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THE REDISTRIBUTIVE DESIGN OF SOCIAL SECURITY SYSTEMS*

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Abstract

Countries with low intragenerational redistribution in social security systems (Bismarckian) are associated with larger public pension expenditures, a smaller fraction of private pension and lower income inequality than countries with more redistributive social security (Beveridgean). This paper introduces a bidimensional voting model to account for these features. Agents different in age, income and in their ability to invest in the capital market vote on the degree of redistribution of the social security system and on the size of the transfer. In an economy with three income groups, a small Beveridgean system is supported by low-income agents, who gain from its redistributive feature, and high-income individuals, who seek to minimize their tax contribution and to invest in a private scheme. Middle-income individuals instead favor a large Bismarckian system.

PAYG social security systems are at the centre of public sector expenditures in OECD countries. Although traditionally high, the attention of both economists

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and policy-makers towards pension systems has even increased recently under the pressure of the aging process. The current debate focuses on the role of public *versus* private pension provisions, the implications of demographic dynamics for the future of PAYG systems, the impact of different benefits on income inequality, redistribution and old age poverty.

PAYG social security systems may involve different types of redistribution, across generations, i.e. from young to old, and within the same generation across different income levels, typically from rich to poor. OECD public pension programs differ in their degree of within-cohort redistribution (see Disney, 2004 and OECD, 2005). What are generally identified as 'Bismarckian' schemes feature a tight link between individual's contributions and pension benefits (France, Germany and Italy[1]). In these countries, pension's replacement rates are similar, and generally high, across individuals of all income levels. Since contributions tend to be proportional to earnings, the social security system does not redistribute within-cohort. Countries with Bismarckian systems typically feature high pension spending and low income inequality. In 'Beveridgean' schemes instead, public pension benefits are only loosely linked to contributions, with lower replacement rates for higher than for lower earners. Thus, these systems redistribute within-cohort.[2] This outcome may be reached under alternative schemes: in Australia benefits are income-tested and financed from general tax revenues, in Netherlands and New Zealand benefits are flat, in Canada, Ireland, Japan, Switzerland and UK a two-tier or multi-pillar system combines flat and earnings-related benefits, in the US benefits are highly non-linear in income.

[1] The recent introduction in Italy, Poland and Sweden of notional accounts defined contribution public pension scheme has strengthened this link between contributions and benefits.

[2] Notice that we focus on PAYG and we abstract from fully-funded pension systems. Our terminology identifies as 'Beveridgean' a pension program that entails high redistribution (as in Casamatta et al.2000a, b; Disney, 2004); yet in the original Beveridge report flat benefits were designed to be financed by flat contributions. See section 2 for a detailed classification.

The aim of this paper is to provide a positive theory of the redistributive design of social security which accounts for these different features of the two alternative systems. We develop a bidimensional political economy model, with two overlapping generations and three income groups, with different access to the capital market. High-income individuals are able to earn higher returns from private savings than respectively middle and low-income agents.[3] The design of the social security system is decided through a political process. People vote contemporaneously, yet issue-by-issue, on two dimensions of the social security system: the pension level and the degree of intragenerational transfer in the benefit formula. In our setting, low-income people support a redistributive (Beveridgean) social security system, middle-income people are more likely to support a Bismarckian public social security system, and high-income individuals oppose any public pension system, since they are able to obtain higher returns from private schemes.

Two political equilibria may arise. For high degrees of income inequality, a coalition of the extremes emerges: a voting majority of low and high-income individuals supports a Beveridgean system, featuring a high level of pension for the low-income individuals. The overall size of the system is small, and a large private pillar arises. Interestingly, in this equilibrium high-income agents favour a more redistributive (Beveridgean) system, which lowers the cost of providing a pension to the low-income types, and thus allows them to invest more resources in the more profitable private pension scheme. If instead income inequality is low, middle-income people represents a majority which sustains a Bismarckian system, with a low pension transfer to the low-income people, but a larger size of the system, which leads also to a smaller private pillar.

This paper belongs to the political economy literature of social security (see

[3]This assumption is supported by the evidence collected in Guiso et al.(2002) in particular by Carroll (2002). More references are in section 2.

Galasso and Profeta, 2002; Mulligan and Sala-i-Martin, 2004 for recent reviews), which has mainly focused on explaining the aggregate size of social security, by assuming benefits to be either perfectly flat-rate (Beveridgean) or earnings related (Bismarckian). A first analysis of different benefit formulas was in Casamatta, Cremer and Pestieau (2000a,b), Cremer and Pestieau (1998) and Pestieau (1999), who examine the effects of the design of the benefit formula (Bismarckian versus Beveridgean) on the optimal size of the social security system. Their papers unveiled a 'puzzle': Beveridgean systems, involving intragenerational redistribution, should enjoy larger support among low-income people than Bismarckian ones, and thus be larger; yet this is counterfactual. However, these studies do not address which system, whether Bismarckian or Beveridgean, arises. Our main contribution to the literature is to introduce a joint analysis of both the size and the redistributiveness of the pension systems. To examine a majoritarian voting game in which the issue space is multidimensional, and hence Nash equilibria may fail to exist, we use the notion of issue-by-issue voting (or structural induced equilibrium)[4] as applied to the social security voting games by Conde-Ruiz and Galasso (2003; 2005) in a different context. In this more comprehensive framework the paper addresses the puzzle and accounts for many features of the two alternative systems.

The paper is organized as follows: the next section provides an empirical motivation. The following sections introduce the economic environment, the voting game and the politico-economic equilibria. Section 4 presents the main results, including a discussion of the consequences of aging on the politico-economic equilibria. Section 4 concludes. All proofs are in the appendix.

[4] Other political structures used in this literature include probabilistic voting, veto power or legislative bargaining and lobbying (see Persson and Tabellini, 2000).

1. Empirical motivation

This section provides a classification of different countries systems between Beveridgean and Bismarckian, presents the features generally associated with these two systems, and discusses the individuals' preferences over the different elements of the two systems, using opinion survey data. This evidence motivates the theoretical model.

1.1. *How to Classify Countries*

Conceptually, the difference between Beveridgean and Bismarckian social security systems hinges on their different degree of within-cohort redistribution. Hence, different criteria can be used to classify countries into these two categories, depending on how intragenerational redistribution is measured. According to Disney (2004), Bismarckian systems are characterized by a high within generation 'actuarial fairness', i.e. benefits are closely related to earnings histories, and by replacement rates that are almost equal across individuals of all income levels, whereas Beveridgean schemes typically depart from the criterion of intragenerational actuarial fairness, and feature lower replacement rates for high earners than for low earners.

Our measure of the degree of redistributiveness of the social security system is obtained by computing the correlation coefficient between pension benefits level and pre-retirement earnings. We refer to this coefficient as to the 'Bismarckian' index. We use survey data from the European Commission Household Panel (ECHP)[5] for a sample of European countries[6] from 1994 to 2000 (7 waves). Fol-

[5] For a detailed description of the ECHP see Peracchi (2002) and Nicoletti and Peracchi (2002).

[6] The sample includes Austria, Belgium, Denmark, France, Germany, Greece, Ireland, Italy, Spain, United Kingdom. We exclude Luxembourg, Finland and Sweden, for which there are too few observations and Netherlands because necessary information is not available (the monthly

lowing a procedure similar to Nicoletti and Peracchi (2002), we select individuals aged 55-59 who retired between February 1994 and December 2000, and calculate their monthly old-age pension benefits in the year of retirement and their monthly wage and salary earnings, net of taxes and social security contributions[7], during the year prior to retirement. For each country, we pool the data for individuals retiring during the considered period, but we exclude observations that differ more than three-standard deviations from the median (outliers). A similar approach is used to calculate the 'Bismarckian' index for US, using data from the Panel Study of Income Dynamics (PSID) for 1990 and 1991.[8] Table 1 shows the result of our calculations. Spain and Greece present the highest correlation between the pension benefit level and the level of pre-retirement earnings, followed by France, Germany, Italy and Austria. These countries can be classified as Bismarckian. Denmark, Belgium, Ireland, USA and the UK present a much lower correlation, and are thus of a Beveridgean type. We also perform a statistical test of the equality of correlations across European countries, that rejects the hypothesis of equality across correlations.[9]

Alternative approaches have been used in the literature to classify countries into Beveridgean or Bismarckian. An institutional approach, based on a detailed description of the pension system, analyzes the redistributiveness of the design of the system. A microeconomic projection approach instead calculates pension entitlements for illustrative workers at different levels of earnings, based on the

employment status of individuals).

[7]With the exception of France, where income is gross, because the ECHP only provides gross income for France.

[8]The limited number of observations for US depends on the limited number of waves of PSID comparable to ECHP, i.e. containing variables defined according to the same criteria. For comparisons issues see also CHER, a comparative household panel (www.ceps.lu/cher).

[9]More precisely, we calculate the cross-countries correlations (wage, pension) for all possible couples of countries. Each of these correlation coefficients is transformed using Fisher Transformation (David F.N, 1949). With the transformed coefficients we perform a standard test of equal means.

pension formulae (see OECD, 2005; Disney and Johnson, 2001; Disney, 2004). Table 2 compares our results with the classifications based on the two alternative approaches for a selection of OECD countries. The first six columns report the classification provided by Social Security Throughout the World (2004-05) following an institutional approach. Countries featuring only earning-related systems are typically classified as Bismarckian (Austria, Belgium, France, Germany, Greece, Italy, Spain), while countries where benefits are only means-tested and financed from general tax revenues (Australia), or where a large component of benefits is flat-rate, possibly combined with an earnings-related component (Canada, Denmark, Ireland, Japan, The Netherlands, New Zealand, Switzerland, UK) are of a Beveridgean type. The US is also generally considered Beveridgean because benefits are highly non-linear. The seventh column presents the classification obtained by Disney (2004), using replacement rates[10] calculated by Blondal and Scarpetta (1998), while the last column reports a progressivity index of pension benefit formulae calculated by OECD (2005) using microeconomic projections[11]. The latter index is designed so that a pure flat-rate system, which pays the same amount to all pensioners regardless of their earning history, would score 100%, while a scheme that pays the same replacement rate to all workers would score zero. Interestingly, a comparison of table 1 and 2 suggests that the classifications obtained using these alternative methodologies are in line with what we obtain using survey data[12]. Our analysis based on real data (which, due to the limited

[10] An earlier, similar classification was in Disney and Johnson (2001).

[11] The index is based on the Gini coefficient and considers only mandatory parts of public pension programs. The OECD (2005) calculates replacement rates (gross and net) also by earnings level for mandatory pension programs.

[12] Unlike in our classification, Italy is the more Bismarckian country in the OECD (2005) study, that accounts for the recent reform, which strengthened the link between contributions and benefits. Small discrepancies between Disney (2004) and OECD (2005) concern Belgium and France. For Belgium, OECD (2005) argues that the redistribution happens mainly through a minimum credit in the earnings-related scheme, while for France through a minimum and targeted scheme. A big difference is Netherlands: OECD (2005) suggests that this may be due

number of waves, does not allow to estimate the lifetime income profile of every individual, and to measure the cross-country lifetime income inequality) instead of projections (which necessarily reduce the complex real world to a simplified formula) hence represents a complementary strategy to these methodologies.

1.2. ***Additional Features Associated with Redistribution within Social Security***

Countries with Beveridgean and Bismarckian systems differ along several dimensions. In table 1, data from the ECHP for a selection of European countries show two additional features: (i) more Beveridgean countries are more unequal, since the share of low and high-income individuals is larger than in Bismarckian countries[13]. Simple correlation between our Bismarckian index and the share of middle income group is about 0.69 and between the Bismarckian index and the share of low plus high-income group is -0.69; (ii) countries with a higher Bismarckian index are associated with lower median[14] replacement rates for low-income individuals. This suggests that more Beveridgean systems offer more generous pensions to low-income individuals.

Additional evidence is collected in table 3 for a sample of OECD countries: (i) More Beveridgean countries are typically associated with lower public pension expenditures than Bismarckian ones, (ii) high-income inequality countries are associated with more Beveridgean systems. The Gini index is significantly higher in the UK (36.1) and US (40.81) than, for instance in Germany (28.31) or Italy

to the 'franchise', a calculation mechanism which cuts occupational pension entitlements by the value of the basic pension received.

[13] According to our definition, low-income individuals have a level of wage income net (gross in France) of taxes and social security contributions below half of the median wage income; high-income individuals have a level of wage income above 1.5 times the median wage income and middle-income individuals are in between.

[14] The median is less affected than the mean by the existence of outliers. Nicoletti and Peracchi (2001; 2002) also use a median regression model.

(27.3). This is due to a higher concentration of income in the top 20% in the former countries, while the 'middle' class (second, third and fourth quintile of the distribution) is significantly larger in the latter ones. In fact, the correlation between the OECD progressivity index and the World Bank measure of the share of middle income group is -0,39 while the correlation between the OECD progressivity index and the share of low plus high income group is 0,3. (iii) More Beveridgean systems have a more developed second pillar than Bismarckian, where public pensions are instead more generous. Pension funds assets represent 73.3% of the GDP in the UK, 66.5% in the US, while in Germany they absorb only 3.4% of the GDP and an even smaller amount (1.8%) in Italy; (iv) More Beveridgean systems feature higher average returns from pension funds (see last column in table 3).

1.3. *Evidence from Survey Data*

Our last source of evidence is people's opinion over several features of the social security program. Due to data availability, we restrict this analysis to Europe. There exist two main alternative models of social security provision in Europe: a 'Continental Europe' model, which is commonly associated to the 'Bismarck" tradition, and an 'Anglo-saxon" model, which generally belongs to the 'Beveridge' tradition. Using data from Eurobarometer 56.1 (2001), figure 1 shows that, for a sub-sample of individuals aged 25-45 years old[15], in selected European countries[16] middle-income individuals tend to prefer a pension system featuring a tight link between contributions and benefits more than poor and rich ones do.[17] In other

[15]We select a sub-sample of people in their primary working age and exclude people who, being close to their retirement age, may consider past contributions as a sunk cost and may answer only according to their future (few) contributions and (high) benefits. For these people the main issue is probably the generosity of their pension.

[16]The pattern is similar across European countries.

[17]Lack of information prevents us from following the classification criterion of table 1. Here, poor individuals belong to the first quartile of the income distribution, rich to the fourth quartile and middle-income to the second and third quartile. As in table 1, income measures wage and

words, middle-income individuals prefer a Bismarckian formula. In fact, a statistical test (see table 4) run by pooling the answers in all countries together, rejects the hypothesis of equal parameters for poor and middle-income ($p_1 = p_2$), for rich and middle-income ($p_3 = p_2$), and for poor, middle and high incomes ($p_1 = p_2 = p_3$). This result is stronger in Bismarckian than Beveridgean countries (UK, Ireland, Denmark).[18] Indeed, the same hypothesis of equal parameters is rejected when we consider only Bismarckian countries, while it can not be rejected in case of Beveridgean countries.

Data from Eurobarometer 56.1 (2001) also suggest that in almost all countries the poor prefer their pensions to be provided mainly through public pension schemes (first pillar), while rich individuals favour occupational schemes (second pillar) or private arrangements (third pillar). Middle-income individuals' preferences are intermediate. Moreover, in Bismarckian countries (Germany, Italy, France, Spain) all income groups tend to have a higher preference for the first pillar than in Denmark and UK (see also Cocco and Lopes (2004)). Finally, using polls data, Boeri et al. (2002) suggest that in Germany and Italy rich individuals are more likely to accept a proposal featuring a reduction in the contributions to the public pension system and in the pension benefits (62% in Germany and 56% in Italy) than middle-income (respectively 49% and 44%) and poor (40% and 39%) This result confirms the idea that richer individuals prefer a small public system, accompanied by alternative provisions of retirement income, mainly through private arrangements.

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salary.

[18]Simple correlations show that in Bismarckian countries middle-income individuals agree more on the Bismarckian benefit formula than in Beveridgean countries: the correlation between the percentage of middle-income individuals agreeing on the Bismarckian formula and our Bismarckian index is about 0.4 (-0.39 using the OECD progressivity index).

1.4. ***Key Points of the Empirical Evidence***

To sum up, the evidence provided in this section suggests that:

- Countries classification into the two categories ‘Bismarckian’ and ‘Beveridgean’ are largely consistent among different procedures.
- Countries with more Beveridgean systems are associated with higher inequality than countries with more Bismarckian systems.
- Countries with more Beveridgean systems are associated with higher replacement rates for low-income individuals, lower public pension expenditures, larger second and third pillar and higher average returns from pension funds than countries with more Bismarckian systems.
- In Europe, middle-income individuals prefer a Bismarckian formula of the pension system more than rich and poor do. This result is stronger in countries with a Bismarckian system.
- In Europe, low-income individuals prefer public pension provisions, while high-income ones prefer the second and third pillar and middle-income preferences are intermediate.
- In Germany and Italy, high-income individuals are more likely to accept a proposal featuring a reduction in the contributions to the public pension system and in the pension benefits than low and middle-income ones.

In the remaining of the paper we build a theoretical model which is consistent with all these facts.

2. The Economic Environment

We consider a two-period overlapping generations model. Every period two generations are alive: Young and Old. Population grows at a constant rate, $n > 0$. Individuals work in youth and retire in old age. Within each generation, there are three types of agents (j): low, middle and high ability ($j = L, M, H$), whose proportions are respectively ρ^L, ρ^M and ρ^H where $\rho^j < 1/2$ for each j. Lifetime incomes are equal to the working abilities, and are respectively w^L, w^M and w^H, with $w^L < w^M < w^H$. We call $\overline{w}$ the mean lifetime income, $\overline{w} = \rho^L w^L + \rho^M w^M + \rho^H w^H$, and we further assume that the distribution of abilities and lifetime income is positively skewed so that the average lifetime income exceeds the median lifetime income, $\overline{w} > w^M$.

Agents value consumption in youth and in old age through a constant elasticity of substitution utility function. Young agents pay a proportional tax, τ_t, on their wage income and decide how much to save for old age consumption.

We assume that the interest rate is exogenous and that the three income groups have different access to the capital market. The first assumption, i.e. exogenous interest rate, simplifies the analysis and guarantees the analytical treatment of our political game, but at the cost of abstracting for general equilibrium effects. Cooley and Soares (1999), Galasso (1999) and Boldrin and Rustichini (2000) analyze the political sustainability of social security when the interest rate is endogenous. They argue that the existence of intergenerational redistribution schemes, such as public debt or social security, tends to crowd out capital, thus reducing real wages and increasing real returns to capital. This general equilibrium effect creates redistribution in favour of asset-holders and against individuals who rely on labour income. The second assumption is that the three income groups have different access to the capital market: low-income people obtain a lower return on their saving than middle-income people, who in turn obtain a lower return than high-income people. In other words, we assume that an individual of ability j who saves 1 euro in period t will have a return of $(1 + r^j)$ euro in period $t + 1$, with $r^L < r^M < r^H$. This is a crucial assumption, which can be justified using several complementary arguments: (i) there exist economies of scale in investment, due to the costs of transactions and acquisition of information; (ii) tax advantages of capital gains income worth more to those with more education/income; (iii) richer people are less risk adverse, or they have a lower preference for liquidity: (iv) more educated individuals, which turn out to be richer, are better informed about financial markets conditions, such as investment alternatives, current and future conditions of the economy and they are able to discriminate among advisors more efficiently. Several analysis give empirical support to the above arguments. In particular, Guiso et al.(2002) find that in US, UK, Netherlands, Italy and Germany richer individuals are willing to take more risk because they expect to earn higher returns: for instance, in the UK the fraction of investors in risky financial assets rises from 4.9% of the bottom quartile to 74% in the top quartile and to 86.9% in the top 5% (see Carroll, 2002 and Solmon, 1975). This different composition of the savings portfolio leads to different returns, since historically risky assets have been associated with higher private returns.[19] A similar relation between the wealth level and the asset composition of the portfolios have been found for the UK by Atkinson and Harris (1978), Shorrocks (1982), Banks et al. (1994) and Blake (1992), who finds that the expected real return on assets increases with the level of wealth.

We also assume that $r^L \leq n$, and $r^M > n$, where n, the population growth rate, corresponds with the implicit average rate of return from the social security

[19] These studies support our assumption that wealthier individuals earn higher average rates of return on their private investment. Notice however, that this does not necessarily mean that they earn higher average rates of return on a risk adjusted basis.

system in our model.[20]

Old agents do not work, but receive a pension transfer, p_t^j, where t indicates the time and j the old agent type.

The representative type-j young agent in period t solves the following optimization problem:

$$\max_{c_t^{t,j}, c_{t+1}^{t,j}} U(c_t^{t,j}, c_{t+1}^{t,j}) = u(c_t^{t,j}) + \beta u\left(c_{t+1}^{t,j}\right) \tag{1}$$

subject to the individual budget constraints and to a non-negativity constraint on savings:

$$\begin{aligned} c_t^{t,j} + s_t^j &\leq w_t^j (1 - \tau_t) \\ c_{t+1}^{t,j} &\leq s_t^j (1 + r^j) + p_{t+1}^j \\ 0 &\leq s_t^j \end{aligned} \tag{2}$$

where $0 < \beta \leq 1$ is a factor of time preference, superscripts indicate the period when the agent was born and subscripts indicate the calendar time. The utility function $u(.)$ is strictly concave, with a coefficient of risk aversion greater than one.[21]

The restriction on non-negative savings rules out the possibility of borrowing in youth against future pension payments. This represents a realistic and standard assumption in a two overlapping generation model (Diamond and Hausman, 1984). When $s_t^j > 0$, the first order condition for an interior solution defines the optimal saving decision $s_t^{*,j}$ of a type-j individual:

$$u'\left[w_t^j (1 - \tau_t) - s_t^{*,j}\right] = \beta u\left['s_t^{*,j}(1 + r^j) + p_{t+1}^j\right](1 + r^j) \tag{3}$$

[20] As it should become clear in the next sections, the main results in the paper do not hinge on the assumption that $r^L \leq n$, although this assumption simplifies the analysis considerably. This assumption guarantees that low-income individuals always support a pension system, regardless of its degree of intragenerational redistribution, since their internal rate of return from social security is at least n (in a Bismarckian system).

[21] This assumption ($r_R(x) = -xu''(x)/u'(x) > 1$) is consistent with empirical estimates (Auerbach and Kotlikoff, 1987).

Thus, savings are increasing in the interest rate and in the disposable wage income and decreasing in the pension transfer. A sufficiently large social security transfer totally crowds out private saving.[22]

2.1. *The Social Security System*

We consider a pay as you go (PAYG) social security system, in which workers contribute a fixed proportion of their labour income to the system, and the proceedings are divided among the old. A type-j retiree at time $t+1$ receives a pension, p_{t+1}^{j}, which consists of: i) a contributory part α which is directly related to individual earnings, w^{j}; and ii) a non-contributory part $(1-\alpha)$ which depends on average earnings, $\overline{w}$. The system is assumed to be balanced every period, so that the sum of all awarded pensions is equal to the total contributions. Therefore, at steady-state the average return from social security is given by the population growth rate, since we assume no labour productivity growth. These properties are consistent with the following expression[23] for the pension received by a type-j pensioner:

$$p_t^j = (1+n)\tau_t \left[\alpha_t w^j + (1-\alpha_t)\,\overline{w}\right] \phi\left(\alpha_t\right) \tag{4}$$

where $\phi\left(\alpha_t\right) \equiv \left(1-\eta\left(1-\alpha_t\right)\right)$ characterizes the tax base net of distortion.

The variable α_t is the Bismarckian factor, that is the fraction of pension benefits related to contributions. When $\alpha = 1$ the pension scheme is income-related or purely Bismarckian; and when $\alpha = 0$ pension benefits are flat and the scheme is purely Beveridgean. For intermediate values, $0 < \alpha < 1$, there exists within-cohort redistribution, from rich to poor, which decreases with α.

[22] Specifically, $s_t^j = 0$ if the level of pension is such that: $u'(w_t^j\,(1-\tau_t)) > \beta(1+r^j)u'(p_{t+1}^j)$.

[23] This expression is a stylized representation of the pension formula as a function of the worker's earning history. To a standard formula used in the literature (Casamatta *et al.* 2000a, 2000b), which has the advantage of summarizing in one parameter (α) the degree of within-cohort redistribution, we add a distortionary element (η). For a complete overview on the formulas currently used and the plausibility of our stylization, see OECD (2005).

The parameter η identifies a distortionary effect associated with the non contributory part of the social security system. This is meant to capture the different impact of the social security tax rate on the labour-leisure decision under the two systems, although we abstract from an explicit analysis.[24] As argued by Disney (2004), any public pension program has two components: a 'saving' component, since contributions constitute forced saving providing a claim to future pension benefits, and a 'tax' component, since a part of the worker's contributions will not entitle him to higher pension benefits, thus affecting his labour decision. The more Beveridegan is the system, the higher is its 'tax" component relative to its 'saving' component, i.e. the larger is the distortion. In other words, pensions are less costly, in terms of deadweight loss from taxation, in a Bismarckian than in a Beveridgean scheme.[25]

As in Tabellini (2000) and Conde-Ruiz and Galasso (2005), the redistributive effect of the social security system can be crucial in our political game, because it increases the internal rate of return of the social security system for low ability young.[26]

The PAYG social security budget constraint is the following:

$$\sum_{j=\{L,M,H\}} \rho^j p_t^j = (1+n)\tau_t \overline{w} \phi(\alpha_t) \tag{5}$$

In every period, the social security system can be characterized by the pension received by a type-j individual ($j = M, L, H$), the payroll tax rate, and the Bismarckian factor: (p^j, τ, α). It is sufficient to have two variables determined by the

[24]Endogenous labor supply is considered in Kothenburger et al. (2004). See also Mulligan (2001) for an explanation of the deadweight cost of taxation in political economy models, and De Donder and Hindriks (1999) for an analysis of labor market distortions associated to social security systems.

[25]Disney (2004) provides also empirical evidence on this distortionary component.

[26]Evidence in favor of the existence of this within-cohort redistribution for the US system can be found in Boskin et al. (1987) and Galasso (2002).

political process, in order to fully characterize the entire social security system using equations 4 and 5. We choose these variables to be α and p^L. The choice of α is straightforward, since our analysis focuses on the degree of intragenerational redistribution in the pension system. Among the other variables, we concentrate on the level of pension for the low-income individuals, p^L, for two main reasons: (i) as Disney *et al.* (1998), we believe that the pension level of the low-income individuals plays a key role in shaping the redistributive structure of the system; (ii) a key purpose of a Beveridgean system is to guarantee a minimum retirement income to maintain a decent standard of living for the poorest (European Commission, 2001). For a given p_t^L and α_t, we thus have:

$$\tau_t = \frac{p_t^L}{(1+n)\left[\alpha_t w^L + (1-\alpha_t)\overline{w}\right]\phi(\alpha_t)} \tag{6}$$

$$p_t^M = \frac{\left[\alpha_t w^M + (1-\alpha_t)\overline{w}\right]}{\left[\alpha_t w^L + (1-\alpha_t)\overline{w}\right]} p_t^L \tag{7}$$

$$p_t^H = \frac{\left[\alpha_t w^H + (1-\alpha_t)\overline{w}\right]}{\left[\alpha_t w^L + (1-\alpha_t)\overline{w}\right]} p_t^L \tag{8}$$

Notice that if the system is purely Beveridgean, $\alpha = 0$, pensions are equal across types, $p_t^L = p_t^M = p_t^H$, while replacement rates ($p_t^j/w^j = (1+n)\tau_t\overline{w}/w^j \ \forall j = L, M, H$) are decreasing in labour income. If the system is purely Bismarckian, $\alpha = 1$, pensions are increasing in labour income, $p_t^L < p_t^M < p_t^H$, while replacement rates are equal across types ($p_t^j/w^j = (1+n)\tau_t \ \forall j = L, M, H$).

2.2. *The Economic Equilibrium*

The following definition introduces the economic equilibrium, given the values of the social security system, which are determined by the political game.

DEFINITION *For a given sequence* $\left\{\tau_t, \alpha_t, p_t^L\right\}_{t=0}^{\infty}$, *and exogenous interest rates,* r^L, r^M *and* r^H, *an economic equilibrium is a sequence of allocations,* $\{s_t^j, c_t^{t,j}, c_{t+1}^{t,j}\}_{j=\{L,M,H\}}^{t=0,..,\infty}$, *such that:*

- *In every period agents solve the consumer problem, i.e., every type j young individual maximizes her utility function $U\left(c_t^{t,j}, c_{t+1}^{t,j}\right)$ with respect to s_t^j, and subject to the individual budget constraints;*

- *The social security budget constraint is balanced every period;*

- *The goods market clears every period.*

The life-time utility obtained in equilibrium by a type-j young agent and the remaining life-time utility for a type j old agent are represented respectively by the following indirect utility functions:

$$v_t^{t,j}\left(p_t^L, \alpha_t, p_{t+1}^L, \alpha_{t+1}\right) = u\left[w_t^j\left(1-\tau_t\right) - s_t^{j*}\right] + \beta u\left[s_t^{j*}\left(1+r^j\right) + p_{t+1}^j\right] \tag{9}$$

$$v_t^{t-1,j}\left(p_t^L, \alpha_t\right) = u\left[K_t^j\left(1+r^j\right) + p_t^j\right] \tag{10}$$

where s_t^{j*} is the optimal level of saving obtained at equation 3, τ_t is a function of p_t^L and α_t by equation 6, p_{t+1}^j and p_t^j are functions of $p_{t+1}^L$and α_{t+1} by equations 7 and 8, and K_t^j is a constant which does not depend on current or future values of the social security system.[27]

3. The Political Institution

The size and composition of the social security system are determined through a political process which aggregates agents' preferences over the low-ability agents' pension, $p^L \geq 0$, and the Bismarckian factor, $\alpha \in [0,1]$.

Since the issue space is bidimensional (p^L and α), Nash equilibria of a majoritarian voting game may fail to exist. The literature provides alternative solutions (see Persson and Tabellini, 2000): probabilistic voting, lobbying, structure induced equilibrium, agenda setting. We adopt a majoritarian voting system and use the

[27] Specifically, $K_t^j = s_{t-1}^j(1+r^j)$.

concept of issue-by-issue voting, or structure induced equilibrium, as formalized by Shepsle (1979). As in Conde-Ruiz and Galasso (2003; 2005), our social security game is intrinsically dynamic, since it describes the interaction among successive generations of workers and retirees. We therefore use their concept of subgame perfect structure induced equilibrium, which reduces the game to a dynamic issue-by-issue voting game.

Elections take place every period. All persons alive, young and old, simultaneously but separately cast a ballot over the two dimensions p^L and α. Consider the case of once-and-for-all voting, in which voters at time t determine the constant sequence of the parameters of the welfare state $\left(p^L, \alpha\right)$. In the absence of a state variable, this represents a static voting game, and the results in Shepsle (1979) apply. Hence, if preferences are single-peaked along every dimension of the issue space, a sufficient condition for $\left(p^{L*}, \alpha^*\right)$ to be an equilibrium of the once-and-for-all voting game is that p^{L*} represents the outcome of a majority voting over the jurisdiction p^L, when the other dimension is fixed at its level α^*, and vice versa. In our environment, to guarantee that voters' preferences are single-peaked over the issue space (p^L, α), we need to impose the following restriction[28]:

$$\eta \leq \min\{\left[w^j\left(\overline{w} - w^L\right) - N^j \overline{w}\left(w^j - w^L\right)\right] w^j w^L, (\overline{w} - w^L)/(2\overline{w} - w_L)\} \qquad (11)$$

For a given p^L, the above condition guarantees that it is not possible to increase α and at the same time decrease the payroll tax, τ.

The results obtained in the case of once-and-for-all voting can be extended to the case of repeated voting, in which voters may only pin down the current values of p^L and α, although they may expect their current voting behaviour to affect future voters' decisions. A general result has been proved by Conde-Ruiz and Galasso (2003; 2005) in a similar economic and political environment.

[28] See the Appendix for the formal proof of this condition.

3.1. *Voting on the Low-ability Pension (p^L)*

Regardless of the type of social security scheme, the elderly are net recipients from the system. Therefore, for any value of α, they choose the pension transfer for the low-income individuals, p^L, that maximizes their pension (see equations 7 and 8), and hence its highest possible value, i.e. p^L s.t. $\tau = 1$.

Today's young individuals may be willing to vote in favour of the pension system, and thus to bear the cost of a current transfer, if their vote will also have an impact on their future pension benefit. In a once-and-for-all voting, a type-j young individual chooses her vote, p_j^L, by maximizing her indirect utility function at equation 9 with respect to a constant sequence of pensions, $p_{t,j}^L = p_{t+1,j}^L = p_j^L$.[29] He will fail to support the system, thus choosing a zero low-ability pension and a zero payroll tax if the following condition is satisfied:

$$\left(1 + r^j\right) > (1+n)\phi\left(\alpha\right)\left[\alpha + (1-\alpha)\frac{\overline{w}}{w^j}\right] = \frac{p^j}{\tau w^j} \tag{12}$$

The intuition is straightforward: if the rate of return of his saving technology, $(1 + r^j)$, is higher than the rate of return of social security, $p^j/\tau w^j$,a type-j worker would prefer to transfer resources to the future by using the private saving technology rather than the social security system. Thus, he will prefer a zero low-ability pension and positive savings.

This vote depends on the type of the social security system: for instance, in a purely Bismarckian system ($\alpha = 1$), a type-j young votes for a positive low-ability pension if $r^j \leq n$; while in a purely Beveridgean one ($\alpha = 0$) he will support a positive low-ability pension if $r^j < (\overline{w}/w^j)(1+n)\phi\left(\alpha\right) - 1$. Low-income young vote for a positive pension in a Bismarckian system because $r^L \leq n$, and they are willing to vote for a positive pension also in a Beveridgean system, provided

[29] Notice that, for a given level of α, voting over the jurisdiction p^L is completely equivalent to voting over the jurisdiction τ. In fact, for a given α there is a one-to-one correspondence between the two variables (p^L and τ) through the balanced social security budget constraint.

that the distortion is not too large, $\eta \leq 1 - (1 + r^L)w^L/(1 + n)\overline{w}$. High-income young always vote for a zero low-ability pension (i.e. a zero payroll tax), since they have access to a better saving technology, $r^H > n$, and are net contributors in a redistributive (Beveridgean) system ($w^H > \overline{w}$). The voting behaviour of the middle-income young depends instead on the degree of redistribution (α) and on the performance of the social security system relative to the capital market (r^M versus n).

Finally, notice that if both low and middle-income young choose to vote for a positive low-ability pension, the middle-income young will vote for a larger pension: $p^L_M(\alpha) > p^L_L(\alpha)$ because they want to move more resources into the future than low-ability agents.[30]

In order to simplify the exposition, in what follows we focus on the case in which middle-income young individuals prefer the private technology as a saving device.[31] In this case the identity of the median voter depends on the size of the low-income group: if $\rho^L \geq n/(2(1 + n))$ the median voter is a low-type young, $\alpha < 1$ and pensions are positive; otherwise, the median voter is a middle-income young, there are no pensions and all transfers into the future occur through private savings.

3.2. *Voting on the Bismarckian Factor (α)*

From now on, we may define a system[32] to be Bismarckian if $\alpha > 1/2$ and Beveridgean if $\alpha < 1/2$.

The old have again a simple choice. Since they are no longer required to contribute to the system, they vote for the Bismarckian factor that maximizes

[30] This result was already in Casamatta et al. (2000a).

[31] This constitutes a more conservative assumption vis-à-vis the introduction of the social security system, since in the alternative case a middle-income young voter would choose a positive pension level.

[32] Notice that the use of 1/2 is just for convenience, but does not affect our analysis.

their current transfer for a given level of p^L. Clearly, low-type old are indifferent on this dimension, because their final pension, p^L, is already determined. Middle and high-income old vote for $\alpha = 1$, since, for a given p^L, a Bismarckian system maximizes their pension transfers:

$$\frac{dp^j}{d\alpha} = \frac{\overline{w}\left(w^j - w^L\right)}{\left[\alpha w^L + (1-\alpha)\,\overline{w}\right]^2} p^L > 0;\ j = M, H \tag{13}$$

A type-j young individual maximizes his indirect utility at equation 8 with respect to current and future Bismarckian factors, $\alpha_t = \alpha_{t+1} = \alpha$, for a given value of current and future low-ability pensions, $p_t^L = p_{t+1}^L = p^L$. The next proposition provides a characterization of their voting behaviour.

PROPOSITION 1. *Low-ability young individuals choose a purely Beveridgean system ($\alpha = 0$). Type-j young individuals, with $j = M, H$ vote for:*

$$\begin{array}{ll} \alpha > 1/2 & \text{if} \quad r^j < R^j \\ \alpha < 1/2 & \text{if} \quad r^j > R^j \end{array} \tag{14}$$

where

$$1 + R^j = (1+n)\,\frac{(2-\eta)^2}{4}\frac{w^j - w^L}{w^j(1-\eta) - \frac{w^j}{\overline{w}} w^L} \tag{15}$$

This proposition suggests that low-income young prefer a Beveridgean system, which, for a given p^L, reduces their wage bill. The voting behaviour of the middle and high-income young instead depends on three elements: (i) the performance of the social security system relative to the saving technology $(1+n)/(1+r^j)$: a better performance increases the support for a Bismarckian system; (ii) the distortionary factor η associated to the non-contributory part of the system: a larger distortion increases the support for a Bismarckian system; and (iii) the redistributive element $(w^j/\overline{w})$: a lower cost of redistribution (smaller $w^j/\overline{w}$) increases the support for a Beveridgean system. High-income types are net contributors to a redistributive (Beveridgean) system. Nevertheless, they are willing to sustain a

Beveridgean system if the return on their private assets is sufficiently high.[33] In fact, a Beveridgean system reduces their pension transfer, but also their contributions to the system, which may more conveniently be invested in a private asset. If, instead the return on private asset is not sufficiently high, high-income choose a Bismarckian scheme. Middle-income types display similar preferences.

To summarize, if high types young obtain sufficiently high returns on private assets, a Beveridgean system is always supported by a coalition of the extremes: low and high types young.

4. The Political Economy Equilibrium

The previous sections separately analyzed the voting behaviour of all individuals along the two dimensions of the issue space, α and p^L. Since preferences are single peaked (under condition 11), we can now apply Shepsle's (1979) result, and characterize the structure induced equilibria of the game.

PROPOSITION 2 *For a sufficiently large number of low-income individuals, i.e.,* $\rho^L > n/\left[2\left(1+n\right)\right]$ *there exist a structure induced equilibrium* $\left(p^{L*}, \alpha^*\right)$ *of the voting game, such that:*

For $r^M > R^M$, *if* $\rho^L + \rho^M > \left(2+n-\rho^L\right)/\left[2\left(1+n\right)\right]$ *or if* $r^H > R^H$, *a Beveridgean system prevails (*$p^{L*} = p^L_L \geq 0$ *and* $\alpha^* < 1/2$*)*

For $r^M < R^M$ *and* $r^H < R^H$, $p^{L*} = p^L_L \geq 0$

and the system is $\begin{cases} \text{Bismarckian}(\alpha^* > 1/2) & \text{for } \rho^L \leq (2+n)/(3+2n) \\ \text{purely Beveridgean } (\alpha^* = 0) & \text{otherwise} \end{cases}$

For $r^M < R^M$ *and* $r^H > R^H$, $p^{L*} = p^L_L \geq 0$

and the system is $\begin{cases} \text{Bismarckian}(\alpha^* > 1/2) & \text{for } \rho^M > \left(\rho^L + n\right)/\left[2\left(1+n\right)\right] \\ \text{Beveridgean } (\alpha^* < 1/2) & \text{otherwise} \end{cases}$

First notice that if there is a small proportion of low-income young, i.e., if $\rho^L <$

[33] This result holds for high-income savers. High type non-savers wish to transfer resources into the present. Thus, even for low private returns, they may be willing to support a Beveridgean scheme in order to decrease today's contributions, and hence to increase today's net income.

$n/[2(1+n)]$, no social security system would arise in equilibrium, i.e. $p^{L*} = 0$. This case arises from section 3.1 and represents a usual result in the literature.

Case i) of the previous proposition suggests that a Beveridgean system is an equilibrium if the middle-income young obtain sufficiently high returns from private savings, regardless of the vote of the high-income young, provided that low and middle-income young constitutes a majority of the voters. If this is not the case, then a Beveridgean system can still be an equilibrium if high-income individuals too obtain sufficiently high returns from private savings, since in this case all young prefer a Beveridgean system.

Case ii) points out that a Bismarckian system arises as an equilibrium when both high and middle-income young have sufficiently low returns from private savings, provided that the low-income young do not constitute a majority of the voters. In this case, low-income would be the only ones to benefit from a Beveridgean system. This result suggests that countries with less efficient capital markets, providing lower returns, are more likely to have a Bismarckian system.

The most interesting result arises when middle-income young individuals do not enjoy sufficiently high returns from private savings, but high-income young individuals do (case iii). In this case, which is illustrated in figure 2, a Beveridgean system may be supported by a voting coalition of low and high-income young individuals. This equilibrium resembles the 'ends against the middle' result in Epple and Romano (1996): in the presence of private alternatives, high and low-income individuals prefer lower public expenditure (with the rich choosing more private consumption) against the middle-income who would prefer more public expenditure. However, if there exist a large share of middle types, a Bismarckian system arises. Thus, more inequality, as measured by a large share of low and high-income young, is more likely to be associated with Beveridgean systems, and vice versa.

To summarize, the results in proposition 2 are consistent with the regularities described in section 1: Beveridgean systems are associated with more income inequality than Bismarckian systems and they are more likely to emerge in countries with more developed capital markets, which provide higher returns (see table 3). Finally, the next corollary proves that our model is able to account for the 'puzzle" that Beveridgean systems are associated with a lower size of the PAYG system (a lower tax rate) than Bismarckian ones, consistently with the data in table 3.

COROLLARY *The equilibrium level of the pension of low-income type is weakly decreasing in α, while the equilibrium tax rate is weakly increasing in α.*

Finally, following Conde-Ruiz and Galasso (2003; 2005) the results in proposition 2 can be generalized to a repeated game. There exists a system of punishment and rewards, which makes the equilibrium outcome of the static game a *subgame perfect* equilibrium outcome of the repeated game. Old agents' voting behaviour does not depend on tomorrow's policy and thus on the specification of the game. Young individuals, who were in favour of a positive social security system (either Beveridgean or Bismarckian) in the static game, will now be willing to enter an 'implicit contract' among successive generations of voters to sustain the welfare state: if current young support the existing welfare system, they will be rewarded with a corresponding transfer of resources in their old age, otherwise they will be punished, and receive no transfers.

4.1. *The Effects of Aging on the Political Economy Equilibrium*

Existing one-dimensional political economy models (see Razin, Sadka and Swagel, 2002; Galasso and Profeta, 2004) identify two effects of aging on the size of PAYG social security systems. Aging decreases the returns from PAYG social security systems, due to a raise in the ratio of retirees to workers, thus inducing individuals to prefer a smaller system, but it also increases the political power of the old, thus creating more demand for social security. Our two-dimensional model allows us to analyze a new, unexplored issue: the effect of aging on the intragenerational redistributive element of the social security system.

We distinguish between a severe aging process, which makes social security less convenient than private savings for at least some individuals, and a moderate aging process, which does not change the relative convenience of the pension system. For simplicity, we also assume that the median voter over p^L always votes for a positive social security system, even if the economy faces a severe aging process[34], and we focus on the effects of aging on α. Here, aging has two opposite effects: it increases the political power of the old, who prefer a Bismarckian system, but decreases the performance of the social security system relatively to the saving technology, thus inducing high and middle-income young types to prefer a small Beveridgean system. The final result depends on which effect dominates and on the specific equilibrium region. Case i) of Proposition 2 is not affected by the aging process, because all workers prefer a Beveridgean system and aging only reinforces their preference. In case ii), where middle and high-income types vote for a Bismarckian system, if aging induces both types to change their vote, the equilibrium would shift towards a Beveridgean system. Alternatively, if aging induces only high-income types to modify their vote, the equilibrium moves towards case iii) and the system may still become Beveridgean. In case iii), where high and low-income types vote for a Beveridgean system and middle-income types for a Bismarckian one, a moderate aging process does not swing any vote, but enlarges the area where the Bismarckian system emerges, due to the increase in the number of elderly. A severe aging process may instead

[34] This amounts to assume that $r^L < (1+n)\phi(\alpha)\left(\alpha + (1-\alpha)\left(\overline{w}/w^L\right)\right) - 1$. In fact, in jurisdiction p^L, aging makes social security less convenient than private savings, thus inducing the median voter to vote for a lower level of p^L, while at the same time the median voter is more likely to be a low-ability type.

induce middle-income individuals to vote for a Beveridgean system (see figure 3), thus inducing the emergence of a Beveridgean system supported by all workers.

4.1.1. *A Numerical Example*

To grasp a better understand of the effects of aging on alternative programs, we parametrize our simple economy for two representative countries, Germany (Bismarckian) and UK (Beveridgean). Every period corresponds to 25 years. The returns of social security are measured by the ratio of workers aged 18-59 to the population aged 60 and over. Using World Bank projections, this ratio for Germany will drop from 2.3 in 2000 to 1.6 in 2025, and for UK from 2.8 to 1.7. To construct the performance of the private savings across income levels we use two information: i) Carroll (2000), using the Survey of Consumer Finances, finds that the portfolio of the richest (top 5%) US households is composed by 50.7% by risky assets and by 37% by safe assets, while the portfolio of the other savers is composed by 29.9% by risky assets and by 54.1% by safe assets; ii) Dimson, Marsh and Staunton (2000) find that the annual long run real rates of return in US for the period 1900-2000 for bonds is 2% and for equities is 8.9%. From these information we compute $r^M = 2.5$ and $r^H = 3.6$.

Using the 1995 ECHP data and the same criterion of table 1, we compute the proportions of low, middle and high income group for UK (33%, 35% and 32% respectively) and Germany (23%, 59% and 18% respectively). The degree of income inequality is summarized by the relative income of the poor, middle and high income types with respect to the average income: $w^P/\overline{w} = 0.15$, $w^M/\overline{w} = 0.89$ and $w^H/\overline{w} = 2.04$ in UK and $w^P/\overline{w} = 0.23$, $w^M/\overline{w} = 0.98$ and $w^H/\overline{w} = 2.01$ in Germany.

Finally, to compute the median voter, we include the election's turnout rates by age from US Census Bureau 'Reported Voting and Registration', in which electoral participation increases substantially with age.

The results of our numerical example are in table 5. We call Benchmark Case the equilibrium before the aging shock. With $\gamma = 0.2$, a Beveridgean system arises in UK and a Bismarckian system in Germany. This result depends crucially on income inequality. In fact, in Germany a large middle class (59% of the working population) forms a coalition with the old generation to sustain a Bismarckian system ($\rho^M > (\rho^L + n)/\left[2(1+n)\right]$), while in UK a coalition of extremes (low and high income) sustain a Beveridgean system ((case iii) of Proposition 2). The second part of table 5 shows the effects of the aging process on the equilibrium outcome. As population becomes older, the performance of the PAYG social security system decreases while private assets become more convenient even for middle income groups (severe aging process). As a consequence, a Beveridgean system is preferred by all working population in both countries.

5. Conclusions

We provided a theory of why a Bismarckian or a Beveridgean system may arise, and be characterized by different regularities. Income inequality represents the key determinant of the social security design. Obviously, many evolutionary factors, such as legal differences, political history, migration, etc. and behavioural aspects may contribute to explain both income inequality and the social security design.[35]

We suggest that Beveridgean systems may be supported by a voting coalition of low- income individuals, who favour its redistributive aspect, and high-income individuals, who support the reduced size of the Beveridgean system, which allows them a larger use of private provisions. This explanation is in line with some features that have characterized the origins and the development of the two alternative traditions. It can be argued that the Beveridge report, generally considered

[35] As argued by Alesina and Glaeser (2004).

at the origins of the Anglo-saxon social security model met the preferences of rich and poor individuals, but was opposed by the middle-class. In fact, Hills *et al.* (1994) argue that 'the old age pension campaign had a powerful momentum due to the fact that it was built upon an unholy and unintentional alliance between conservatives and socialists'. The alternative continental European social security model was instead (with the exceptions of Netherlands and perhaps Switzerland) established in Germany by Bismarck, under the pressure of the 'middle class', which included influential industrial unions, narrow industrialized groups, politically important blue-collar, but not the poor.[36] In the last few years the UK program has become more redistributive (European Commission 2001): rich individuals may 'contract out' of the public system and enjoy a reduction of the contribution rate, while the State Second Pension (S2P) scheme introduces a particular attention to the level of pension received by the poor.

Appendix

Proof of single peakness.

We prove that $\eta \leq \min\{\left[w^j\left(\overline{w}-w^L\right)-N^j\overline{w}\left(w^j-w^L\right)\right]w^jw^L,(\overline{w}-w^L)/(2\overline{w}-w_L)\}$ guarantees that preferences of all individuals are single-peaked in both p^L and α.

i) Some straightforward algebra is sufficient to show that $v_t^{t,j}\left(p^L,\alpha\right)$ is a concave function of p^L.

ii) To analyze the preferences over α, first notice that, for a given p^L, an

[36] The introduction of the social security system represented a way to combat dissent and to cement the alliance of these social groups with the Reich, in opposition to the socialist forces (Cutler and Johnson, 2001). In 1871 Bismarck wrote: 'The only means of stopping the Socialist movement in its present state of confusion is to put into effect those Socialist demands which seem justified and which can be realized within the framework of the present order of state and society' (Kohler et al., 1982).

increase of α increases the tax rate (equation 6) only if $\eta \leq (\overline{w} - w^L)/(2\overline{w} - w_L)$:

$$\frac{\partial \tau}{\partial \alpha} = -\frac{-p^L \left\{ \left[\left(\alpha w^L + (1-\alpha)\overline{w} \right) \right] \eta + \phi \left(w^L - \overline{w} \right) \right\}}{\left\{ (1+n)\phi\left(\alpha\right) \left[\alpha w^L + (1-\alpha)\overline{w} \right] \right\}^2}$$

In this case, an increase of α (for a given p^L) reduces the utility of a low-type (equation 9), who, as a consequence, will vote for $\alpha = 0$. On the other hand, an increase of α increases the middle and high type's pensions (equations 7 and 8):

$$\frac{\partial p^j}{\partial \alpha} = \frac{\overline{w}(w^j - w^L)p^L}{\left[\alpha w^L + (1-\alpha)w^H \right]^2} > 0 \text{ for } j = M, H$$

Thus, for middle and high-type savers, $s^{*,j} > 0$, and by the envelop theorem, we can concentrate on the effect on the lifetime income, that we indicated by I^j. $\frac{\partial I^j}{\partial \alpha}$ turns out to be equal to the following expression:

$$\frac{p^L}{\left[\alpha w^L + (1-\alpha)\overline{w} \right]^2} \left(-\frac{w^j \left\{ \left[\alpha w^L + (1-\alpha)\overline{w} \right] \eta + \phi \left(w^L - \overline{w} \right) \right\}}{(1+n)\phi\left(\alpha\right)^2} + \frac{\overline{w}(w^j - w^L)}{1 + r^j} \right)$$

If an internal solution exists, there are two levels of α such that the $\frac{\partial I^j}{\partial \alpha} = 0$:

$$\begin{aligned} \alpha_A^j &= a + b \\ \alpha_B^j &= a - b \end{aligned}$$

where

$$\begin{aligned} a &= \frac{w^j \left(\overline{w} - w^L \right) - \left[(1-\eta) N^j \overline{w} \left(w^j - w^L \right) \right]}{\eta N^j \overline{w} \left(w^j - w^L \right)} \\ b &= \frac{\sqrt{\left[\left(\overline{w} - w^L \right) w^j \right]^2 - N^j \overline{w} \left(w^j - w^L \right) \left[\overline{w} - (1-\eta) w^L \right] w^j}}{\eta N^j \overline{w} \left(w^j - w^L \right)} \end{aligned}$$

Since $\eta N^j \overline{w} \left(w^j - w^L \right)$ is always positive, a sufficient condition to guarantee that preferences are *single peaked* is to impose that $\alpha_A^j > 1$ (notice that $\alpha_A^j > \alpha_B^j$). After some algebra, this condition turns out to be the following:

$$\eta < \frac{w^j \left(\overline{w} - w^L \right) - N^j \overline{w} \left(w^j - w^L \right)}{w^j w^L}$$

Therefore, $\eta \leq \min\{\left[w^j\left(\overline{w}-w^L\right)-N^j\overline{w}\left(w^j-w^L\right)\right]w^jw^L, (\overline{w}-w^L)/(2\overline{w}-w_L)\}$ guarantees that preferences over α are single-peaked.

Proof of Proposition 1

We know that, if $\eta \leq (\overline{w}-w^L)/(2\overline{w}-w_L)$ (as assumed by equation 11) a low-income young individual votes for $\alpha = 0$. To analyze the preferred level of α for middle and high-type savers, $s^{*,j} > 0$, by the envelop theorem, we can concentrate on the effect on the lifetime income (indicated by I^j). $\frac{\partial I^j}{\partial \alpha}$ is equal to the following expression:

$$\frac{p^L}{\left[\alpha w^L+(1-\alpha)\overline{w}\right]^2}\left(-\frac{w^j\left\{\left[\alpha w^L+(1-\alpha)\overline{w}\right]\eta+\phi\left(w^L-\overline{w}\right)\right\}}{(1+n)\phi\left(\alpha\right)^2}+\frac{\overline{w}(w^j-w^L)}{1+r^j}\right)$$

Since preferences are concave in the interval $\alpha \in [0,1]$, if the first order condition of a type-j individual is positive, $\frac{\partial I^j}{\partial \alpha} > 0$, at $\alpha = 1/2$, her most preferred level of α is achieved for $\alpha > 1/2$ (Beveridgean) and vice versa. It can be proved that the first order condition is positive at $\alpha = 1/2$ if and only if:

$$1+r^j < (1+n)\frac{(2-\eta)^2}{4}\frac{w^j-w^L}{w^j(1-\eta)-\frac{w^j}{\overline{w}}w^L}$$

Therefore the above condition guarantees that the individual votes for a Beveridgean system.

Non-savers are at a corner solution in their saving decision, and thus the envelop theorem does not apply. In particular, they would like to borrow against future pension wealth to transfer resources into the present. Analytically,

$$-\frac{\partial U}{\partial c_t^t}+\beta\frac{\partial U}{\partial c_{t+1}^t} < 0$$

For middle and high type non-savers, the choice of α amounts to maximize the following expression: $U(w^j(1-\tau))+\beta U(p^j)$. Thus, we have:

$$\frac{p^L}{\left(\alpha w^L+(1-\alpha)\overline{w}\right)^2}\left(-\frac{\partial U}{\partial c_t^t}\frac{w^j\left\{\left[\alpha w^L+(1-\alpha)\overline{w}\right]\eta+\phi\left(w^L-\overline{w}\right)\right\}}{\left[(1+n)\phi\left(\alpha\right)\right]^2}\right)+$$
$$\frac{p^L}{\left(\alpha w^L+(1-\alpha)\overline{w}\right)^2}\beta\frac{\partial U}{\partial c_{t+1}^t}\frac{\overline{w}(w^j-w^L)}{1+r^j}$$

The previous condition is always positive for $\alpha=1/2$ if

$$1+r^j<(1+n)\frac{\left(2-\eta\right)^2}{4}\frac{w^j-w^L}{w^j\left(1-\eta\right)-\frac{w^j}{\overline{w}}w^L}$$

and therefore $\alpha^j>1/2$.

Proof of Proposition 2

Notice that since $\left(1+r^M\right)>(1+n)\phi\left(\alpha\right)\left[\alpha+(1-\alpha)\frac{\overline{w}}{w^M}\right]\forall\alpha$ and $\eta\leq(\overline{w}-w^L)/(2\overline{w}-w_L)$, the low-type young vote for a purely Beveridgean system and the middle-type young vote always for a zero low-ability pension. We assume that the median voter over the jurisdiction p^L is a low-type young ($\rho^L\geq n/2\left(1+n\right)$, i.e. $p^{L*}=p_L^L(\alpha)$). We thus have the following three cases:.

i) $r^M>R^M$: The middle-young always vote for $\alpha>1/2$. If $\rho^L+\rho^M>(2+n-\rho^L)/\left[2\left(1+n\right)\right]$, the middle-young is always the median voter over the jurisdiction α (regardless of the preferences of the high) and he supports a Beveridgean system ($\alpha>1/2$). If $r^H>R^H$, all young will vote for a Beveridgean system.

ii) $r^M<R^M$ and $r^H<R^H$. In this case the middle and high young vote for $\alpha>1/2$. Since old low types are indifferent, $2+n-\rho^L$ is the size of total population. The median voter over the jurisdiction α is a middle or a high-young only if the low types are less than half the total population ($\rho^L<(2+n)/(3+2n)$), otherwise the median voter is a low-young type. Therefore the system is Beveridgean ($\alpha^*=0$) only if $\rho^L>(2+n)/(3+2n)$ and Bismarckian ($\alpha^*>1/2$) otherwise.

iii) $r^M<R^M$ and $r^H>R^H$. In this case, the middle-young vote for a Bismarckian system $\alpha>1/2$ and the high-young vote for a Beveridgean system $\alpha>1/2$.

The system is Beveridgean if the low and high-young are the majority of the population, i.e. $\left(\rho^H + \rho^L\right)(1+n) > (2+n-\rho^L)/2$, which is equivalent to say that $\rho^M < (\rho^L + n)/\left[2\left(1+n\right)\right]$. Otherwise, if the middle young are the majority, $\rho^M \geq (\rho^L + n)/\left[2\left(1+n\right)\right]$, the system is Bismarckian.

Proof of Corollary

The most preferred level of a low-ability pension for a low ability worker is implicitly defined by the following first order condition:

$$FOC^L(p_L^L) = -u'\left(w^L\left\{1 - \frac{p_t^L}{(1+n)\left[\alpha_t w^L + (1-\alpha_t)\,\overline{w}\right]\phi\left(\alpha_t\right)}\right\}\right) + \\ \beta u'\left(p^L\right)(1+n)\phi\left(\alpha\right)\left[\alpha + (1-\alpha)\left(\overline{w}/w_t^L\right)\right] = 0$$

Using the implicit function theorem we can calculate

$$dp_L^{L*}(\alpha)/d\alpha = -\left[dFOC^L(p_L^L)/d\alpha\right]/SOC(p_L^L)$$

Then, $sign\left(dp_L^{L*}(\alpha)/d\alpha\right) = sign(dFOC^L(p_L^L)/d\alpha)$, since $SOC(p_L^L) \leq 0$. By differentiating $FOC^L(p_L^L)$ with respect to α, we obtain that:

$$\frac{dFOC^L(p_L^L)}{d\alpha} = u''(c_t^L)w^L\left(\frac{p_t^L(1+n)\phi\left(\alpha_t\right)\left(\overline{w} - w^L\right)}{\left\{(1+n)\left[\alpha_t w^L + (1-\alpha_t)\,\overline{w}\right]\phi\left(\alpha_t\right)\right\}^2}\right) + \\ \beta u'\left(p^L\right)(1+n)\left\{\eta\left[\alpha + (1-\alpha)\left(\overline{w}/w_t^L\right)\right] + \phi\left(\alpha\right)\left[1 - \left(\overline{w}/w_t^L\right)\right]\right\}$$

Since $\eta \leq (\overline{w} - w^L)/(2\overline{w} - w_L)$, $dFOC^L(p_L^L)/d\alpha$ is negative. Therefore $dp_L^{L*}(\alpha)/d\alpha \leq 0$.

The most preferred level of tax for a low ability young individual is implicitly defined by the following first order condition:

$$FOC^L(\tau_L^L) = -u'\left[w^L\left(1-\tau\right)\right]w^L + \beta u'\left(p^L\right)(1+n)\phi\left(\alpha\right)\left[\alpha w_t^L + (1-\alpha)\,\overline{w}\right] = 0$$

Using the implicit function theorem, we can calculate

$$d\tau_L^{L*}(\alpha)/d\alpha = -\left[dFOC^L(\tau_L^L)/d\alpha\right]/SOC(\tau_L^L)$$

Then, $sign\left[d\tau_L^{L*}(\alpha)/d\alpha\right] = sign\left[dFOC^L(\tau_L^L)/d\alpha\right]$, since $SOC(\tau_L^L) \leq 0$. By differentiating $FOC^L(\tau_L^L)$ with respect to α, we obtain that:

$$\frac{dFOC^L(\tau_L^L)}{d\alpha} =$$
$$\beta(1+n)\left\{\phi'(\alpha)\left[\alpha w_t^L + (1-\alpha)\overline{w}\right] + \phi(\alpha)\left(w_t^L - \overline{w}\right)\right\} u'\left(p^L\right)\left[\frac{u''\left(p^L\right)p^L}{u'\left(p^L\right)} + 1\right] =$$
$$\beta(1+n)\left\{\phi'(\alpha)\left[\alpha w_t^L + (1-\alpha)\overline{w}\right] + \phi(\alpha)\left(w_t^L - \overline{w}\right)\right\} u'\left(p^L\right)\left[1 - r_R(p^L)\right]$$

Since $r_R(p^L) > 1$ by assumption and $\eta \leq (\overline{w} - w^L)/(2\overline{w} - w_L)$, then $d\tau^*(\alpha)/d\alpha \geq 0$.

References

Alesina, A. and Glaeser, E. (2004). *Fighting Poverty in the US and Europe*, Oxford: Oxford University Press.

Atkinson, A.B. and Harrison, A.J. (1978). *The Distribution of Personal Wealth in Britain*, London: Cambridge University Press.

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

Banks, J., Dilnot, A. and Low, H. (1994). *The Distribution of Wealth in the UK*, London: Institute for Fiscal Studies.

Blake, David (1996). 'Efficiency, Risk Aversion and Portfolio Insurance: An Analysis of Financial Asset Portfolios held by Investors in the United Kingdom', ECONOMIC JOURNAL, vol. 106(438) (September), pp. 1175-1195.

Blondal, S. and Scarpetta, S. (1998). 'The retirement decisions in OECD countries', OECD Economics Department Working Paper 202, Paris.

Boeri, T. and Boersch-Supan, A. and Tabellini, G. (2002). 'Pension Reforms and the Opinions of European Citizens', *American Economic Review*, vol.92(2) (May), pp. 396-401.

Boldrin M. and A. Rustichini (2000).'Political Equilibria with Social Security', *Review of Economic Dynamics*, vol. 3(1) (January), pp. 41-78.

Boskin, M.J., Kotlikoff, L.J., Puffert, D.J. and Shoven, J.B. (1987). 'Social Security: A Financial Appraisal across and within generations', *National Tax Journal* vol. 40, pp. 19-34.

CHER (Consortium of Household Panels for European Socio-Economic Research) www.ceps.lu/cher.

Carroll, C. (2002). 'Portfolios of the Rich', in (L. Guiso *et al.*, eds), *Household Portfolios*, pp. 389-430, Cambridge: MIT Press.

Casamatta, G. and Cremer, H. and Pestieau, P. (2000a). 'The Political Economy of Social Security', *Scandinavian Journal of Economics,* vol. 102(3) (September), pp. 503-522.

Casamatta, G. and Cremer, H. and Pestieau, P. (2000b). 'Political Sustainability and the Design of Social Insurance', *Journal of Public Economics,* vol. 75 (3) (March), pp. 341-64.

Cocco, J. and Lopes, P. (2004). 'Adverse selection in Pension Choice', mimeo, LBS and LSE.

Conde-Ruiz, J. I. and Galasso, V. (2003). 'Early Retirement', *Review of Economic Dynamics,* vol. 6(1) (January), pp. 12-36.

Conde-Ruiz, J. I. and Galasso, V. (2005) 'Positive Arithmetic of the Welfare State', *Journal of Public Economics,* vol. 89 (5-6) (June), pp.

933-955.

Cooley T.F., and J. Soares (1999). 'A Positive Theory of Social Security Based on Reputation', *Journal of Political Economy*, vol. 107(1) (February), pp. 135-160.

Cremer, H. and Pestieau, P. (1998). 'Social Insurance, Majority Voting and Labor Mobility', *Journal of Public Economics,* vol. 68(3) (June), pp. 397-420.

Cutler, D. and Johnson, R. (2001). 'The birth and growth of the social-insurance state: explaining old-age and medical insurance across countries', Federal Reserve Bank of Kansas City Working Paper 01-13.

David, F. N. (1949). 'The Moments of the z and F Distributions', *Biometrika*, vol. 36, pp. 394-403.

Davis, E.P. (2001). 'Portfolio regulation of life insurance companies and pension funds' in *Insurance and Private Pension Compendium*, Paris: OECD.

De Donder, P.and Hindriks, J. (2002). 'Voting over Social Security with Uncertain Lifetimes', in (C. d'Aspremont *et el.,* eds), *Institutional and Financial Incentives for Social Insurance*, pp. 201-220, Boston: Kluwer Academic Publishers.

Diamond, P.A. and J.A. Hausman (1984). 'Individual Retirement and Savings Behavior', *Journal of Public Economics* vol. 23(1-2) (March), pp.81-114.

Dimson, E., Marsh, P. and Staunton, M. (2000) 'Risk and Return in the 20th and 21st centuries', *Business Strategy Review* vol. 11(2), pp. 1-18.

Disney, R., Mira d'Ercole, M. and Scherer, P. (1998). 'Resources During Retirement', Aging Working Paper 4.3, OECD, Paris.

Disney, R. and Johnson, P. (eds). (2001) *Pension Systems and Retirement Incomes across OECD countries,* Cheltenham: Edward Elgar.

Disney, R. (2004). 'Are contributions to public pension programmes a tax on employment?', *Economic Policy* vol. 19(39) (July), pp. 267-311.

Epple, D. and Romano, R. (1996). 'Ends Against the Middle: Determining Public Service Provision when There are Private Alternatives', *Journal of Public Economics* vol. 62(3) (November), pp. 297-325.

Eurobarometer 56.1 (2001), Bruxelles: European Commission.

European Commission Household Panel. Wave 1994-2000, Bruxelles: European Commission.

European Commission (1997). *Supplementary Pensions in the Single Market. A Green Paper*, Bruxelles: European Commission.

European Commission (2001). Economic Policy Committee Report. *Budgetary challenges posed by ageing populations*, Bruxelles: European Commission.

Galasso (1999). 'The US Social Security System: What Does Political Sustainability Imply?', *Review of Economic Dynamics*, vol. 2(3) (July), pp. 698-730.

Galasso, V. (2002). 'The US Social Security: A Financial Appraisal for the Median Voter', *Social Security Bulletin vol.* 64(2) (September), pp. 57-65.

Galasso, V. and Profeta, P. (2002). 'The Political Economy of Social

Security: A survey', *European Journal of Political Economy*, vol. 18(1) (March), pp. 1-29.

Galasso, V. and Profeta, P. (2004). 'Lessons for an Aging Society: the Political Sustainability of Social Security Systems'*Economic Policy*, vol. 19(38) (March), pp. 63-115.

Guiso, L. Haliassos, M. and Jappelli, T. (2002). *Household Portfolios*, Cambridge: MIT Press.

Hills, J. Ditch, J. and Glennerster, H. (eds) (1994). *Beveridge and Social Security,* Oxford: Clarendon Press.

Kohler, P. Zacher, H. and Partington, M. (eds) (1982). *The evolution of social insurance 1881-1981,* London and New York: St. Martin's Press.

Kothenburger, M., Poutvaara, P. and Profeta, P. (2005). 'Why are more redistributive social security systems smaller? A median voter approach', CESifo Working Paper 1397.

Mulligan, C.B. (2001) 'Economic Limits on "Rational" Democratic Redistribution' mimeo, University of Chicago.

Mulligan, C. and X. Sala-i-Martin (2004). 'Internationally Common Features of Public Old-Age Pensions, and Their Implications for Models of the Public Sector', *Advances in Economic Analysis & Policy*, vol. 4(1), article 4.

Nicoletti, C. and Peracchi, F. (2002). 'Aging in Europe: A cross-country comparison', mimeo, University of Essex and University of Rome Tor Vergata.

OECD (2004a). *Total public social expenditures*, Paris: OECD.

OECD (2004b). *Total assets of private pension funds*, Paris: OECD.

OECD (2004c). *Financial Market Trends* vol.87, Paris: OECD.

OECD (2005). *Pensions at a Glance. Public policies across OECD countries,* Paris: OECD.

Peracchi, F. (2002). 'The European Community Household Panel: A review', *Empirical Economics* vol. 27(1), pp. 63-90.

Pestieau, P. (1999) 'The Political Economy of Redistributive Social Security', International Monetary Fund Working Paper 99/180.

Persson, T. and Tabellini, G. (2000). *Political Economics. Explaining Economic Policy*, Cambridge: MIT Press.

PSID (Panel Study of Income Dynamics), 1990-1991, US.

Razin, A., Sadka, E. and Swagel, P. (2002). 'The aging of the Population and the Size of the Welfare State', *Journal of Political Economy,* vol. 110(4) (August), pp. 900-918.

Shepsle, K. (1979). 'Institutional arrangements and equilibrium in multidimensional voting models', *American Journal of Political Science,* vol. 23 , pp. 27-59.

Shorrocks, A. (1982) 'The portfolio composition of asset holdings in the United Kingdom', ECONOMIC JOURNAL, vol. 92(366) (June), pp. 268-84.

Solmon, L. (1975) 'The Relation between Schooling and Savings Behavior: An Example of the Indirect Effects of Education', in (F.T. Juster ed.) *Education, Income and Human Behavior*, pp. 253-293, New York: Mc Graw-Hill.

Tabellini, G. (2000) A Positive Theory of Social Security, *Scandinavian Journal of Economics*, vol.102(3) (September), pp. 523-545.

U.S. Social Security Administration. (2004-2005). *Social Security Programs Throughout the World.*

US Census Bureau 'Reported Voting and Registration', US.

World Bank (1998-2001). *World Development Indicators*, Washington: The World Bank.

Table 1

OECD Pension Systems. Evidence from Panel Data.

Country	Bismarckian index	Percentage of individuals by income groups (on total number)			Total number of observations	Replacement rate for low-income individuals
		Low	Middle	High		
Austria	0.527	8.73	73.82	17.45	149	1.05
Belgium	0.4349	12.19	78.05	9.76	124	0.88
Denmark	0.49	12.23	70.22	17.55	163	1.72
France	0.652	12.23	70.22	17.55	319	1.27
Germany	0.555	15.11	69.71	15.18	323	1.52
Greece	0.73	13	68.5	18.5	201	1.24
Ireland	0.491	10.28	71.96	17.76	107	1.42
Italy	0.557	8.65	81.3	10.05	567	1.7
Spain	0.71	9.37	69.28	21.35	192	1.34
UK	0.268	32.97	35.89	31.14	273	2.5
US	0.208	30.6	42.8	26.6	50	2.8

Source: Authors' calculations from European Commission Household Panel (waves 1994-2000) for European countries, Panel Study of Income Dynamics (1990-1991) for US.
Notes. Bismarckian index is defined as correlation (wage, pension). Low are individuals with wage less than 0.5 times the median wage; middle are individuals with wage between 0.5 times the median wage and 1.5 times the median wage; high are individuals with wage above 1.5 times the median wage

Table 2

Pension programs in selected OECD countries.

Country	Institutional approach[a]						Classification[b]	Microeconomic projection[c]
Country	Flat-rate	Earnings-related	Means-tested	Flat-rate universal	Occupational retirement schemes	Individual retirement schemes	Type	Progressivity index (data OECD average for the earnings distribution)
Australia			x		x		BE	74.8
Austria		x	x				BI	20.7
Belgium		x	x				BI	64.8
Canada		x		x			BE	86.5
Denmark		x		x		x	BE	91.7
France		x	x		x		BI	46.4
Germany		x					BI	22.9
Greece		x					BI	4.3
Ireland	x		x				BE	100
Italy		x	x				BI	4
Japan	x	x					BE	47.8
Netherlands	x		x				BE	5.7
New Zealand		x	x				BE	100
Spain		x					BI	13
Switzerland	x	x	x		x		BE	44.1
United Kingdom	x	x	x				BE	69.6
United States		x	x				BE	40.6

Source:[a] Social Security Programs Throughout the World 2004-2205, [b]Disney (2004), [c]OECD (2005).

Notes. According to Social Security Programs Throughout the World flat rate is a pension of uniform amount or one based on years of service or residence but independent on earnings, financed by payroll tax contributions from employees, employers, or both. Earnings-related is a pension based on earnings, financed by payroll tax contributions from employees, employers, or both. Means-tested is a pension paid to eligible persons whose own or family income, assets, or both fall below designated levels. It is generally financed though government contributions, with no contributions from employers or employee. Flat-rate universal is a pension uniform amount normally based on residence but independent of earnings, generally financed through government contributions, with no contributions from employers or employees. In occupational retirement schemes employers are required by law to provide occupational retirement schemes financed by employer and, in some cases, employee contributions. Benefits are paid as lump sum, annuity, or pension. In individual retirement schemes employees and, in some cases, employers must contribute a certain percentage of earnings to an individual account managed by a public or private fund manager chosen by the employee. The accumulated capital in the individual account is used to purchase an annuity, make programmed withdrawals, or a combination of the two and may be paid as lump sum. BE indicates a Beveridgean system and BI a Bismarckian system. In Canada the universal pension is increased by an income-tested supplement. In Switzerland the benefit formula contains a flat-rate component as well as an earnings-related element.

Table 3

Pension system in OECD countries. Additional evidence.

Country	Public pension Expenditures [a]	Measures of inequality[b]				Pension funds and financial markets			
	Old-age (%GDP) 2001	Gini Index	Lowest 20%	II+III+IV 20%	Highest 20%	Total assets of private pension funds(% GDP) 2001[c]	Weight of pension funds in the economy (share of GDP %) 2001[d]	Weight of pension funds in the economy (share of market capitalisation, %) 2001[d]	Average returns on pension funds portfolios (1980-95) (real in parenthesis) [e]
Australia	4.7	35.19	5.9	52.78	41.32	62	na	na	na
Austria	10.7	23.1	10.4	56.3	33.3	1	3.9	29.7	na
Belgium	8.7	25	8.25	54.45	37.3	6	5.6	7.7	11.8 (8.8)
Canada	4.8	33.14	6.99	52.63	40.37	48	51.9	59.8	12.4 (7.5)
Denmark	8.3	24.7	8.34	55.86	35.8	22	27.1	50.6	10 (6.3)
France	10.6	32.7	7.2	52.6	40.2	-	na	na	na
Germany	11.7	28.31	8.52	54.6	36.88	3	3.4	5.8	9.4 (7.1)
Greece	12.7	32.7	7.5	52.2	40.3	4	na	na	na
Ireland	2.7	35.9	7.09	50.4	42.9	52	na	na	14 (10.3)
Italy	11.3	27.3	8.7	55	36.3	4	1.8	3.7	na
Japan	7.3	24.85	10.58	53.77	35.65	21	na	na	8.9 (6.9)
Netherlands	6.4	32.6	7.25	52.61	40.14	113	106	81.3	9.2 (6.3)
New Zealand	4.7	36.17	6.45	49.79	43.76	11	14.8	42.8	na
Spain	8.3	32.5	7.5	52.2	40.3	2	6	7.4	13.8 (7)
Switzerland	11.8	33	7	53	40	102	109.4	43	na
United Kingdom	8.1	36.1	6.6	50.4	43	85	73.3	48.4	15.5 (10.2)
United States	5.3	40.81	5.44	48.74	45.82	75	66.5	48.2	13.2 (8.4)

Source. [a]OECD (2004a). [b]World Development Indicators, World Bank (1998-2001). [c]OECD (2004b). [d]OECD(2004c). [e]European countries: Green Paper EC 1997, based on federation of European Stock Exchange and European Commission. Non European Countries: Davis (2001)

Table 4

Preferences for a Bismarckian versus a Beveridgean system across income levels.

	Parameter			Hypothesis		
	p_1	p_2	p_3	$p_1 = p_2$	$p_3 = p_2$	$p_1 = p_2 = p_3$
All countries	0.65	0.75	0.70	LR test 19.04	LR test 5.32	LR test 14.02
	(0.01)	(0.01)	(0.01)	p valor 0.00	p valor 0.02	p valor 0.00
Countries BI	0.64	0.76	0.68	LR test 18.69	LR test 17.63	LR test 16.64
	(0.001)	(0.02)	(0.02)	p valor 0.00	p valor 0.00	p valor 0.00
Countries BE	0.66	0.73	0.72	LR test 1.58	LR test 0.01	L R test 0.40
	(0.03)	(0.04)	(0.02)	p valor 0.20	p valor 0.91	p valor 0.52

Notes. This table is based on the Eurobarometer 56.1 answers to the question: “The amount of one’s pension should be strictly based on the amount of contributions one has paid into the pension schemes?” The numbers of "yes" and "no” (don’t know is neglected) are assumed to follow a binomial distribution of the unknown parameter "p”. The table presents the estimated coefficients for the parameters “p” in a binomial distribution for the different income group and country group specification. The last three columns present the value of the Likelihood Ratio test of the null hypothesis of equal “p” coefficients for the three income groups (p_1 is for the poor income group, p_2 is for the middle income group and p_3 is for the rich income group).

Table 5

The effects of aging on the political economy equilibrium: A Numerical example

	Middle income	High Income	Median voter / Equilibrium
Benchmark case. Economies before the aging shock			
UK 2000 (workers/pensioners=2.8)	$r^M=2.5< R^M=2.89$ (vote for BI)	$r^H=3.6> R^H=3.23$ (vote for BE)	Coalition of Extremes - BE
Germany 2000 (workers/pensioners=2.3)	$r^M=2.5< R^M=2.51$ (vote for BI)	$r^H=3.6> R^H=2.89$ (vote for BE)	Middle income type + old - BI
Simulation. Economies after the aging shock			
	Middle income	High Income	Median voter / Equilibrium
UK 2025 (workers/pensioners=1.7)	$r^M=2.5> R^M=1.75$ (vote for BE)	$r^H=3.6> R^H=1.96$ (vote for BE)	Working population - BE
Germany 2025 (workers/pensioners=1.6)	$r^M=2.5> R^M=1.74$ (vote for BE)	$r^H=3.6> R^H=2.02$ (vote for BE)	Working population -BE

Notes: BE indicates a beveridgean system, BI a Bismarckian system.

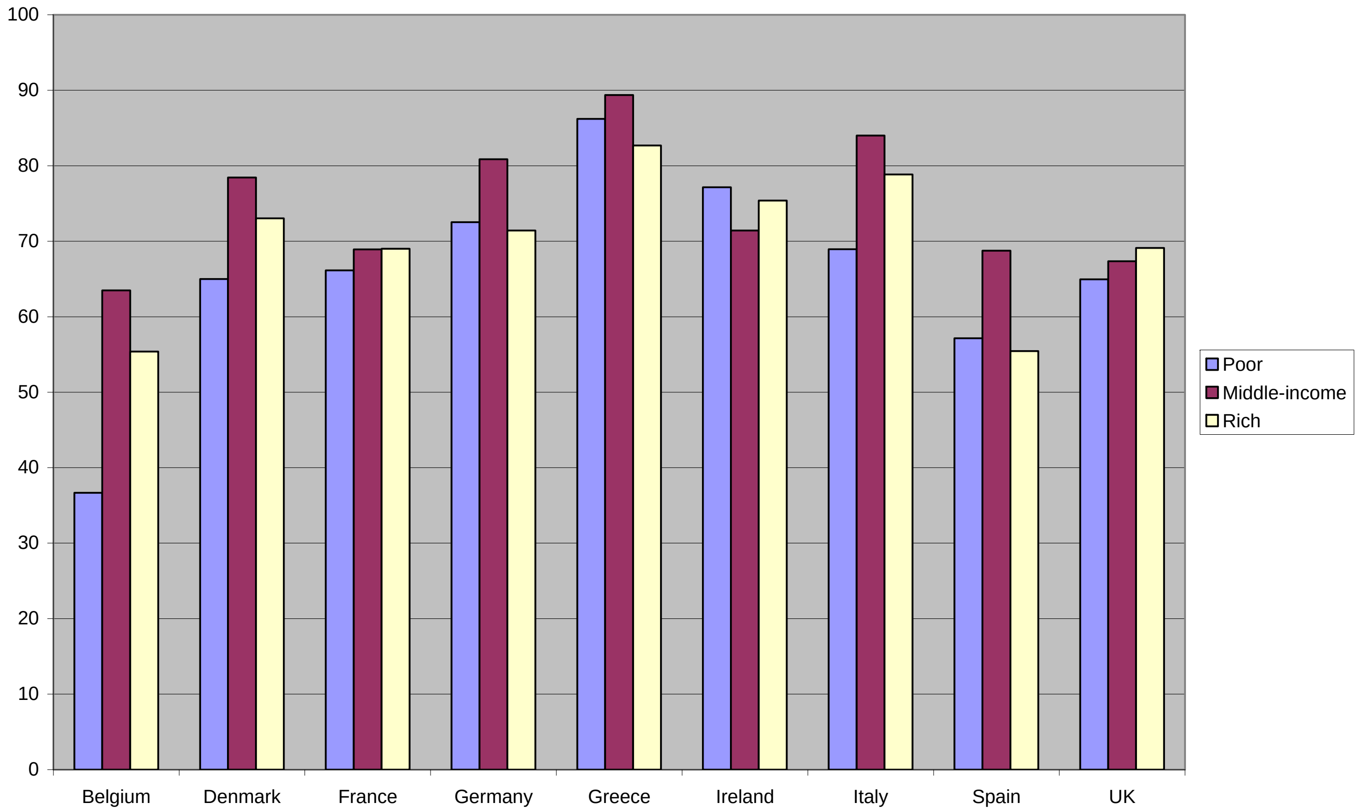

Fig. 1. *Do you agree on the following statement: "The amount of one's pension should be strictly based on the amount of contributions one has paid into the pension schemes?" Percentage of YES.*

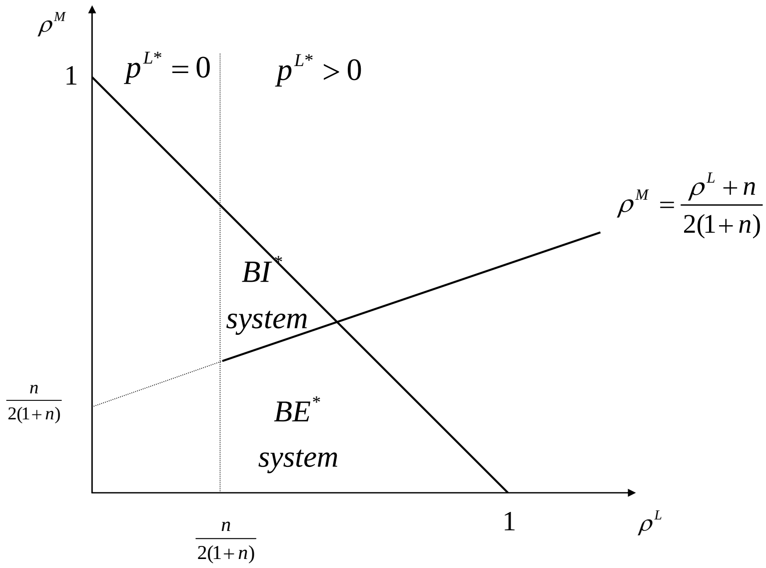

Fig. 2. *Equilibrium (coalition of the extremes)*

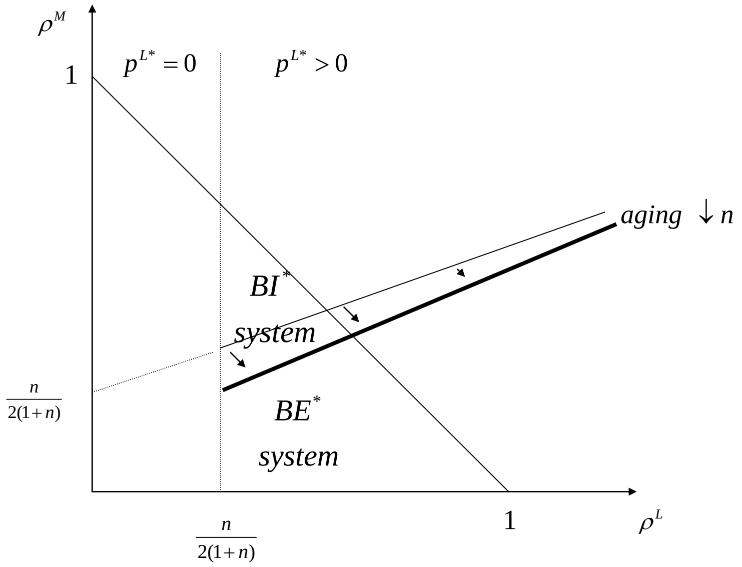

Fig. 3. *The effects of aging on the equilibrium (coalitions of the extremes)*