IRR is an indicator of the long-run financial sustainability of a pension plan. For a given contribution rate, if the average IRR is systematically greater than the growth rate of total labor income, additional resources are needed to finance pensions (see Samuelson,1975). The ratio between average pension and labor productivity, together with the elderly dependency ratio which we have already examined, determines the ratio of pension expenditures to GDP and therefore drives the overall financial sustainability of the system.

Table 6 gives some rough estimates of IRRs and of the ratio of pension to average productivity for some EU countries in order to have a first check on the sustainability of the current pension plans. The IRR is defined as the discount rate that makes the present discounted value of the flow of pension benefits equal to the present discounted value of the flow of social security contributions. To get some feeling about the size of the IRRs and the ratio of average pension to average labor productivity that generations currently entering into the labor market will get in the future from public pension systems if their current rules (*i.e.* contribution rates, method of pension calculations, etc.) are kept invariant, we make the following simplifying assumptions:

- contribution rates are taken to be constant at their current levels (see Table A.2);
- the length of the contribution period is taken to be 35 years (which for most countries is higher than the average working period implied by the employment rates in Tables 4 and 5);
- the length of the retirement period is current life expectancy at 60 years (see Table 2);
- pension benefits are computed according to current rules which, in most cases, relate the pension replacement rate to the length of the contributory period and the worker's average earnings during a given period (see Table A.2 and column 2 of Table 6);
- pensions are determined by the replacement ratio plus the ongoing indexation rule in each country (see Table A.2);
- real wages increase at the same rate as labor productivity, both during the contributory and the retirement periods. Labour productivity growth is taken to be 1.5 percent, as in Roseveare et al. (1996).

According to our estimates, the IRRs implicit in the current rules of the systems, range from about 2 percent in Germany and Italy[3] to about 5 percent in Sweden (where the contribution rate for the employment earnings-related scheme is fairly low). With future productivity and employment growing at 1.5 and 0.5[4] percent respectively, the growth of the wage bill would be below the IRRs we have computed (except possibly for Italy). This implies that either additional financial resources need to be devoted to cover pension expenditures or contributions need to be raised and/or pension benefits lowered to avoid permanent deficits in the current pension systems.

As for the ratios of average pension to average labor productivity, our calculations yield values ranging from about 30 percent in France to about 65 percent in Spain, where the replacement rate (100 percent of the average wage in the last 15 years of the working life) is by far the largest in the sample of countries considered. Overall, these ratios are not too far from those currently observed in the EU countries (with the exceptions of Spain and Portugal), as can be seen in Figure 4. Thus, if current rules are maintained, the only reason why the ratio of pension expenditures to GDP will increase is the rise in the dependency ratios.

2.5 The future of current systems: A simulation

We conclude our description by providing a quantitative evaluation of the financial distress that European public pension systems are expected to suffer over the next fifty years. We do this by presenting crude simulations of how the pension burden, namely the ratio between total pension expenditures and GDP, would behave should current trends and legislation be maintained.

Our simulations are based upon the following decomposition of the pension burden

$$\frac{P}{Y} = \frac{N_o}{N_e} \cdot \frac{p}{y},$$

where P is pension expenditure (defined as expenditure for old-age and survivors benefits), Y is GDP, N_o is the number of the elderly (conventionally defined as those aged 60+), $p = P/N_o$ is average pension expenditure per elderly person,[5] N_e is the number of employed workers, and $y = Y/N_e$ is labor productivity (GDP per employed worker). This may also be rewritten in the

[3] Calculations for Italy are based on the system introduced with the 1995 reform which, however, will only be phased in very gradually.

[4] Even the 0.5 percent employment growth figure may be too optimistic since, everything else alike, labor force is expected to decrease in the EU15 over the near future.

[5] Notice that p is not the same as the average old-age pension of a retired worker, as P includes both cash benefits (periodic and lump-sum payments) and benefits in kind, whereas N_o includes both pensioners and other elderly people. The use of p is mainly dictated by data availability and the desire to keep our model as simple as possible.

following useful way:

$$\frac{P}{Y} = \frac{d}{a(1-u)} \cdot \frac{p}{y}.$$

where $d = N_o/N$ is the dependency rate, $a = N_a/N$ is the aggregate LFPR and $u = N_u/N_a$ is the unemployment rate, with N, N_a and N_u being the working age population (defined here as those aged 20–59), the active population and the number of unemployed, respectively.

Given assumptions about the future values of the old age dependency ratio d, the labor force participation rate a, the unemployment rate u, and the ratio p/y between pension expenditure per elderly person and labor productivity, one may use the above relationship to obtain predictions about the future pension burden. In the baseline simulation presented in this subsection, we adopt Eurostat demographic projections for the period 1995-2050 and make the following assumptions about a, u and p/y.

(1) age-specific LFPRs and unemployment rates for both men and women remain constant at their current levels for all future cohorts;

(2) both average labor productivity y and average pension expenditure p grow at an annual rate of 1 percent, thereby keeping the ratio p/y constant.

The second assumption is not too far from the observed evidence during the period 1983–95 which, for most EU countries, shows no clear sign of trends in the p/y ratio (Figure 4).

Our baseline simulation represents the extreme case of pure demographic effects, with no changes in participation and unemployment rates by sex and age, and no changes in the ratio between average pension expenditure and labor productivity. Its results are presented in Figure 5, which also reports the current (1995) pension burden for comparison.

In the baseline simulation, the pension burden grows in all countries, especially in France, Germany, Italy, Netherlands and Spain. The increase is most notable in Italy, where a peak of 32.4 percent is reached in 2045. In France the peak is 24 percent and is reached in 2050, in the Netherlands is 24.2 percent and is reached in 2035, in Germany is 24.1 percent and is reached in 2045, in the UK is 18.5 percent and is reached in 2050, in Spain is 21 percent and is reached in 2050.

These are very high numbers, more than twice the current values, and lead additional support to the view that PAYG pension systems are inevitably doomed and that financial collapse can be averted only by a swift transition to a funded system.

3 A quantitative evaluation of the sources of long-run imbalance

What may happen in the next 30 to 50 years, should the ongoing trends continue while the current rules of public pension systems remain unaltered, has been documented in the previous section. Our purpose now is to consider different scenarios and assess the quantitative impact they may have on the future pension burden.

Our exercise is rooted on the following premise. Unlike demographic trends, which can hardly be affected by policy, LFPRs, unemployment levels and labor productivity are all very sensitive to changes in policies, fiscal regimes, labor market legislation and so on. The empirical evidence (see Blöndal and Scarpetta [1998] and Gruber and Wise [1998] for recent assessments) also shows that a number provisions of curent PAYG systems tend to lower labor force participation, facilitate early retirement, and reduce labor supply in general among citizens older than 50. Such provisions are not linked to or determined by the PAYG nature of the pension systems. They are, instead, more easily understandable as aberrations, generated by political pressure and the rent-seeking behaviour of special interest groups.

This is crucial for understanding the significance of the simulations that follow. They are not meant to suggest that increasing LFPRs among certain groups or reducing unemployment to the level it was 20 years ago are easy policy tasks, or that we have a menu of well defined policies that would achieve just that. There exists a huge literature, both theoretical and applied, addressing this issue and suggesting specific structural policies that may help increasing LFPRs and reducing unemployment. It is not the task of this paper to evaluate such research effort or to draw specific policy conclusions from it. Our task is to point out that it is not the PAYG nature of the system that is leading to its financial collapse, and that the demographic crisis, while serious, could be overcome if other factors were not concurring. Such factors are the sharp reduction in LFPRs, the rise of unemployment, and the increase in the generosity of the system with older pensioners. Such factors have been caused by policy choices other than the establishment of unfunded pension systems, and should not be confused with it. Attenuating or eliminating them may require hard and controversial policy choices, but certainly it cannot be accomplished by replacing existing PAYG systems with funded systems.

Besides, LFPRs and employment levels among women have been changing spontaneously in the last two decades, and are likely to continue along their upward trend in the foreseeable future if appropriate conditions are maintained by well designed policies. The same is true, to a lesser extent, for the growth rate of

labor productivity. After two decades of relatively stagnant performances, labor productivity has picked up in the last decade and, again, its future behaviour may be enhanced by policies favoring innovation and labor mobility.

Last, but not least, we must consider the extent to which a well designed PAYG system should treat old and new pensioners "generously". We showed in Figure 4 that, in most EU countries, outstanding pensions have grown at roughly the same rate as average labor productivity for the last 15–20 years. This is a remarkably generous policy when compared, for example, to one of pure inflation indexation. If the replacement rate (that is the ratio between initial pension and the last earnings) were to be kept constant, we would expect *new pensions* to grow at the same rate as labor productivity. Let us call this a policy of *constant generosity*, with a lower case "g". European countries have instead adopted a policy of *constant Generosity*, with an upper case "G", according to which *all pensions* are increased at the same rate at which labor productivity grows. This second kind of generosity is less obviously implied by the rules of a properly functioning, stationary PAYG system. Instead, it is more likely to be the outcome of political pressure from well organized unions of elderly citizens. It becomes particularly destabilising when coupled with increases in life expectancy of the size experienced by the EU countries during the last 30–40 years. Again, an unfunded system does not require old pensions to grow at the same rate as average labor productivity.

Before deciding what is causing what, and what needs to be fixed, it is therefore worthwhile to clearly separate the impact of one policy choice from the other. This is the motivation for the four sets of simulations that follow. They ask the following question: Given current rules of the system and current demographic trends, what would happen if female LFPRs converged to the ones already observed in the UK and the Scandinavian countries? And what would happen if, in addition, male employment rates were pushed back to the level of the early 1980s? And what would happen if we moved from a policy of "constant Generosity" to one of "constant generosity"? Finally, what would happen if these changes in policy and labor market conditions happened all together?

3.1 Alternative scenarios

We consider four alternative scenarios. They all share the same demographic trends and old-age dependency ratios of the baseline simulation described in Section 2.5 but differ as follows.

1. Increasing LFPRs and falling unemployment rates. This process is assumed to take place gradually and be fully completed by the end of our

simulation horizon in year 2050. Everything else follows the same trends as in the baseline case. Within this scenario, we distinguish two cases. In the first one (Simulation 1a), age-specific male LFPRs stay constant at their current level, female LFPRs rates increase until reaching 80 percent of those of men, whereas age-specific male and female unemployment rates converge to a common value, equal to half the current level of male unemployment rates. In the second case (Simulation 1b), age-specific male LFPRs and unemployment rates revert to their levels in the early 1980s, female LFPRs rates increase until reaching 80 percent of those of men, whereas female unemployment rates converge to the male ones.

2. A policy of constant generosity is enacted with labor productivity growing annually at either 1 percent (Simulation 2a) or 2 percent (Simulation 2b). Everything else follows the same trends as in the baseline case.

3. The changes of simulations 1. and 2. occur together, while all other parameters follow the same trends as in the baseline case. Labor productivity grows at 2 percent per year and we distinguish between the two alternative labor market scenarios (Simulations 3a and 3b).

4. A policy of decreasing generosity is enacted, with the ratio between new pensions and labor productivity decreasing by one half of a percentage point a year, while labor productivity grows at 2 percent per year. We distinguish between the two alternative labor market scenarios (Simulations 4a and 4b). Everything else follows the same trends as in the baseline case.

The assumptions that we make about the behaviour of the female labor force are much less demanding than it may appear. Indeed, countries such as Denmark, France, Germany and the UK have already reached female LFPRs equal or close to 80 percent of those of males, while other (such as Ireland) already show no gender differences in unemployment rates. The reduction in unemployment rates to half of their current values by 2020 is, instead, a stronger assumption which may well be realized, but only under substantial changes in the functioning of the European goods and factor markets.

3.2 Basic Findings

Figure 6 reports the major findings for each of the eight simulations described above. For simplicity, we only report EU averages obtained by weighting the available countries (Austria, Finland, Greece and Sweden are excluded) by their

share of the GDP.[6] Each of the panels refers to one of the four basic simulations, and presents the ratio of pension expenditures to GDP, along with its current value (the unmarked horizontal line) and its value in the baseline case. Define the "demographic burden" as the difference between the current pension expenditures/GDP ratio and its value in the peak year. We will be mainly concerned with the reductions in the demographic burden under each of the alternative scenarios.

Under the first scenario, in which LFPRs increase and unemployment rates fall, the reductions of the demographic burden with respect to the baseline scenario vary between one fourth (if only female LFPRs increease) and one third (if LFPRs increase for both men and women). These are substantial improvements over the baseline case. Changes in labor market conditions of the kind we have assumed may help alleviate the fiscal burden of forthcoming pension payments.

An obvious criticism to our exercise is the following: that increasing LFPRs at time t is only a temporary palliative, as it implies an increase in the number of pensioners at time $t + \tau$, where τ is the number of years it takes for the additional workers to retire. This criticism is, to a certain extent, correct, yet its quantitative impact is limited. First of all, certain increases of LFPRs do not imply an increase in the future number of pensioners but, instead, a decrease in the internal rate of return of the pension system. This is the case for increasing LFPRs among elderlies and, more generally, individuals who are already working during part of their lifes and receiving some pension after the age of 60. Most countries have "minimum pension" provisions, which generate very high rates of return for the social security contributions of individuals with very short working histories (for quantitative evaluations across countries, see the papers in Gruber and Wise [1998]). A similar argument applies to the possible effects of reduction in unemployment rates: all unemployment spells lasting less than 2 or 3 years do not reduce perspective pensions as "figurative" contributions are being paid by the Social Security Administration. Hence, the only side along which the labor market scenarios we study are open to the previous criticism, would be that increasing female LFPRs. But, even in this case, a careful consideration of the actual institutional mechanisms currently in place, suggests the practical impact may be rather limited. The reason is simple: non-working women live longer than men, are typically married to working men who draw a pension and are often entitled to survival pensions after the death of the spouse. Getting those women to work and contribute would, at least in part, reduce the internal rate of return for married men with

[6] Detailed tabulations by country are available from the authors upon request.

long-living non-working wives.[7] For each nation the peak burden is now lower than in the baseline case, and substantially lower for countries, such as Italy and Spain, where the current level of female LFPRs is low or male LFPRs have fallen very sharply during the last 15 years.

In the second simulation, a policy of "constant generosity" (*i.e.* the ratio between new pensions and average labor productivity is kept constant at its current level, but old pensions are not increased with labor productivity) yields reductions of similar order of magnitude as in the first scenario for the same productivity growth (1 percent), or higher with higher productivity growth (2 percent). The typical profile in most countries sees an initial small decline till about year 2005, a subsequent increase until about year 2035, and then a flattening or a mild decline. When the changes envisaged by the two previous scenarios are enacted simultaneously, the demographic burden is reduced by at least half in all countries. Further, most countries generate a "surplus" (relative to current expenditure levels) for the next 10–15 years.

Finally, in the fourth scenario, under which a policy of slight reductions of generosity is implemented, the demographic burden is reduced by 30–40 percent, again generating large surpluses for the next decade or so. Moreover, simulations 1 and 4 together imply that most countries would be able to maintain their pension burden at or below its current (1995) level for the next 55 years.[8]

These findings provide support for our first two policy prescriptions: before dismantling the existing PAYG systems, there are important and reasonable policy options available which may prevent financial disruption even in the face of the forthcoming demographic bomb. Of course, our simulated results may be perfected. Although based on fairly reasonable assumptions about demographics and labor productivity growth, they are "partial equilibrium results" by construction and make no attempt to evaluate the impact that increasing female LFPRs and decreasing unemployment levels may have on the growth of labor productivity and real wages. Should the former bring about a substantial reduction in the latter, total labor income may grow less than we are implicitly

[7] Because of the demographic projections that we are using, our simulation horizon ends in 2050. This does not allow us to take into account the effects, after year 2050, of the increased number of female retirees. On the other hand, the effects before year 2050 are small, due to the extreme smoothness of the labor market changes we envisage.

[8] If we take the current pension burden as a reference point, the "surpluses" obtainable during the next 10–15 years could be very helpful, when properly capitalised, to finance the deficits of the later periods. As a matter of fact, a policy of this kind has been adopted in the USA a few years ago. The current surpluses of the Social Security Administration are being kept, at least from an accounting point of view, in a Trust Fund which is to be used later on to mitigate the impact of baby boomers' retirement. An interesting debate is currently taking place as to the opportunity of investing a portion, or even all, the Trust Fund into equities as opposed to the government bonds in which they are currently kept.

assuming here. The reduction in the fiscal burden would then be substantially lower. It is hard to guess which way the effect should go. While textbook assumptions about decreasing returns to scale suggest that average labor productivity may decrease, the USA experience suggests the opposite. Further, the intrinsically dynamic nature of the process of technological innovation and job creation, implies that a more flexible labor market, more efficient search and matching procedures, and a faster creation of jobs may increase, rather than reduce, average labor productivity.

4 Reconsidering the transition to a fully funded system

The analysis developed so far implies that EU governments should concentrate upon reducing unemployment and the growth rate of old pensions before starting to dismantle existing PAYG systems. Still, our discussion falls short of proving that a transition to a fully funded system would not be superior to even a reformed PAYG system and of providing a positive argument as to why a PAYG system should continue to exist altogether. This is what we do in this and the following section.

First, we argue that a numerical evaluation of a feasible transition to a fully funded system proves that all gains are accrued in the far future and all costs are paid up-front. This makes the transition politically untenable, and calls for an intergenerational debt arrangement to sustain it. Second, we recall an argument due originally to Robert Merton according to which an optimal portfolio should contain, among other, assets with payoffs determined by the return on both physical and human capital. Empirical evidence from the EU countries strongly supports this view, which is coherent with a stochastic version of the simple growth model we outline in the following section.

About transition, let us begin by dispensing with the idea that a "small tax now" coupled with the magic of financial markets is an easy and safe way to avoid the "big tax later". This seems, as far as we can tell, the backbone of the recent suggestion (Feldstein [1999]) to reform the USA social security system by introducing immediately an additional, 2.3 percent, wage tax, with proceedings to be invested in stocks and bonds. Assuming the chosen portfolio yields an average net return, over the next 30 to 50 years, equal to 5.5 percent, the capitalized value of the tax flow would be enough to cover the additional pension payments the American Social Security Administration is expected to face after 2030. This allows maintaining the payroll social security contributions at its current level (12.4 percent) instead of going to the 17.8 percent or higher level that is commonly forecasted.

We fail to see in what sense such reform would engender some kind of welfare improvement. Current taxation would move to 14.7 percent, instead of staying at 12.4. It is reasonable to ask: what is the discount rate at which the pain of an additional 2.3 percent tax now is equal to that of an additional 5.6 percent tax in 2030? The answer, obviously, is: 5.5 percent. But then, if this is the return one can safely earn in the financial markets, why not announcing that the Payroll Social Security tax will be kept at 12.4 percent forever and that pension payments will have to balance the budget? Done this, the Government can safely leave in the workers' pocket the 2.3 percent of their wages it would have to take otherwise. Workers will be free to save and invest that money as their risk/return preferences recommend. Certainly, this cannot be Pareto inferior to an additional distorting tax paired with a Federal official in charge of portfolio allocation decisions.

There is another, dubious, side to the proposal: the risk burden it involves. This is considered, with great care and precision, in the paper by Miles and Timmermann [1999], to which we refer for more details.

Moving on to a different set of issues, we should look at the aggregate and redistributional implication of a transition. Actual proposals on the table, differ as to the extent to which private savings invested in the financial markets should account for future pension payments, and as to the timing and modes of the introduction of such a "fully funded" system. Contrasting opinions also exist with regard to the mandatory or voluntary nature of the private saving which should flow into the private or public pension funds. Deciding if fully funded systems should replace (in part or completely) the current PAYG systems or should instead just grow spontaneously on their side, is not a secondary matter. Let us call the first approach the "replacement", and the second one the "parallel". Our claim is that, in order to be effective, both approaches involve a sharp reduction in the pensions of those who are currently retired or are going to retire over the next two or three decades. This raises a serious issue of intergenerational redistribution which ought to be addressed if we hope to make any transition to a fully funded system, even a partial one, economically and politically viable.

If the parallel approach is taken, one needs to explain where the additional resources to be invested in professional or individual pension plans should be found. Short of engineering (by which means?) an increase in the private propensity to save out of permanent income, it is hard to see how such extra saving may come around. If the aggregate fiscal pressure is to be kept constant and, in particular, if social security contributions cannot be drastically reduced, total disposable income of current workers is not going to increase by an act of magic. It is easy to see that the "fiscal incentives" refrain one often encounters in

many policy papers is, indeed, only a refrain. Consider, to be a bit more specific, the case of the EU countries. If public spending (inclusive of public pension payments) remains constant and additional budget deficits are not allowed, in keeping with the Stability Pact required by the Monetary Union, providing fiscal incentives to certain kinds of financial instruments will require adding fiscal pressure somewhere else, thereby keeping average disposable income constant, net of redistributional effects between its different sources. It is very hard to believe that, by simply reshuffling fiscal pressure among income groups, one may engineer a substantial increase in the aggregate saving rate. Moreover, should the fiscal incentives achieve their purpose, the additional private saving flowing to the pension funds will most likely come at the expense of a reduction in other kinds of private saving. On average, this is unlikely to generate higher aggregate saving and it may even reduce fiscal revenues. Hence a substantial reduction of social security pensions, to increase the private disposable income of the generations that are still working and saving, is an implicit ingredient of a feasible transition process.

Alternatively, if the "replacement" option is adopted, it implies using legal coercion to divert, toward saving and investment, resources that are currently taxed to finance pensions payments. This leaves unanswered the question of which other resources should be used to pay for pensions in the meanwhile or if, again, a reduction in per-capita pensions should be phased in over the next two decades or so. References to the Chilean or other Latin American experiences are, in this debate, quite misleading. Common to all those experiences was a particular combination of the following elements, which are altogether missing in the EU countries: (a) existing unfunded pensions were set at relatively low levels; (b) it was politically and economically possible to run large budget surpluses for a number of consecutive years; (c) it was politically feasible to implement a drastic reduction in the absolute income level of the pensioners; (d) the demographic structure of the population was the opposite of the EU: many young and few old people. Also the replacement approach, therefore, implies a drastic redistributional choice, either between generations or between social groups or both at the same time.

That the transition is, fundamentally, an issue of intergenerational redistribution was pointed out by Breyer [1989] and other authors quite a while ago. The point is simple and intuitive. Let $(1+g)$ be the earnings growth factor and $(1+r)$ the rate of return on capital, with $r > g$. If the currently old are expected to receive p under the PAYG plan, switching to capitalization, without making some generation worse, off implies paying them p by issuing public debt. By doing this, the working generation avoid taxation and is allowed to invest the same amount p in the financial markets, providing for its retirement. Instead

of receiving $p(1+g)$ when old the generation that is working and saving at the time of transition will receive $p(1+r)$, which is larger. But, and here is the trick, somebody must bear the burden of the accumulated public debt, which has a value exactly identical to $p(1+r)$. If this is charged to the new working generation, they are worse off. They would end up paying $p(1+r) > p(1+g)$, the latter being their social security contribution under the old PAYG system. Hence a portion at least as large as $(r-g)p$ must be born by the currently old, which were supposed to be benefitted by the transition. It is easy to see that, once the debt is taken care of, also this generation is indifferent between PAYG and capitalization. The argument can be iterated as many times as one pleases, leaving every generation neither worse nor better off than under PAYG. There is no free lunch, indeed.

Further, to the extent that both r and g are random variables and that, as everybody knows, $\sigma_r > \sigma_g$ (i.e. returns on capital are more volatile, even over long periods of time, than GDP growth rates)our citizens are worse off. After the transition they are bearing more risk while receiving the same expected return. No exercise in financial engineering, like the "Government issued put options" proposed, e.g. by Modigliani et al. [1999], can obliterate this simple fact. The new lunch is, indeed, quite expensive.

Last, but not the least, is the issue of "which generation is going to gain" from the transition? This topic has not been investigated enough in the literature and it certainly deserves additional and important attention. To the best of our knowledge only Miles [1998] and Miles and Iben [1998], have tried to provide a quantitative answer to this question, by modelling explicitly the transition path and its differential impact upon various generations. The answer is unequivocal: under wide ranges of realistic parameter values, a transition from an unfunded to a funded pension system entails a drastic reduction in the consumption levels of the generations that are currently alive, be them retired, working or even just born. The gains from transition would begin to flow only to individuals that are (Miles and Iben [1998], Tables 7 and 8) at least 10 to 20 years from being born at the date the transition starts. Most of the gains are expected to flow to individuals that are born between half and a full century after the transition was initiated.

Even taking for granted the efficiency gains obtainable at the new steady state (which, as already argued, are not there), it is unclear why the current generations should even consider the hypothesis of undertaking such a transition. As a matter of fact, simple political economy considerations suggest that, at least in this respect, the demographic bomb does matter. The age of the median voter that, in most European countries, is now between 42 and 45 will grow steadily toward 50+ in the next few decades. We cannot envisage

reasonable institutional reforms that may lower its age. Therefore, we believe the redistributional implications of a full transition makes it politically unfeasible. For once, the median voters' preferences may get us closer to the efficient allocation than otherwise.

In our view there is only one approach to the problem which may make the (partial) transition to a fully funded system both economically and politically attractive. It amounts to financing most of the pension payments to be incurred during the transition phase by issuing new public debt. The cost of servicing and redeeming such debt should be shared equally by all the generations benefitting from the reform. Holzmann [1997] contains some preliminary estimates of the quantities involved here. Much more empirical and theoretical work is needed before we can feel comfortable with these assessments. Such research work is most welcome because, as we argue in the conclusions, some version of this approach is probably the *only* way to implement a successful version of what we have called the "consensus view".

One may argue that those raised so far are purely redistributional issues and that, as such, they should be dealt with by politicians. On purely normative grounds, and abstracting from transition costs, a fully funded system still stands superior to a PAYG one. While we disagree with the naive view that leaves redistributional issues to politicians to meddle with, the substantive claim of the next section is that even on purely normative grounds a fully funded pension system is not to be recommended. We now turn to justify this claim.

5 Issues in the design of an optimal pension system

The intuition behind the claimed Pareto superiority of a fully funded system is based upon the following two facts. b(a) Unfunded systems are financed via a tax on labor income, which inevitably distorts labor supply. Funded systems, instead, are based upon voluntary private saving which involves no distortions in the allocation of resources. (b) Within the context of an overlapping generation model of capital accumulation, unfunded systems can be modelled (see Diamond [1977]) as an income transfer from the young generation to the old one. In such framework, a transfer from the young to the old is beneficial only if the growth rate of the total wage bill were higher than the rate of return on capital. When this is not true (as it seems to have been the case for the EU countries during the last 20 years) the transfer involved with PAYG pensions may lead to an inefficient intertemporal allocation of resources. Claim (a) cannot be disputed: non-lump sum taxes, in general, distort allocations. Hence social security taxes, to the extent they are not lump-sum, are a source of distortions in the labor market. Reliable estimates of the size of such distortions are not available, but

a rough comparison between the USA and the EU suggests they may be non-negligible. Hence, in particular, policies aimed at fostering labor demand in the EU countries may entail a reduction in social security contributions, paralleled, for example, by the adoption of a policy of "flow generosity", such as the one we described in Section 3 or a shifting of taxation to sources other than labor income.

The practical relevance of claim (a), though, should be assessed in relation to the actual form in which fully funded pension plans have been or are being introduced. In the theoretical models, fully funded pension plans are equivalent to private savings of the working generation being invested in productive capital stock and earning the appropriate return. If this were the case in practice, the only policy needed to support a fully funded system would be a reduction of social security contributions or, better, of the total fiscal pressure upon private sector's income. This would increase private disposable income and generate the additional savings to be invested in the mutual funds. In practice, pension funds have been and still are the objects of a host of fiscal and legal incentives that are hardly justifiable on the grounds of economic efficiency. Hence it is not obvious that, in practice, the efficiency gains we can achieve by reducing the distorting social security tax would not be wiped out by the efficiency losses induced by the new fiscal incentives to investing in pension funds.

As for point (b), it is correct *only* in a world in which physical capital[9] is the only reproducible factor of production and the only channel through which individuals can transfer income from the present to the future. The claim, in particular, is not correct whenever there exists a second productive asset, call it human capital, which may be accumulated over time, which contributes to future production but whose rights of ownership cannot be traded in the financial markets or, more generally, cannot be freely transferred from one individual to another. In such circumstances the optimal allocation of resources over time requires that the accumulation of both productive assets be financed in the appropriate proportion. Accumulation should occur up to the point at which, controlling for differential risks, the different investments yield the same rate of return.

Fully funded systems, relying upon the existence of properly functioning capital markets, are generally assumed to be economically efficient. As argued in the previous subsection, their weaknesses are generally attributed either to unwarranted fiscal advantages or to the intra- and inter-generational inequalities they may bring about. We believe this statement is incorrect. Do not misunderstand us: we are not going to claim that, under general circumstances, a

[9] Or, more generally, whatever productive assets financial markets instruments are claims to.

PAYG system is Pareto superior to a fully funded one. We content ourselves with less: fully funded pension plans are not strictly superior to unfunded ones, both as a matter of theory and of facts. Neither strictly dominates the other. A well-designed public pension system should adopt both funding strategies. The latter statement is not meant to be vacuous, that is, the claim that an unfunded system is socially valuable does not refer to a very scaled down, minimum income maintenance unfunded plan as in many "three pillar" proposals currently circulated.

5.1 Is there a reason to keep an unfunded pension system?

Markets in which credit can be obtained to finance investment in individual human capital are not frequent. Indeed, there are well understood reasons for which such markets are difficult to set up and sustain over time. It is also well understood that, in the absence of such borrowing-lending opportunities, the competitive equilibrium cannot bring about an efficient allocation of resources, either static or dynamic.

To fix ideas, consider a world in which people live for three periods. When they are young, they attend school, receive an education and prepare for work. When middle aged, they sell their accumulated human capital on the market, earn a wage, consume and save for retirement. When old, they consume interests and principal from their savings. In each period of time a new generation is born, so that three different generations are alive in each period.

Assume also that both human and physical capital are useful in the production of aggregate output. So, both engineers and machines are needed to carry out production. Better engineers will operate machines more efficiently, while more machines will make the engineers more productive. In such a context a social planner would like to accumulate both kinds of capital. Assume the young have no resources to invest in their own education, and that parents are too selfish to provide privately with the adequate amount.

One may suspect that the last, somewhat unrealistic, assumption will drive our conclusions. This is not so. Parental altruism, as long as it does not fully internalise the welfare of all future generations, would only attenuate but not eliminate the inefficiency we mentioned. In particular, parental altruism by itself cannot, in general, provide the right amount of investment in human capital. This is because parents, even when they care for the consumption or the human capital level of their progenies, cannot internalize the impact upon physical capital's productivity of an increase in the *aggregate* stock of human capital.

Now assume there exists a complete set of financial markets in this economy,

by which we mean that whoever desires to save or borrow can do so, at the market interest rate, provided it respects a lifetime budget constraint: one cannot borrow more than one can pay back. In these circumstances life is simple: the young borrow from the middle age to finance their education. The middle age, who are saving, lend to the young up to the point at which the return from this kind of investment (accumulation of future human capital, H) is equal to the return from the other available investment (accumulation of physical capital, K). Hence both H and K are accumulated in the proper amounts, and our miniature economy displays persistent growth and both static and dynamic efficiency.

When markets are not complete, economic growth is reduced or eliminated altogether and the equilibrium allocation is inefficient. Clearly one may assume that both kinds of capital markets are absent to that neither H nor K can be accumulated. But, in reality, there exist abundant financial instruments to accumulate K and very few if any to accumulate H, especially basic H (the one received in most countries before the age of 18). Hence it is reasonable to assume that, absent some form of collective action, accumulation of H would be drastically reduced.

Such an outcome may be overcome if the members of subsequent generations are capable of implementing a repeated sequence of intergenerational transfers. Consider the following scheme. In each period t two taxes are levied upon the middle age generation, to provide resources for two simultaneous transfers. The proceedings from the first tax are used to pay out a pension (net of income taxes) to the elderly. For the sake of simplicity, assume a period-by-period balanced budget, hence

$$T_t^p = P_t \tag{4.1}$$

where the first symbol denotes the tax and the second the transfer. The proceedings from the second tax are used to finance investment in the education of the young generation. Balanced budget, again, implies

$$T_t^e = E_t \tag{4.2}$$

The budget constraint for the representative member of a generation born in period $t-1$ is, period by period

$$\begin{aligned} 0 \leq & \text{ Investment in education } \leq E_{t-1} \\ \text{Consumption } + & \text{ Saving } \leq \text{ Income } - T_t^p - T_t^e \\ \text{Consumption } \leq & \text{ Return on Savings } + P_{t+1} \end{aligned} \tag{4.3}$$

The structure of the scheme is simple. At each point in time the working age citizens pay back their debt to the elderly, who financed their human capital accumulation during the previous period. Simultaneously they also diversify their

investment portfolio by financing both the accumulation of physical (Savings) and of human capital (E_t). Could this mechanism reach the efficient outcome? Certainly.

5.2 The optimal system of intergenerational transfers

Let d_t^*, denote the amount that a young would invest in personal education in the complete market model of the previous subsection. Equation (4.3) shows that, if the amounts (T_t^p, P_t, T_t^e, E_t) are chosen appropriately, they can satisfy

$$E_t = d_t^* = T_t^e, \qquad P_t = d_{t-1}^*(1 + r*_t), \tag{4.4}$$

where r_t^* is the market rate of return.

Only this arrangement can restore efficiency and improve long-run growth. Without the explicit linkage, stressed in (4.4), between the financing of public education and the payment of PAYG pensions, equilibria in this economy are not efficient. In particular, retirement pensions financed by the investment in K only cannot achieve efficiency. Which is the first point we wanted to make: fully funded pension systems alone do not deliver the efficient allocation.

Secondly, we should also stress that a system of public school financing alone, without connections to the PAYG pensions, cannot achieve intertemporal efficiency either. The ensuing wealth effects on the middle age generation would move consumption and saving away from the dynamically efficient levels. The same "partial" system also suffers of the obvious problem of not being individually rational: each middle age generation would find it attractive to dismantle public education when its turn of financing it arrives. Only the explicit intergenerational linkage ("You will not get your pension if you do not finance the education of the young generation") guarantees that the correct allocation is sustained over time[10].

The scheme we are proposing here is also intergenerationally "fair", in the sense that it provides each generation with a market driven return from its investment in human capital. In the applied literature on PAYG Social Security systems the issue of "actuarial fairness" between contributions paid and pensions received is hotly debated. Our model suggests that one should test actuarial fairness by comparing, on the one hand, the contributions paid with the amount of public education received and, on the other hand, taxes devoted to public education with pension payments.

The final point to be addressed concerns the implementability of such a scheme in the current European context and the difference between the essentially lump-sum taxes considered in our model and actual (linear or non-linear)

[10] For further discussion and technical details, see Boldrin and Montes [1998].

taxes. Implementability hinges, in our view, on the extent to which the proposed system would modify or not the intergenerational transfer flows that are already taking place through the public education and the pension systems. A proper answer requires extensive and detailed microeconomic data analysis to be carried out country by country. Such study has been performed for Spain.[11] It is found there that only relatively minor adjustments should take place, at least for the average citizen. That is: the flow of taxes and benefits paid or received by the average (Spanish) citizen during its lifetime would not be drastically changed. Taking current levels of Spanish investment in public education as given, a reduction of between 2 and 9 percent in the average pension would be the most important change required to satisfy the requirements of our normative model.

This is, though, only the macroeconomic side of the problem. On the microeconomic side things are more complicated and, potentially, more interesting. The rules according to which taxes and transfers are determined would have to change, and change substantially, under the system we are proposing here. Notice, that the education subsidy is de-facto a lump-sum transfer already in most European countries. This is true, at least, for the portion involved with mandatory schooling. The portion relative to higher education is not delivered lump-sum. It is not obvious, at least to us, that public financing of higher education should indeed be maintained. If somebody argues it should, it must be because the social benefits from such provision overcomes the social costs and the distortions induced by the transfer. If this is the case, the superposition of our scheme would not change the results.

One should recognise next that if the educational transfer is lump-sum, then also the social security tax is lump-sum: at the beginning of his or her working life each citizen faces a fixed amount of debt, proportional to the amount of public education received. In practice, it would not be hard to allow individual citizens a certain degree of flexibility about how such debt could be paid back. One may then select to pay it upfront or be charged a fixed labor income tax for a certain number of periods.

Income and other taxes to finance education are certainly not lump-sum and they can hardly be made so. The practical point is, though, that they already exist in all EU countries. Given this fact, our scheme would not add any additional distortion to those already in place. Earmarking simply makes explicit the destination of a certain portion of total tax revenues. By linking some taxes to future pension payments and treating them as an investment it creates, if anything, an incentive for the citizen–voter to guarantee that re-

[11] See Boldrin and Montes [1998], and, for the complete details, Montes [1998].

sources keep flowing into public education and the investment in human capital. Admittedly, if such "investment" becomes subsidized and offers an abnormally high rate of return this would be an inefficient outcome. The latter seems, at least to us, the most serious potential weakness of the proposed scheme. While not a trivial issue, one may think of a variety of checks and balances that can be built into the system to reduce the likelihood of such an outcome.

5.3 The case of uncertain returns, once again

In our model we treat returns on either physical or human capital investments as completely deterministic. In the real world, those rates of return are quite uncertain. Table 7 reports historical averages for each country, while Table 8 presents the estimated variance-covariance matrix. We have not reported explicit computations of private returns on human capital investments, as we have been unable to find comparable estimates for the set of EU countries. Nevertheless, to the extent that labor earnings represent the gross returns from human capital, their mean growth rate and standard deviations are a very reasonable proxy for the unmeasured mean return on human capital investment and its standard deviation.

The reported figures confirm that the return on physical capital is uncertain and risky, and that the rate of growth of real wages is also uncertain but less risky (that is, less volatile) than the former. Expected rates of return are, as expected, higher for physical than for human capital, but both their relative volatility and covariance structure suggest that neither one dominates the other, at least in a mean-variance sense.

Let us go back to our simple model and add some uncertainty to the rates of return from both kinds of investments assuming, as the data show, that the stochastic processes for the two returns are negatively correlated. Would this change the policy recommendation? Indeed no, it would reinforce it. Diversification of risk provides an additional reason to invest in both human and physical capital. This argument, as mentioned in the Introduction, goes back to Robert Merton (see e.g. Merton [1983]).

Hence, a second normative reason for keeping some form of PAYG pension system. Returns on investments are uncertain, the direction of technological progress cannot be predicted decades ahead, rates of return on the stock market need not dominate forever the growth rate of human capital income. Investment in the latter is hard to finance via private credit markets and returns from human capital investment are even harder to securitize.

It is important to note that, also here, financial engineering alone would not do. While the idea of issuing bonds or derivative securities whose return is,

positively, linked to the growth of labor earnings can help diversify individual portfolio, this cannot be true for the aggregate one, unless some external, very large indeed, investor is willing to bear the risk. Eventually, the market portofolio can be diversified only if there exist securities which finance investments in human capital and which, therefore, are *direct* claims to a portion of future labor earnings. A PAYG pension system in which returns are linked to previous investments in human capital, constitutes exactly such a "security".

6 Conclusion and policy recommendations

In this article we have argued the following. The public unfunded pension plans which are currently in place in most European countries are doomed, *rebus sic stantibus*, to become fiscally, and therefore politically, untenable in about 15 to 25 years time. According to our calculations, this fate is determined by a number of concurrent factors: (a) demographic trends, which are rapidly increasing the ratio between the elderly and the rest of the population; (b) rapid decreade in the labor force participation of men, slow increase in the participation rate of women and persistently high unemployment rates across demographic groups; (c) a policy that increases the real value of outstanding pensions by transferring to all pensioners, new and old alike, any increase in average labor productivity; (d) a policy of increasing incentives to early retirement for individuals aged 55+.

Only (a) is a truly exogenous phenomenon, scarcely modifiable by policy, at least in the medium run. All other factors are the direct outcome of political choices. While these choices may be based upon perfectly legitimate social concerns, they are generally unrelated to the purposes and functioning of PAYG pension systems. It takes indeed little to recognise the redistributional nature of factors (b) to (d), the identity and composition of the rent-seeking groups that have been beneficiaries of such redistribution, as well as the specific political episodes that, country by country, have motivated or justified their adoption.

By means of well-calibrated numerical simulations we have shown that, by reversing those ill-fated political choices, the destiny of existing unfunded public pension schemes may also be turned around. More precisely, we have shown the following. Under the assumption that labor productivity will grow at an annual average of 2 percent for the next 55 years, there exists a set of conditions sufficient to maintain the ratio between Old-age pension payments and GDP at worst equal to its current level and in fact below it, for most of the years between now and 2050. Those conditions are:

I From its current level, reduce the ratio between new pensions and labor

productivity of half a percentage point a year. Keep constant the real value of old pensions.

II Between now and 2050, bring LFPRs of males back to where they were in the early 1980s.

III Raise female LFPRs at around 80 percent that of males by 2050.

IV Reduce unemployment rates for men to about half their current level and equate female and male unemployment rate by year 2050.

Secondly, we have argued that proponents of fiscally supported transitions to fully funded pension systems have failed to consider or properly address the following set of controversial issues.

V Fiscal incentives to private, or employment related, pension funds would come at the cost of increasing taxation somewhere else, at least as long as public expenditure is not drastically reduced and the Stability and Growth Pact is in force among EU15 countries. To the extent that disposable income remains the same it is unclear from where the additional saving should come. Hence the transition to a fully funded system requires either a drastic reduction in pension payments to the currently retired or the issuance of earmarked debt and the corresponding relaxation of the debt ceilings established by the Stability and Growth Pact.

VI Even under the assumption that the growth rate of labor productivity will remain substantially below the rate of return on capital for the indefinite future, a transition from PAYG to fully funded cannot be beneficial to everybody. It must, inevitably, imply some loss for the generations currently alive. Unfortunately, careful analysis shows that the benefits will accrue only to generations that are not yet born. This casts serious doubts upon the political feasibility of such a reform.

Thirdly, we have claimed that, at least in principle but also as a matter of practical historical circumstances, the following normative statements should be taken into account when planning a reform of public pension systems.

VII A PAYG system (of a smaller size than current ones) is a necessary tool for achieving intergenerational efficiency and fairness and to sustain long-run growth. This is true at least as long as we do not find means better than public expenditure for financing the accumulation of human capital.

VIII A PAYG system is also a necessary instrument to achieve socially beneficial portofolio diversification.

IX The internal rate of return of an efficient PAYG pension system should not be determined by the growth rate of GDP but, instead, by the rate of return on human capital investments.

X The optimal relative size of the two systems (PAYG and funded) as well as the generosity of the PAYG one, can be calculated by means of objective evidence and well understood economic theory. Historical data about rates of return and their variance-covariance structure can be used, together with optimal portfolio theory, to solve this problem.

Finally, the historical experience of unfunded pension schemes in Europe reminds us of the wisdom of distinguishing "market completing" from "redistributive" policies. PAYG pension plans are public institutions aimed at alleviating inefficiencies generated by the lack of certain financial markets. Their use as camouflaged redistributional devices, motivated by rent-seeking and political purposes, has turned into an abuse and, in about three decades, almost lead to their financial bankruptcy.

We insist on the fact that, in the justifiable and commendable process of getting rid of such redistributional distortions, one does not want to "throw away the baby with the dirty water". PAYG public pension systems do serve a useful purpose, which should be salvaged and enhanced by a deeper reform of the European Welfare State.

References

Bank for International Settlements (BIS) (1998). *The Macroeconomic and Financial Implications of Ageing Populations: A Report by the Group of Ten*, BIS, Basel.

Blöndal, S. and S. Scarpetta (1998). "Falling Participation Rates among Older Workers in the OECD Countries; the Role of Social Security Systems", OECD, Paris.

Boldrin, M. and A. Montes (1998). "Intergenerational Transfer Institutions. Public Education and Public Pensions", mimeo, Universidad Carlos III de Madrid.

Breyer, F. (1989). "On the Intergenerational Pareto Efficiency of Pay-as-you-go Financed Pension Systems", *Journal for Institutional and Theoretical Economics.*

Davis, E.P. (1998). "Pension Fund Reforms and European Financial Markets", Financial Markets Group, Special Paper No. 107.

Diamond, P. (1977). "A Framework for Social Security Analysis", *Journal of Public Economics.*

Diamond, P. (1997). "Macroeconomic Aspects of Social Security Reform", *Brookings Papers on Economic Activity.*

European Commission (1997). *Supplementary Pensions in the Single Market*, Office for Official Publications of the European Communities, Luxembourg.

European Commission (1998). *Social Protection in Europe, 1997*, Office for Official Publications of the European Communities, Luxembourg.

Eurostat (1996). *Demographic Statistics 1996*, Office for Official Publications of the European Communities, Luxembourg.

Feldstein, M. (1995). "Would Privatizing Social Security Raise Economic Welfare?", NBER Working Paper No. 5281.

Feldstein, M. (1996). "The Missing Piece in Policy Analysis: Social Security Reform", *American Economic Review Papers and Proceedings.*

Feldstein, M. (1999). "America's golden opportunity", *The Economist*, March 13th.

Feldstein, M. and A. Samwick (1998). "The Transition Path in Privatizing Social Security", in M. Feldstein (ed.) *Privatizing Social Security*, University of Chicago Press, Chicago.

Gruber, J. and D. Wise (eds.) (1998). *Social Security and Retirement Around the World*, University of Chicago Press, Chicago.

Holzmann, R. (1997). "On Economic Benefits and Fiscal Requirements of Moving from Unfunded to Funded Pensions", *European Economy Reports and Studies.*

Kotlikoff, L. (1995). "Privatization of Social Security: How it Works and Why it Matters", NBER Working Paper No. 5330.

Kotlikoff, L. (1996). "Privatizing Social Security at Home and Abroad", *American Economic Review Papers and Proceedings.*

Merton, R. (1983). "On the Role of Social Security as a Means for Efficient Risk Sharing in an Economy where Human Capital is not Tradeable", in Z. Bodie and J. Shoven (eds.) *Financial Aspects of the United States Pension System*, University of Chicago Press, Chicago.

Miles, D. (1999). "Modelling the Impact of Demographic Change Upon the Economy", *Economic Journal.*

Miles, D. and A. Iben (1998). "The Reform of Pension Systems: Winners and Losers Across Generations in the UK and Germany", mimeo, Imperial College.

Miles, D. and A. Timmermann (1999). "Risk Sharing and Transition Costs in the Reform of Pension Systems in Europe", *Economic Policy*, this issue.

Mitchell, O. and S. Zeldes (1996). "Social Security Privatization: A Structure for Analysis", *American Economic Review Papers and Proceedings.*

Modigliani, F., M.L. Ceprini, and A.S. Muralidhar (1999). "An MIT Solution to the Social Security Crisis", Sloan Working Paper SWP No. 4051.

Montes, A. (1998). *Education and Pensions: Looking Deeper into the Mechanisms of the Welfare State*, Ph.D. Dissertation, Universidad Carlos III de Madrid.

Roseveare, D. W. Leibfritz, D. Fore, and E. Wurzel (1996). "Ageing Populations, Pension Systems and Government Budgets: Simulations for 20 OECD Countries", OECD Economics Department Working Paper No. 168.

Samuelson, P. (1975). "Optimum Social Security in a Life-cycle Growth Model", *International Economic Review.*

World Bank (1994). *Averting the Old Age Crisis: Policies to Protect the Old and Promote Growth*, The World Bank, Washington D.C.

U.S. Department of Health and Human Resources (1998). *Social Security Programs Throughout the World*, Washington, DC.

Table 1: Social protection expenditures in the EU, 1995

	SPE %GDP	SPE %GE	SPE p.c. PPS '000	GDP p.c. PPS '000	Pension Expenditures %SPE	%GDP
Austria	29.7	55.2	5.7	19.2	46.7	13.9
Belgium	29.7	52.9	5.6	18.9	39.8	11.8
Denmark	34.3	55.2	6.3	19.8	36.6	12.6
Finland	33.8	54.7	5.0	16.8	31.8	10.4
France	30.6	55.1	5.5	18.6	40.7	12.5
Germany	30.4	53.5	5.8	20.3	40.8	12.0
Greece	21.0	44.7	2.3	11.2	n.a.	n.a.
Ireland	19.9	40.1	3.2	16.0	24.9	5.0
Italy	24.6	43.6	4.1	18.1	62.7	15.4
Luxembourg	25.3	57.9	7.7	29.0	43.2	10.9
Netherlands	31.6	56.1	5.8	18.5	35.5	11.2
Portugal	20.7	42.3	2.4	12.1	38.6	8.0
Spain	21.8	49.7	2.9	13.2	44.1	9.6
Sweden	35.6	48.9	6.1	17.8	36.6	13.0
UK	28.5	57.4	4.5	17.3	38.0	10.4
EU	28.4	52.2	4.8	17.4	42.4	12.1

Notes: SPE: Social Protection Expenditures. GE: Government Expenditures. Pensions include expenditures classified under the Old-age and Survivors functions.

Table 2: Demographic indicators for the EU

	(1)	(2)	(3)	(4)	(5)	(6)
Austria	2.7	-1.3	69.5	7.4	18.6	22.8
Belgium	2.6	-1.0	70.6	6.2	18.5	23.3
Denmark	2.5	-0.7	72.4	2.9	17.8	21.6
Finland	2.7	-0.9	69.1	7.4	18.2	22.8
France	2.7	-1.1	70.3	7.6	19.7	25.0
Germany	2.4	-1.1	72.3	4.2	18.2	22.5
Greece	2.3	-0.9	69.9	7.8	19.9	22.8
Ireland	3.8	-1.9	70.0	5.8	17.4	21.4
Italy	2.4	-1.2	69.8	8.4	19.0	23.9
Luxembourg	2.3	-0.6	69.4	7.2	18.5	23.9
Netherlands	3.1	-1.6	73.4	4.1	18.5	23.2
Portugal	3.1	-1.7	64.0	10.8	18.0	22.1
Spain	2.9	-1.6	69.8	8.1	19.4	23.9
Sweden	2.2	-0.3	73.0	5.8	19.9	24.0
UK	2.7	-1.0	70.8	5.9	18.3	22.3
EU	2.6	-1.1	70.1	7.1	18.5	23.0

(1) Fertility rates in 1960.
(2) Fertility rates, difference 1995-60.
(3) Life expectancy at birth in 1960.
(4) Life expectancy at birth, difference 1995-60.
(5) Male residual life expectancy at age 60 in 1995.
(6) Female residual life expectancy at age 60 in 1995.

Source: Eurostat (1996).

Table 3: Dependency ratios (projections to years 2020 and 2050)

	Youth (0–19)			Elderly (60+)			Total		
	1995	2020	2050	1995	2020	2050	1995	2020	2050
Austria	40.9	36.6	39.5	34.7	46.2	67.3	75.6	82.8	106.7
Belgium	44.1	42.2	44.2	39.0	54.0	66.4	83.1	96.3	110.6
Denmark	41.7	42.0	43.4	35.2	48.8	57.5	76.9	90.8	100.9
Finland	45.9	43.9	43.9	34.0	57.2	64.8	79.8	101.1	108.7
France	48.6	44.4	44.8	37.1	52.9	70.8	85.7	97.3	115.7
Germany	37.3	35.3	37.5	35.8	52.0	64.0	73.1	87.3	101.5
Greece	45.2	41.9	43.0	39.8	51.8	71.4	85.0	93.7	114.4
Ireland	66.8	48.6	47.6	30.1	50.0	104.6	96.9	98.6	152.2
Italy	38.2	35.8	37.7	39.5	56.2	81.5	77.7	92.0	119.2
Luxembourg	41.6	41.7	43.7	33.5	46.6	58.1	75.2	88.3	101.8
Netherlands	42.1	41.8	44.0	30.5	49.6	62.3	72.6	91.4	106.2
Portugal	48.4	41.7	42.8	36.7	44.5	65.5	85.1	86.2	108.3
Spain	46.0	37.4	38.9	37.9	48.2	82.5	83.9	85.6	121.4
Sweden	46.3	45.1	45.9	41.4	52.7	59.1	87.7	97.7	104.9
UK	46.7	41.3	43.4	37.8	48.4	66.7	84.5	89.7	110.1
UE	43.1	39.4	41.2	37.1	51.4	71.8	80.2	90.8	113.0

Source: Eurostat (1996).

Table 4: Participation rates by age and sex in the EU, 1980 and 1995.

	Aged 15–24				Aged 25–54				Aged 55–64			
	Men		Women		Men		Women		Men		Women	
	1980	1995	1980	1995	1980	1995	1980	1995	1980	1995	1980	1995
Austria	n.a.	64.6	n.a.	58.9	n.a.	93.2	n.a.	73.3	n.a.	42.6	n.a.	18.8
Belgium	46.0	36.0	41.8	31.7	94.4	92.3	54.1	68.2	50.6	35.9	12.3	13.3
Denmark	68.3	77.0	62.3	69.4	94.2	91.8	84.4	82.1	67.2	67.9	42.1	40.1
Finland	63.9	51.1	52.8	39.3	92.3	88.3	81.2	85.1	56.3	41.6	41.3	42.9
France	52.5	32.8	44.2	26.7	96.3	94.9	63.0	77.3	69.9	41.5	39.0	30.9
Germany	62.7	57.0	57.2	50.1	94.9	93.1	55.4	73.3	66.9	54.1	28.4	31.1
Greece	50.2	41.3	36.4	32.5	95.3	94.5	44.1	55.0	71.2	61.1	26.2	24.5
Ireland	68.9	49.0	54.2	42.0	95.0	90.6	27.6	54.6	77.9	63.9	20.1	21.2
Italy	48.7	43.8	39.9	33.8	93.3	89.5	38.9	53.7	56.2	44.1	10.5	13.8
Luxembourg	63.2	42.8	58.1	40.0	95.3	93.9	41.1	52.7	38.1	35.1	15.2	13.3
Netherlands	49.2	62.2	46.3	61.8	93.0	92.6	34.0	65.7	65.3	41.4	14.4	18.6
Portugal	78.3	47.2	63.7	38.9	95.0	93.6	54.8	74.1	75.6	61.9	32.4	34.5
Spain	70.8	47.7	49.4	42.4	95.6	92.5	30.2	55.1	77.6	54.9	21.9	19.9
Sweden	71.8	50.1	69.7	49.9	95.3	90.6	81.1	86.2	79.2	70.4	54.5	63.4
UK	86.5	74.4	68.4	64.9	95.3	92.7	69.2	74.0	79.2	62.4	37.8	40.8
EU	62.5	52.4	52.9	43.8	94.3	92.4	54.2	68.7	65.2	52.3	28.2	27.9

Source: OECD, *Employment Outlook*, several years.

Table 5: Unemployment rates by age and sex in the EU, 1980 and 1995.

	Aged 15–24				Aged 25–54				Aged 55–64			
	Men		Women		Men		Women		Men		Women	
	1980	1995	1980	1995	1980	1995	1980	1995	1980	1995	1980	1995
Austria	n.a.	5.7	n.a.	6.2	n.a.	3.6	n.a.	4.8	n.a.	4.4	n.a.	2.9
Belgium	10.0	19.7	28.6	23.7	7.2	6.2	15.2	11.1	12.0	3.8	4.3	4.4
Denmark	17.9	7.8	19.4	12.3	7.4	5.0	8.3	7.6	6.2	6.9	6.5	9.8
Finland	11.1	41.3	10.5	28.1	5.4	14.6	4.3	14.6	3.6	16.3	5.5	22.8
France	9.3	21.0	18.6	32.2	3.2	8.8	5.5	12.6	4.1	7.7	5.1	6.6
Germany	2.9	8.3	5.2	8.0	2.0	6.4	3.8	9.2	5.5	10.7	5.9	13.5
Greece	16.9	19.4	29.9	37.7	4.7	5.1	8.3	10.9	3.0	3.6	1.8	2.9
Ireland	10.0	20.5	8.1	17.4	6.6	11.2	4.5	10.9	6.5	7.5	4.4	8.5
Italy	21.3	29.0	30.7	37.6	1.9	6.7	7.1	12.6	2.0	4.1	7.4	4.9
Luxembourg	5.4	6.7	7.6	7.8	1.6	1.7	3.9	3.9	.1	.0	3.5	1.0
Netherlands	7.3	11.5	8.9	12.7	2.9	5.4	2.8	7.9	3.3	3.6	2.7	3.2
Portugal	10.2	15.1	27.3	17.1	2.4	5.3	7.3	7.0	.3	4.9	.7	2.6
Spain	17.7	37.0	22.0	49.1	5.7	15.3	4.6	27.5	5.0	12.6	1.1	11.4
Sweden	4.7	16.7	5.3	14.0	1.3	7.2	1.6	5.9	1.8	8.5	2.2	6.3
UK	9.2	17.9	8.2	12.2	5.3	8.5	5.5	6.0	7.6	10.1	4.6	3.7
EU	11.0	19.2	16.5	22.2	4.1	8.0	5.9	11.0	4.4	8.7	4.0	8.2

Source: OECD, *Employment Outlook*, several years.

Table 6: "Typical" internal rates of return and pension benefits from earnings-related pension schemes in some EU countries.

	(1) Retirement years	(1) Benefits	(3) IRR (%)	(4) $\frac{\text{Pension}}{\text{Productivity}}$ (%)
Austria	21	1.9%*wage for each year 1-15 plus 1.5%*wage for each year 16-34	3.02	42.5
Belgium	21	$.675\frac{35}{42.5}$*lifetime average wages	3.79	32.1
Finland	20	.575*average wage in 2 of last 4 years (taking out highest and lowest wage)	3.00	41.2
France	22	$.5\frac{35}{37.5}$*average wage in last 15 years	3.32	30.7
Germany	20	$.7\frac{35}{37.5}$*lifetime average wages	2.04	38.6
Greece	21	.5*average wage in last 5 years	2.70	35.7
Italy	21	.7*lifetime average wage	1.95	36.9
Portugal	20	.7*average wage in last 10 years	3.23	48.5
Spain	22	Average wage in last 15 years	4.03	66.3
Sweden	22	.6*lifetime average wages	4.94	34.9

Note: The ratio of pension to labor productivity is the average over the retirement period.

Table 7: Average percentage rates of return on different assets, 1961–96

	USA	Germany	UK	France	Italy	Japan
GDP growth						
1961–70	3.8	4.3	2.8	5.4	5.6	9.9
1971–80	2.8	2.7	1.9	3.3	3.5	4.4
1981–90	2.6	2.2	2.6	2.3	2.2	3.9
1991–96	2.1	3.2	1.5	1.2	1.0	1.8
1961–96	2.9	3.1	2.3	3.2	3.3	5.4
Earnings						
1961–70	4.0	4.5	3.3	5.2	5.2	5.2
1971–80	2.6	3.0	1.9	3.9	3.6	3.6
1981–90	2.4	1.3	2.7	1.2	2.2	2.2
1991–96	2.1	3.2	.6	.8	-.3	-.3
1961–96	2.8	3.0	2.3	3.0	3.0	3.0
Long term bonds						
1961–70	1.7	3.0	2.8	2.1	2.2	–
1971–80	-.1	2.7	-1.6	.4	-3.4	-.5
1981–90	5.4	4.7	4.6	5.1	4.4	4.6
1991–96	4.3	4.0	4.8	5.6	6.5	3.7
1961–96	2.7	3.6	2.4	3.0	1.9	2.6*
Stocks						
1961–70	4.8	-4.1	.3	-3.4	–	1.9
1971–80	.23	-4.3	-4.5	-4.4	-17.9	4.9
1981–90	11.5	11.3	9.8	11.1	15.9	15.8
1991–96	16.5	-.3	5.4	-.1	-4.5	-4.4
1961-97	7.4	0.8	2.5	.9	-1.8*	5.5

Notes: *1971–96.

Earnings: Rate of growth of the compensation of employees, adjusted for self-employment and deflated by the GDP price deflator. Long term bonds: Long-term interest rates minus the rate of growth of the GDP Price deflator. Stocks: Rate of growth of stock indexes minus the rate of growth of the GDP Price deflator (it does not include dividends).

Table 8: Standard deviations and correlations of annual percentage rates of return on different assets, 1961–96

		GDP growth	Earnings	Bonds	Stocks
USA					
	GDP growth	*2.02*			
	Earnings	.85	*1.74*		
	Bonds	-.01	-.02	*2.48*	
	Stocks	-.18	-.35	.39	*16.70*
Germany					
	GDP growth	*2.66*			
	Earnings	.89	*2.89*		
	Bonds	-.10	-.31	*1.45*	
	Stocks	-.07	-.37	.28	*16.32*
UK					
	GDP growth	*1.99*			
	Earnings	.61	*2.11*		
	Bonds	.35	.09	*3.51*	
	Stocks	.35	-.09	.27	*16.25*
France					
	GDP growth	*1.96*			
	Earnings	.80	*2.19*		
	Bonds	-.33	-.63	*2.47*	
	Stocks	-.11	-.39	.21	*18.73*
Italy					
	GDP growth	*2.35*			
	Earnings	.70	*2.48*		
	Bonds	-.27	-.39	*4.41*	
	Stocks	.14*	-.16*	.23*	*38.82**
Japan					
	GDP growth	*3.53*			
	Earnings	.69	*2.48*		
	Bonds	.12*	-.34*	*4.01**	
	Stocks	.20	-.08	.29*	*19.08*

Notes: *1971–96. Standard deviations in italics.

Figure 1: Exit rates from the labor force, average 1994–96

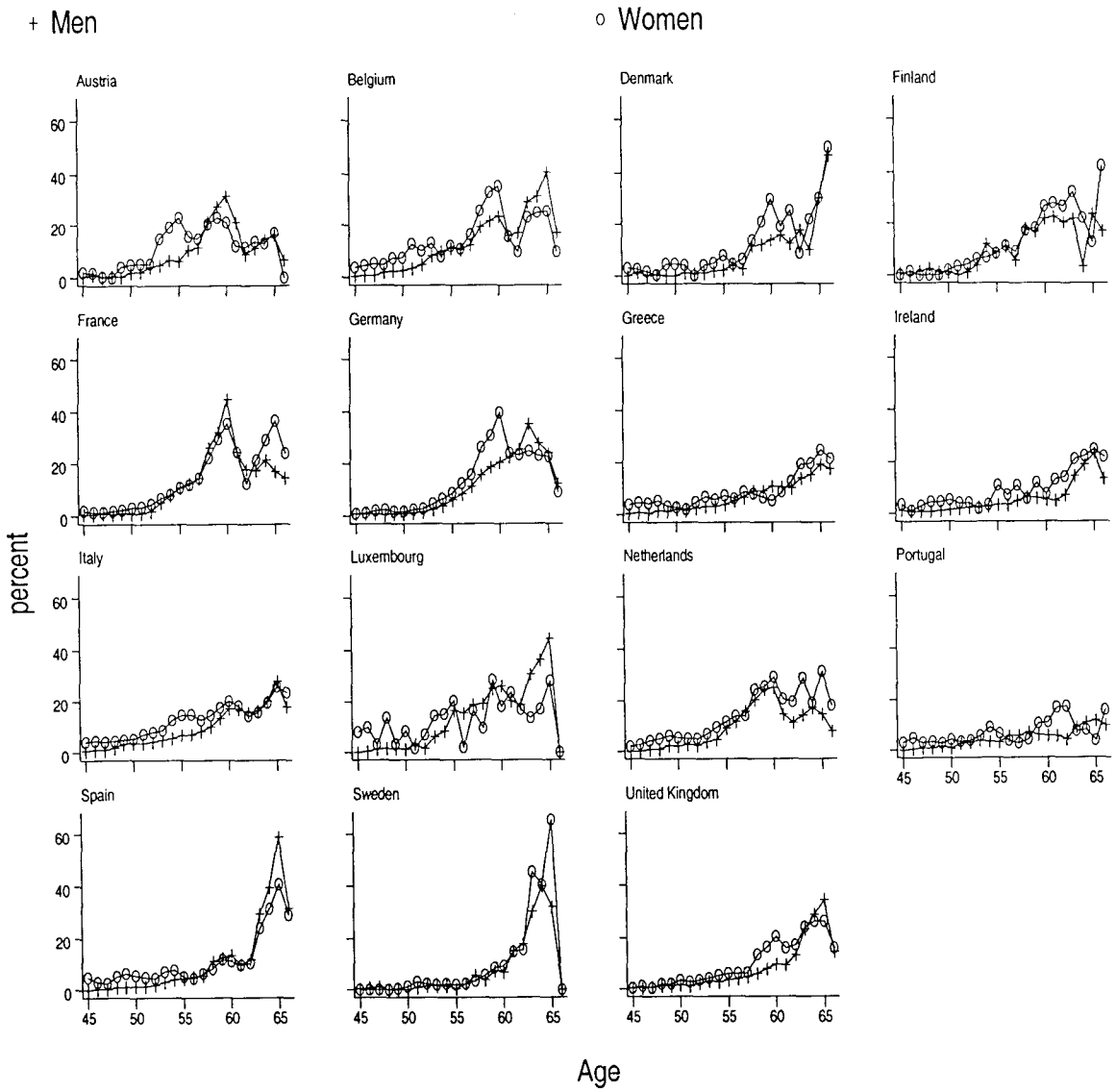


Figure 2: Exit rates between 1991 and 1996 of men born in 1931–40 and changes in the unemployment rates of men aged 21–30.

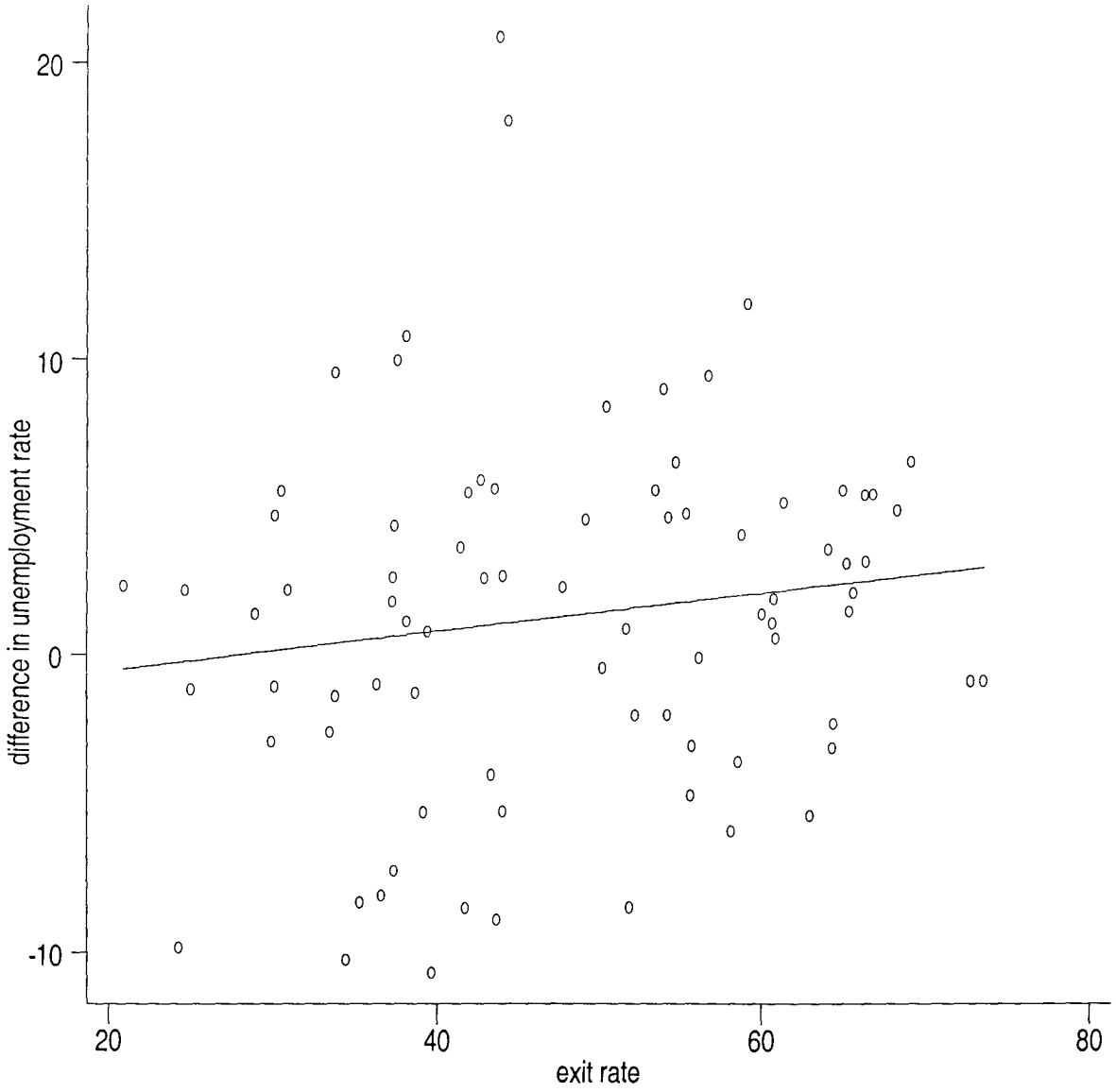


Figure 3: Exit rates between 1991 and 1996 of women born in 1931–40 and changes in the unemployment rates of women aged 21–30.

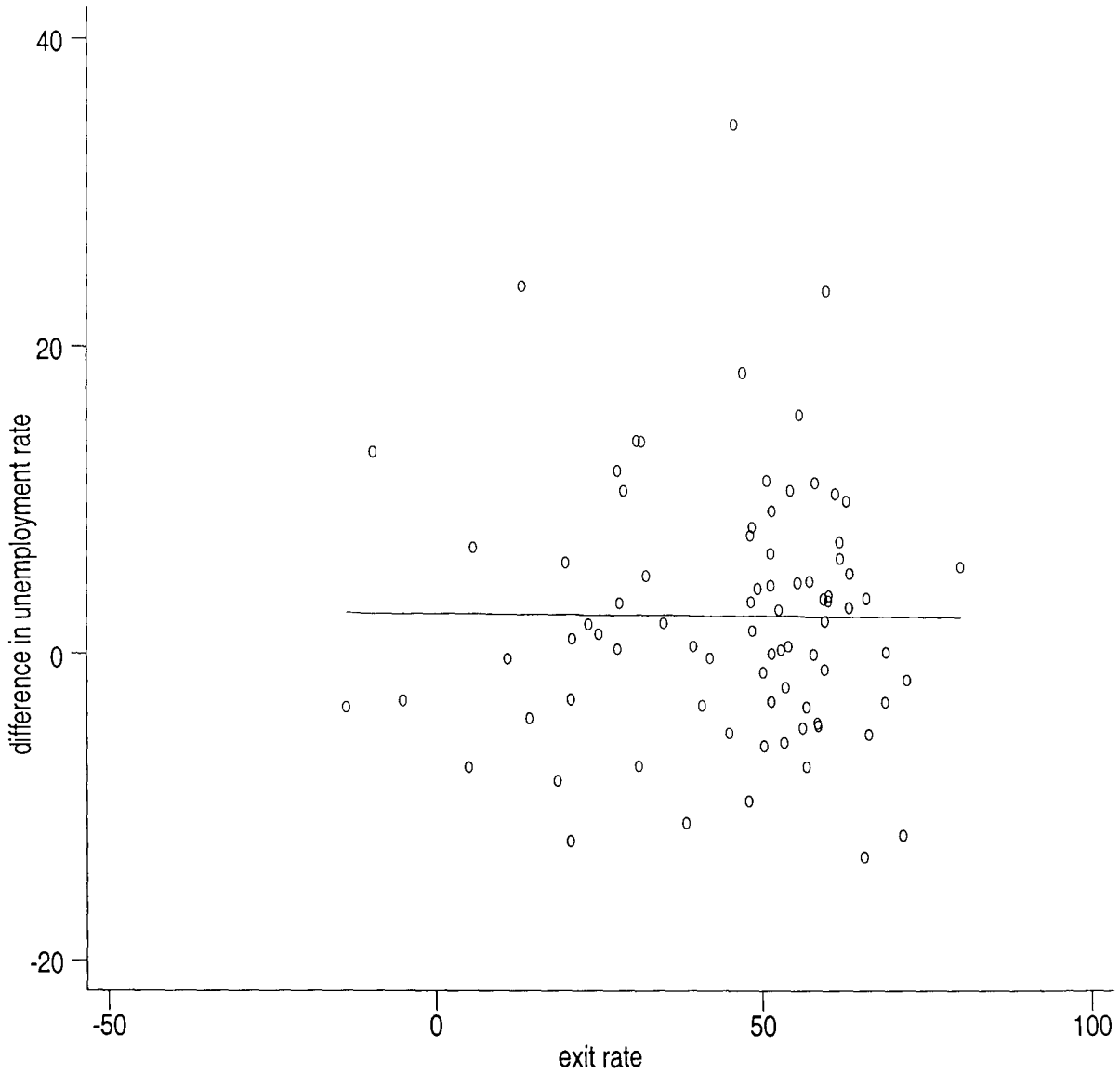


Figure 4: Average pension/labor productivity, 1980–95

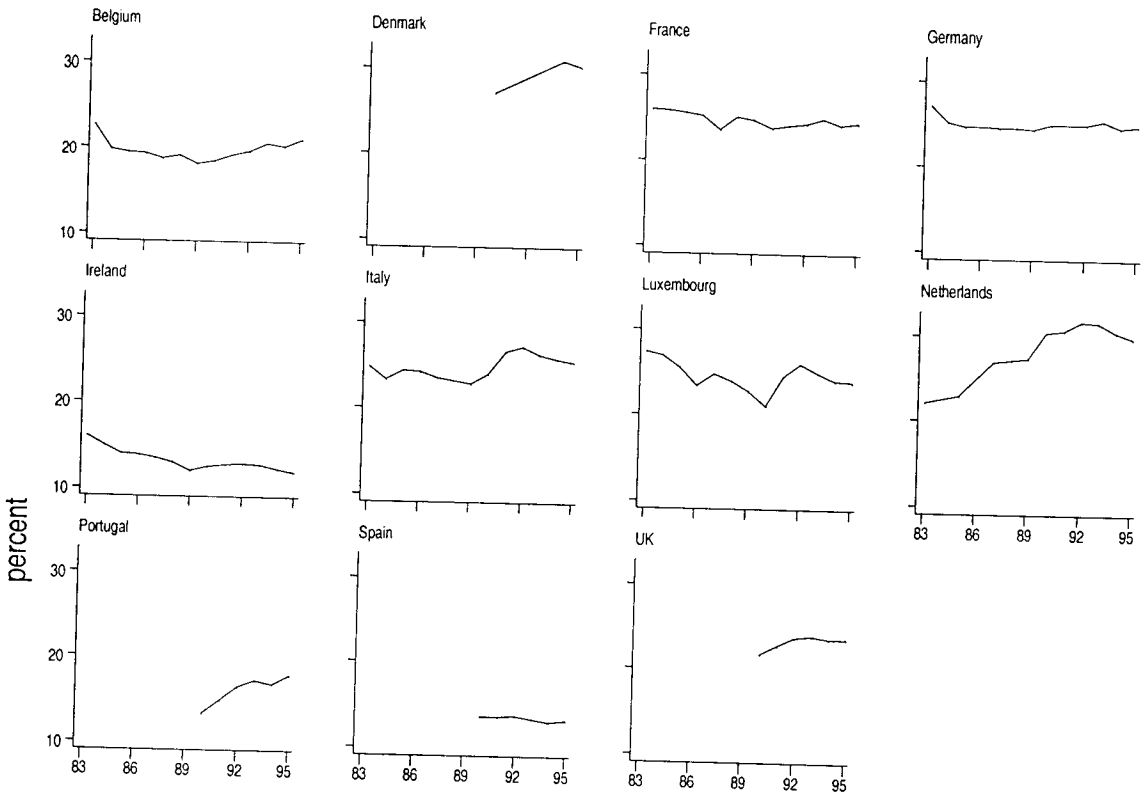


Figure 5: Pension expenditure/GDP by country. Baseline simulation

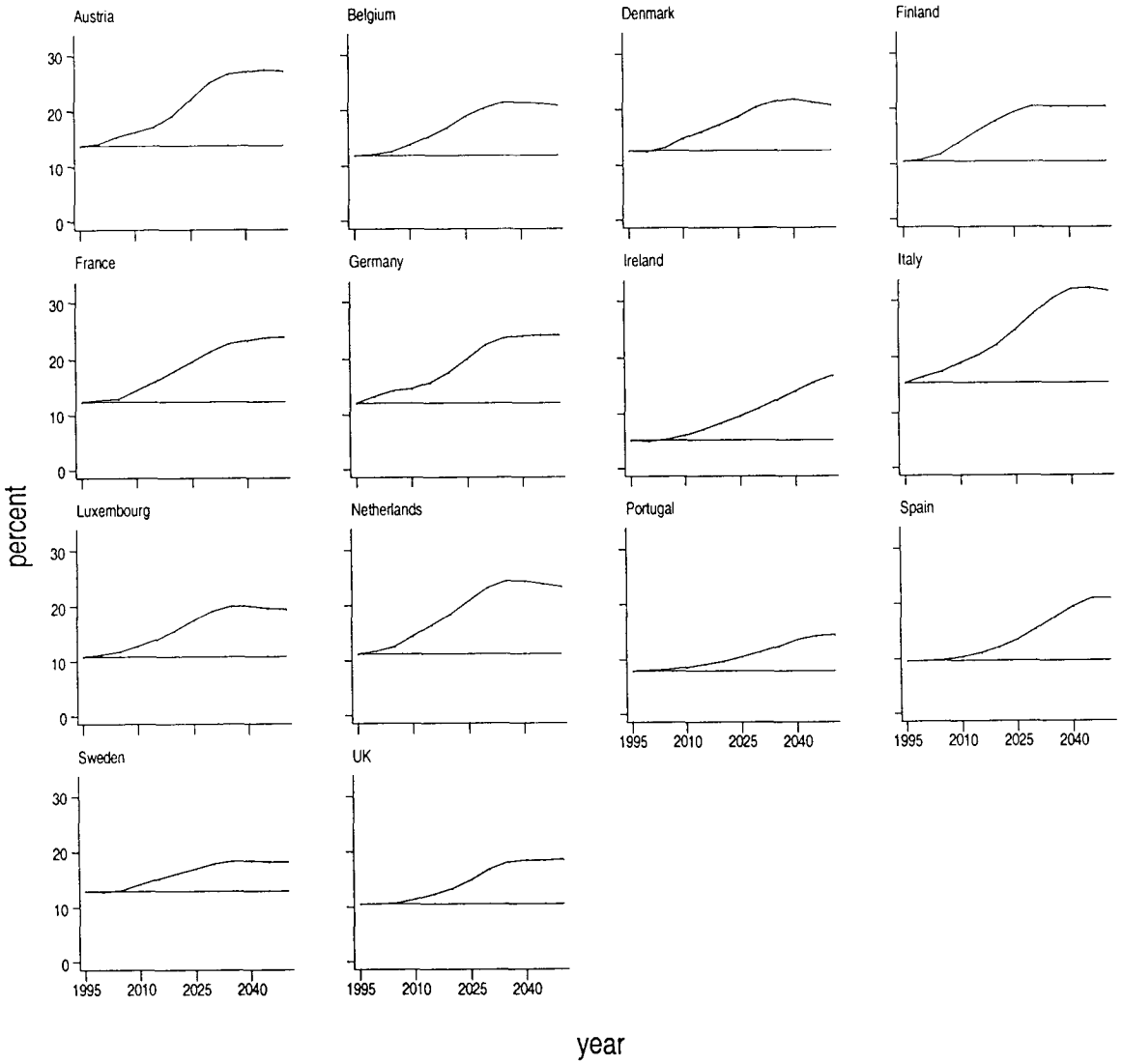
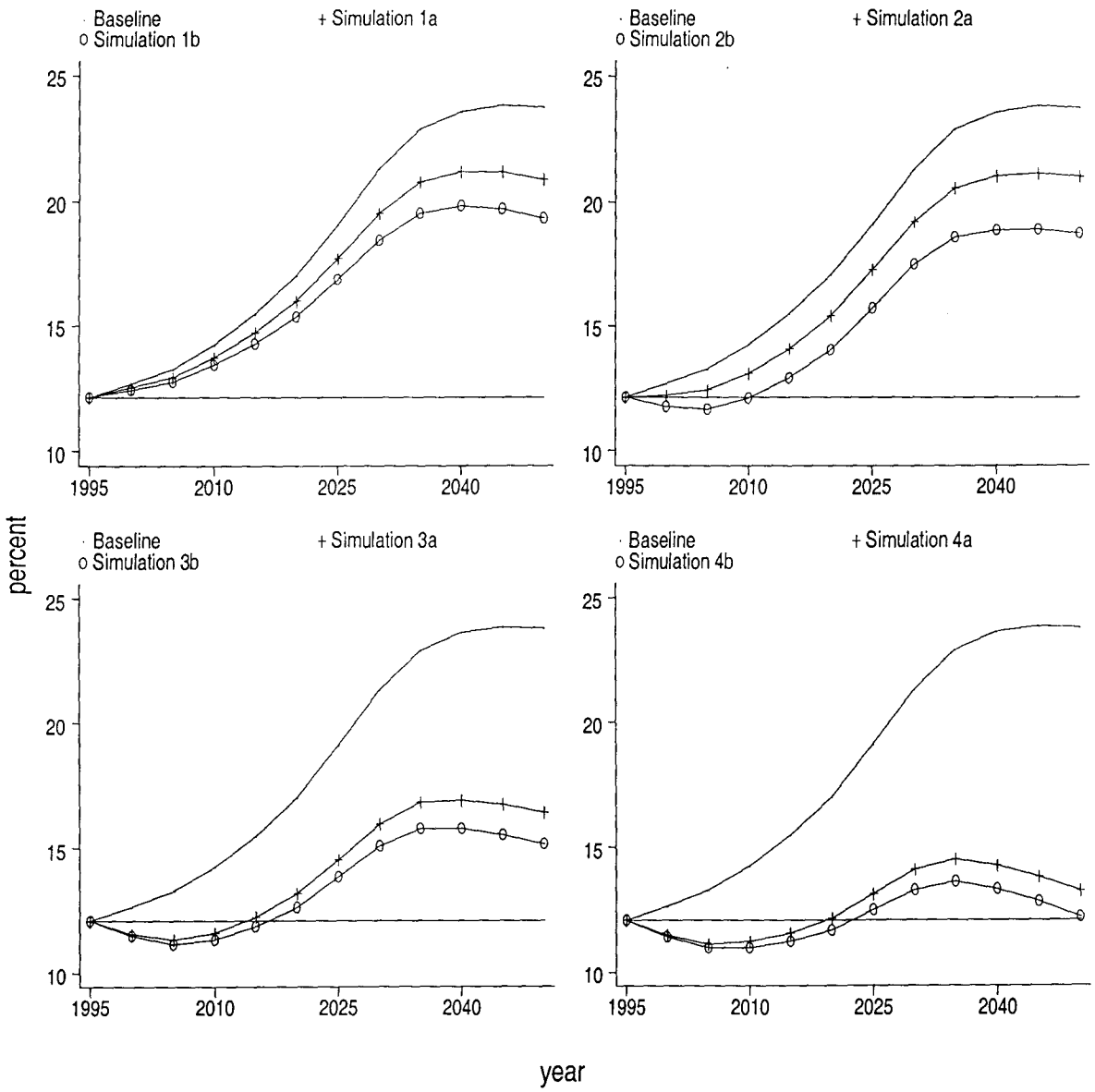


Figure 6: Pension expenditure/GDP. EU11 average



A Institutional features of pensions systems in the EU

Table A.1: The three pillars of pension systems in the EU

	Public pay-as-you-go system			Employers' provided pensions		Private pensions
	Flat-rate scheme	Earnings-related schemes Benefits related to contributions	Special schemes	Coverage (1)	Funds (2)	Pension funds (3)
Germany	NO	YES	YES	46	5.8	14
France	YES (MT)	YES	YES	less than 10	3.4	7
Italy	YES (MT)	YES	YES	5	1.2	7
UK	YES	NO	NO	75	79.4	77
Ireland	YES (MT)	NO	NO	40	40.1	n.a.
Spain	YES (MT)	YES	YES	15	2.2	4
Belgium	YES (MT)	YES	YES	31	3.4	11
Netherlands	YES	NO	NO	85	88.5	127
Portugal	YES (MT)	YES	YES	15	n.a	9
Greece	NO	YES	YES	n.a.	n.a.	n.a.
Denmark	YES (MT)	YES	NO	80	20.1	84
Sweden	YES	YES	NO	n.a.	n.a.	66
Finland	YES (MT)	NO	YES	n.a.	n.a.	35
Austria	YES (MT)	YES	YES	n.a.	n.a.	n.a.

MT: Means-tested.

(1) (% private employment, early 1990s)

(2) (%GDP, 1993)

(3) (%GDP). Including funded employers' provided pensions.

Sources: US Department of Health and Human Resources, Social Security Programmes Throughout the World.

Table A2 Public earnings-related pensions in sample of countries, mid 1990s

	Contribution (%)		Eligibility			Pension		Indexed to	Widow's
	Worker	Firm	Age (M, W)	Contribution years	Early retirement (M, W)	Benefits	Maximum		benefit
Aust	10.25	12.55	65, 60	15 of last 30	60, 55	1.83% earnings in best 15 years of first 30 years + 1.675% for each year 31-45	80% of average covered earnings; 60% if early retirement	Wages	40-60%
Belg	7.5	8.86	65, 61	45 (M), 41 (W)		Based on salary & length of work	60-75% average lifetime earnings	CPI	80%
Denm	33.3	66.7 of max of 233.. kroner	67		50-66	Based on entry date and contributions	13500 kroner pa (if work 40 years)	Wages	Lump sum
Fin	4.5	16.6	65	40	60	1.5% per year worked (2.5% after age 59) Average wage in 2 of last 4 years (eliminating highest and lowest)	60-70%	CPI	up to 50%
Fra	6.55	8.2 + GSC & 1.6% total payroll	65	37.5	60	50% of highest 10 years	50%	CPI	52%
Ger	10.15	10.15	65, 60	at least 5	60	[earnings/ avge earnings] x [years] x 46 DM/month	70% (after 45 years)	Wages	60-100%, 3 months max
Gre	< 8.87	<14.73	65, 60	4500 days	58, 50	30-70% earnings in last 5 years		Pensions of Civil servants	70%
Ire	< 7.75	<12.2%	66	156 weeks		71-116.5 punts/week			64.5 punts/wk
Ita	6	24.5	63, 58		50	1.6 – 2 % of average lifetime earnings		CPI	60%
Net	16.35		65			1988-2860 guilders (couple); 1430 (single)		Minimum wage	1755 – 2040 guilders
Por	7.7	16.7	65	180 months	60	2% of earnings per year;average annual earnings during highest 10 of last 15 year	80%	CPI	60%
Spa	4.7	23.6	65	15	60	3.5% (first 15 years) + 2.5% (rest); average of last 15 years	100% (after 35 years)	CPI	45%
Swe		13.0	65	30	60	60% (average of last 15 years)		Wages	40%
UK	<10	<10	65, 60			£58.85 / wk + supplement		CPI	£58.85 / wk
US	6.2	6.2	65		62	Based on lifetime earnings	$2099 / month	CPI	100%
Jap	8.67	8.67	60, 59	25	60	0.75% times months worked		CPI	

Source: US Dept of Health and Human Resources: *Social Security Programmes Throughout the World*