Politics, ageing and pensions

SUMMARY

What is the future of social security systems in OECD countries? We suggest that the answer belongs to the realm of politics, and evaluate how political constraints and ageing shape the social security system. The increasing ratio of retirees to workers lowers the rate of returns of unfunded pay-as-you-go social security, and induces citizens to prefer smaller such systems and a larger role for private savings. An ageing electorate, however, increases the relevance of pension spending on the agenda of office-seeking policy-makers and tends to increase the size of unfunded pension systems. Calibrating the strength of these effects for France, Germany, Italy, Spain, the UK and the US, we find that the latter political aspect always outweighs the former. The relative size of the effects depends on country-specific characteristics and modelling details: when labour market distortions are accounted for the political effect still dominates but becomes less sizeable; the different redistributive character of pension systems and the strength of family ties also play a role in determining politico-economic outcomes. A higher effective retirement age always decreases the size of the system chosen by the voters, often increases its generosity, and may be the only viable solution to pension system problems in the face of population ageing.

— *Vincenzo Galasso and Paola Profeta*

Lessons for an ageing society: the political sustainability of social security systems

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1. INTRODUCTION

In OECD countries, unfunded social security systems are receiving enormous attention by both economists and policy-makers. Most of the debate focuses on the implications of demographic dynamics for such systems' financial soundness. Ageing tends to increase the proportion of retirees and reduce the proportion of workers. As more people draw from the pay-as-you-go (PAYG) social security system and fewer individuals contribute to it, our ageing society will hardly be able to honour its commitment to pay social security benefits to future retirees. Unless productivity increases fast enough to compensate for the negative demographics or an even larger financial

burden is placed on the working generations, current PAYG systems will soon become financially unsustainable, since contribution revenues will not be sufficient to cover the pension benefits awarded under the current rules.

The impact of ageing on our unfunded social security systems will call for either higher contribution rates or lower pension benefits, and the political process will have to balance the conflicting interests of different generations. As argued by Cremer and Pestieau (2000), the effect of ageing on the PAYG social security system and its possible reforms depend on political factors. In this paper, we investigate the future of social security systems in OECD countries from this perspective, and evaluate how political constraints shape the social security system in six countries – France, Germany, Italy, Spain, the UK and the US – under population ageing.

1.1. The issue: political sustainability

The aim of this paper is to provide a *quantitative assessment* of the magnitude of the change in the size of the current social security systems, which is needed to retain their political sustainability under the ageing process. In our framework, *political sustainability* of a social security regime or reform identifies the existence of political majority that is willing to support this pension system in all its provisions – such as retirement age, contribution rate and benefit calculation method.

We view the social security system as a saving vehicle with possible redistributive effects, and identify two main aspects of the ageing process: an *economic* and a *political* effect. The economic effect of ageing is given by the increase in the 'dependency ratio' of retirees to workers. Since the average long-run return of a PAYG social security system depends on the dependency ratio and on productivity growth, ageing reduces the average long-term profitability of the system. This induces agents to substitute their claims towards future pensions with more private savings, and the size of the system should be reduced. Ageing, however, also has a direct political impact: as an older electorate increases the relevance of pension spending on the agenda of the policy-makers, it tends to foster larger and more generous systems. The latter effect is sizeable in all countries. The median age of voters, a summary measure of electorate ageing, is expected to increase over the next 5 decades by 6 years in the US (from 47 to 53) and by as much as 13 years in Spain (from 44 to 57).

1.2. Our approach

To evaluate quantitatively how political constraints may shape social security systems under population ageing, we analyse individuals' economic and political decisions in the context of a detailed, if unavoidably still stylized, theoretical framework. In their role as economic agents, individuals choose their consumption, saving and labour supply; as political agents, they vote on the social security contribution rates. The outcome is decided by simple majority.

In its initial steady state, our model is calibrated to capture the main economic, demographic and political aspects, and the institutional elements of the different social security systems in France, Germany, Italy, Spain, the UK and the US, around the year 2000. To simulate how political constraints will shape social security under ageing, we feed the model with forecasted values of demographic, economic and political variables for the year 2050, and calculate the social security contribution rates, which arise as a steady state political equilibrium, under different policy scenarios.

1.3. Results

Our simulations suggest that increased political influence of the elderly voters leads the size of the social security system, although not always its generosity, to increase in all countries. In our simulation scenarios Spain, the fastest ageing country, would face the largest increase in the social security contribution rate; the largest contribution rate, 50%, would arise in Italy.

When we allow for labour market effects, such as distortions from taxation, the political effect still dominates but becomes less sizeable. The ageing process's economic effects on labour supply imply higher employment rates for elderly workers, while reducing the labour force participation of the young.

Our simulations suggest that an increase in the effective retirement age always decreases the equilibrium social security contribution rate, while often increasing the system generosity.

Country-specific characteristics not accounted for in our simulations may also matter. In countries such as the UK and the US, the induced increase in the size of the system is likely to be accompanied by a shift towards a less redistributive scheme. In countries with strong family ties, such as Italy and Spain, non-emancipated adult children living with their parents may strengthen the positive effect of ageing on social security's political support.

1.4. Organization of the paper

To appreciate the impact of ageing on the financial and political sustainability of the social security system, in Section 2 we summarize the relevant features of the demographic process and provide a brief description of the different social security systems. Section 2 also summarizes the recent reform measures and presents official social security expenditure projections. Section 3 provides a brief survey of the recent political economics literature on social security and introduces the notion of political sustainability. In Section 4, we present our sets of simulations results and discuss the main policy implication. Section 5 examines some country-specific features, which may affect our simulation results. Finally, Section 6 discusses some directions for future research. Appendix A provides technical details of the model; the calibration is presented in Box 1 in the text and the data sources are in Appendix B.

2. AGEING AND SOCIAL SECURITY SYSTEMS

In this section, we set up the stage to analyse the effects of ageing on the political sustainability of current social security systems, by discussing the nature of the ageing process and its strong connections with some crucial elements of the unfunded social security systems. In particular, we concentrate on the private employees' schemes. We first present some data on the demographic projections for the next 50 years. We then summarize the main features of the current social security systems and the legislated reforms in France, Germany, Italy, Spain, the UK and the US. Finally, we discuss the official projections on the future evolution of size of the social security system, under the forecasted demographic process.

2.1. Demographic elements

The current ageing process is due to the combination of an increase in life expectancy and a decrease in fertility rates. Both elements have been common to all countries in our sample. While fertility rates are believed to be returning towards their post-war levels, Table 1 shows that all countries expect to enjoy a further increase of life expectancy at birth, from 74.1 for male and 80.6 for woman in 2000 to 79.3 for male and 84.7 for woman in 2050 for the average of OECD countries.

These two elements will induce a substantial increase of the share of elderly people. Figure 1 shows that the proportion of elderly individuals, that is, those older than 65 years, over the total population will rapidly increase until 2035; after that date it will remain almost constant or increase at a lower rate. This ageing process will be especially accentuated for Italy and Spain, while it will be less dramatic in the UK and the US.

A measure of the ageing process is provided by the old age dependency ratio – defined as the ratio of persons aged 65 or more to the persons aged 20 to 64. According to OECD projections, the average old age dependency ratio in the OECD countries will increase from 23.8 in the year 2000 to 49.9 in 2050. This demographic

Table 1. Life expectancy at birth

	2000		2050	
	Male	Female	Male	Female
France	74.8	82.8	80.0	87.0
Germany	74.7	80.8	80.0	85.0
Italy	75.5	82.0	81.0	86.0
Spain	74.9	82.1	79.0	85.0
UK	75.2	80.0	80.0	85.0
US				
OEC	73.9	79.6	79.1	83.5
OECD average	74.1	80.6	79.3	84.7

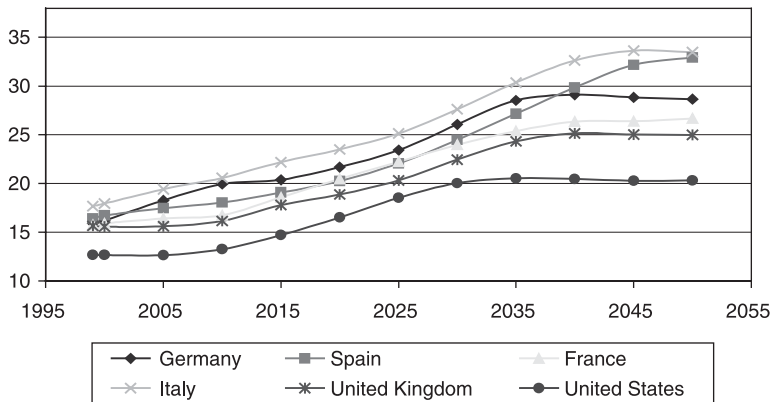*Source:* OECD, 'Health Data'; and EC – Economic Policy Committee (2000).

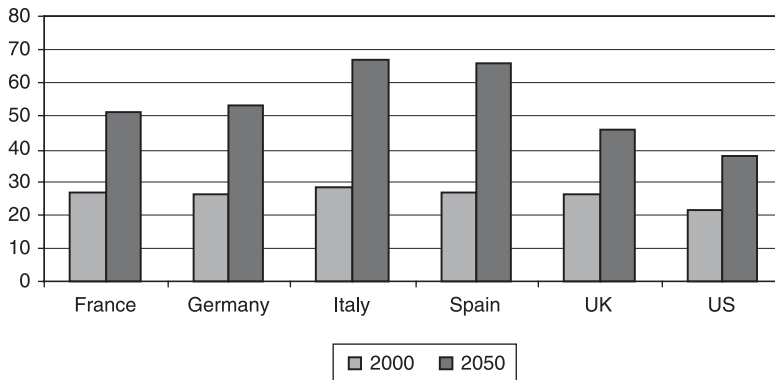**Figure 1. Percentage of those over 65 in total population**

Figure 2. Old age dependency ratios

process does, however, differ across countries. For instance, as shown in Figure 2, Spain and Italy experience the largest growth of the dependency ratio; France and Germany are close to the OECD average, while the UK and the US are well below average.

Because of early retirement provisions, however, the old age dependency ratio does not correspond to the ratio of retirees to workers. Most countries feature a legal retirement age at which the elderly are induced or required to exit the labour market before they can collect their pensions, but this official retirement age does not correspond to the effective retirement age (see Profeta, 2002a). Interestingly, data suggest that this early retirement phenomenon has reinforced the effects of population ageing: labour force participation of the elderly has decreased at the same time as population aged (Costa, 1998). This labour market trend – extensively studied by Gruber and Wise (1999) and Blöndal and Scarpetta (1998) – exacerbates the ageing process, as the proportion of retirees per workers becomes even higher than the old-age dependency ratio; thus creating an additional element of concern vis-à-vis the fiscal sustainability of the social security systems. According to Latulippe (1996), in

1990 the average effective retirement age for males in OECD countries was 62.2 years, down from 68.5 years in 1950. In 2000, only the UK (63) and the US (63) have an effective retirement age[1] above the OECD average. In France and Italy, the effective retirement age is 58, while in Germany and Spain, it is respectively 61 and 62 years.

2.2. Main features of social security systems

Table 2 summarizes the main features of the private employees' schemes of the current social security systems. All these countries have an extended PAYG social security system. In four of them – France, Germany, Italy and Spain – a funded pension scheme (second pillar) is present in an embryonic form. In the UK and the US, this second pillar is instead well developed. In the UK, for instance, employees may choose to opt out – albeit partially – of the PAYG system to join a funded scheme. There are important common elements across countries which, however, differ in several key respects such as tax rate, benefit formula, benefit indexation, eligibility requirements and official retirement age.

2.2.1. Social security contribution rates. The highest social security contribution rates are in Italy – 32.7% of earnings (8.89% paid by the insured person and 23.81% by the employers) – and Spain – 28.3% (4.7% paid by the insured person and 23.6% by the employer). Germany and France feature a salary ceiling on the contribution tax to be paid. The tax rates are 19.5% in Germany (equally levied on employers and employees) and 14.75% (Regime General, of which 8.2% paid by the employers and 6.55% by the employees) plus 6.5% (ARRCO) in France (see Table 2). Finally, the US and the UK enjoy the lowest tax rates. In the US, the tax rate is 12.4% of the income below a ceiling (equally levied on employer and employee). In the UK, the tax rate is 10% of income between the Primary Threshold (£67 per week) and the Upper Earnings Limit (£535 per week), reduced to 8.4% of income between the Lower Earnings Income (£67 per week) and the Upper Earnings Limit, if the person 'opts out' of the public system; additional contributions are due by the employers.

2.2.2. Pension benefits, eligibility, retirement age. All countries, with the exception of Italy after the 1995 Dini reform, feature a defined benefit (DB) PAYG system whereby pension amounts depend on the number of years of contributions and on a reference wage. However, even countries with a DB system differ in how pensions relate to this reference wage. The UK and the US have 'Beveridgean' systems, in which pension benefits are almost flat, that is, almost unrelated to the worker's past wages. Italy, France, Germany and Spain have a 'Bismarckian' system instead, featuring a tight link between previous wages and benefits: the benefit formula

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[1] See Appendix B for a description of the data source.

Table 2. Main features of PAYG social security systems

	Tax rate	Benefit formula and indexation	Eligibility requirement	Official retirement age
France	Regime General (main scheme): 14.75% (8.2% by the employers and 6.55% by the employees) below the social security ceiling + 1.6% on the entire salary (due by the employers). Complementary mandatory system: ARRCO: 6% (+ 1.5% for financial balance) below a ceiling for managers and professional staffs, below 3 times the ceiling for other employees (60% by the employers and 40% by the employees). Above the social security ceiling (or 3 times the ceiling): between 15 and 20% depending on firm's longevity. AGIRC: 16% (+ 4% for financial balance) applied on income between the ceiling and 4 or 8 times the ceiling.	Regime General's Pension: $T \times (N/150) \times R$ T = Replacement rate, based on the age of the insured person and the number of years of contribution. Maximum 50%. N = number of quarters of contribution to the scheme. Maximum 150. R = Reference salary, annual average salary below the ceiling over the best 19 years (to become 25 in 2008). Complementary pension (AGIRC & ARRCO). The old-age benefit is determined by the accumulation of points during the working life Indexation: Consumer price index	Payment of contribution enabling the validation of at least one quarter's insurance (i.e. remunerated at 200 or more hours of the minimum wage).	Regime General: 60 years old. Early retirement programmes: ASFNE and ARPE. ARRCO & AGIRC: 65 years old. Early retirement: 55 years, no penalties if the conditions to retire with the maximum pension in the main scheme are satisfied.
Germany	19.5% payroll tax equally levied on employers and employees below a certain ceiling.	Pension: $PEP \times C \times AR$ PEP: Personal Earnings Point; depends on number of years of contribution and on the individual's wage level, relatively to the average wage in the economy. C: pension type factor (e.g., $C = 1$ for old age and $C = 2/3$ for disability). AR: average current pension value – corresponding to the monthly pension paid to an average earner for each insured year Indexation: Gross wage growth	Minimum 5 years of contributions	65 years old. Early retirement: 63 years old (60 for severely handicapped) after 35 years of service. Women: 60 with 180 contribution months.

Table 2. *Continued*

	Tax rate	Benefit formula and indexation	Eligibility requirement	Official retirement age
Italy	32.7%, of which 8.89% of earnings (insured person) + 23.81% of payroll (employer). Special contributions in certain industries and tax relief in economically distressed areas.	Category 1 (persons whose insurance period started after 1st January, 1996): pension benefits are calculated as 33% (20% for the self-employed) of taxable base income, revaluated on annual basis, multiplied by a conversion coefficient. Category 2 (persons with more than 18 years of contributions at 31st December, 1995) pension benefits are a percentage (0.9% to 2%) of reference wage (equal to the average wage in the 5 years before retirement) times the number of years of contributions. Category 2 (all others): pro-quota combination of the two schemes. Indexation: Consumer price index	*Old-age pension*: Category 1: 57 years old and 5 years of contributions. Category 2: 65 years old (men)/ 60 (woman) and 15 years of contributions prior to 1992. Category 3: 65 years old (men) or 60 (woman) and 20 years of contributions prior to 2001. *Seniority pensions*: 57 years old and 35 years of contributions or 37 years of contributions, regardless of the age (increase to 40 by 2008).	New system: 57–65 years old. The amount of the benefit decreases if retirement age decreases.
Spain	28.3%, of which 4.7% of covered earnings (insured person) + 23.6% of earnings (employer) based on wage classes that vary according to 11 occupational classes.	Pension: $R \times T$ R = Reference salary, sum of pensionable wages during the 180 months preceding retirement divided by 210. T = Replacement rate: 50% of benefit for the first 15 years of contributions + 3% for each year between 16 and 25, and 2% for each year beginning with the 26th, up to	15 years of contributions (at least 2 years during the 15 years immediately preceding retirement). 35 years of contributions for a full rate retirement pension.	65 years old. Transitory measure: persons insured according to the system abolished on 1967 may retire at 60. Special reduction of age for groups with

		100%. Since 2002, this amount may exceed 100% for those who retire at 66 or later with at least 35 years of contributions. Indexation: Consumer price index (automatic adjustment)		particular professional activity.
UK	Primary national insurance contribution rate of 10% of income between the primary threshold and the upper earnings limit, due by the employee; reduced to 8.4% of income between the lower earnings income (£67 per week) and the upper earnings limit if the insured person 'opts out' of SERPS. Secondary national insurance contribution rate of 11.8% for the earnings above the secondary threshold, due by the employer; rebated by 3.5% if the employee opts out of SERPS.	BSP (basic state pension): flat rate pension related only to the contributory years. Maximum level of BSP achieved (for a man) with 44 years of contributions. SERPS (state earning related pension system): pension benefit equal to the average indexed surplus earnings (after 1978) between the lower and upper earnings limit, multiplied by the number of valid contribution years and by an accrual rate of 1.25% per year (for persons retiring after April 2000, the accrual rate is reduced to 1% for a 10-year transitional period). Indexation: Consumer prices legislated annually	BSP: 11–12 years of contributions. SERPS: earnings above the lower earning limit, for at least one year since April 1978.	65 years old for men and 60 for women (for women it will be raised between 2010 and 2020 until 65). No early retirement. Pension increases of 7.5% yearly if pension age is deferred for 5 years.
US	Flat tax of 12.4% of wage income up to a ceiling equally shared by employee and employer for OASDHI.	Retirement benefits are based on average earnings during a 35-year career. Indexation: Consumer price index	10 years of contributions and minimum retirement age.	65 for full benefit. 62 with reduced benefit. From 65 to 70 benefits increase.

Source: SSA (1999), EC (2002).

is aimed at offering a replacement rate, that is, the ratio between pensions and the last wage income, that does not depend on the worker's lifetime wage income profile. Since contributions are typically proportional to labour earnings – possibly up to a ceiling – a Bismarckian system does not imply nearly as much redistribution among income groups as a Beveridgean system.

In France, the reference wage corresponds to the annual average salary limited to the social security ceiling calculated over the best 19 years (to become 25 by 2008). In Germany, the reference wage is the personal earnings point, which depends on the level of income on which contributions were paid multiplied by the current pension value (monthly pension paid to an average earner for each year insured). In Spain, it corresponds to the sum of the wage during the 180 months before retirement divided by 210. The pension is 50% of this amount if the contribution period is 15 years, plus 3% for each additional year between 16 and 25 and 2% for each year from the 26th up to a maximum of 100%. In a pure Beveridgean system, such as in the UK, the main pension is flat, that is, it does not depend on the reference wage, although it does depend on the number of years of contribution. The second tier of the public pension (SERPS) does instead depend on the level of earnings – although it retains an element of intragenerational redistribution. Also the US have a Beveridgean system, albeit not a pure one, since the reference wage is calculated as the average earnings during 35 years of contributions, but a redistributive formula applies to reduce the pension benefits of the high lifetime earners.

Italy presents a different scenario. In 1995, its system was changed from a (Bismarckian) defined benefit formula, in which the reference wage was calculated as the average of earnings during the entire career multiplied by the number of years of contributions, to a notional defined contribution scheme. After this reform, the pension entitlement is calculated as 33% of the earnings revaluated on annual basis, multiplied by a coefficient that depends on the age of retirement.[2]

Currently, all countries index pension benefits to inflation except Germany, where benefits are instead indexed to gross wage growth (this adjustment was temporarily suspended in 2000 and 2001). Eligibility for pension benefits is typically conditional on having contributed for a minimum number of years and/or having reached a minimum retirement age. The minimum contribution period varies from one-quarter in France to 20 years in Italy (5 for new entrants at 1996). It is equal to 5 years in Germany, 15 in Spain, 11–12 in the UK (for the state pension) and 10 in the US.

All countries feature an official retirement age at which people are allowed to exit the labour market and receive their pension benefits: 60 years in France, 65 in Germany, 57–65 in Italy under the new scheme, 65 in Spain, 65 for men and 60 for women in the UK, 65 in the US. However, several countries have early retirement provisions, which allow workers to retire before the official age on a reduced pension

[2] This new scheme applies entirely to the workers who joined the system after January 1996, while the old formula applies to those who had more than 18 years of contributions in December 1996.

benefit (France, Germany, Spain, US). New rules are introducing incentives to post-
pone retirement by penalizing early exits from the labour market (France, Italy, and US).

2.3. Recent social security reforms

Faced with the challenges of an ageing population, most OECD countries have
implemented – or at least legislated – some reform of the social security system.
These reforms have typically been 'parametric', since the unfunded nature of the
system has not been modified (see Lindbeck and Persson, 2003, for a survey on
pension reforms). These recent measures have pursued three main objectives (OECD,
2002): (1) an increase in the effective retirement age, through a reduction of the
incentive to early retirement and an increase in the demand for elderly workers;
(2) a reduction of the pension benefits – in order to improve the financial sustainability
of the social system – through changes of the benefits formulas and the indexation of
the pensions benefits to the prices, rather than to the wages; and (3) an increase of
the private pension arrangements – in order to modify the current mix of public-
private pensions, mainly through tax incentives to contributions to private pension
and by establishing new regulations for the relevant financial institutions.

Table 3 summarizes the main recent reforms in our six countries. In the last
10 years, these reforms have mainly concerned the increase of retirement age – France
(2003) Germany (1992 and 1997), Italy (1992 and 1995), Spain (1999) and the UK
(1995) – and the development of a private second pillar (occupation funds) and third
pillar (individual funds). Complementary – albeit unfunded – pension schemes pre-
existed their 1997 extension and regulation in France (Arrco and Agirc). In Germany,
the 2001 Old Age Pension Act has introduced additional advantages in the tax
treatment of pension funds. In Italy, the Amato Reform in 1993 has created occupa-
tional schemes and subsequent legislative interventions in 2000 have introduced
special tax treatments for non-mandatory funded pensions and for investing part of
the TFR ('Trattamento di fine rapporto', a deferred wage payment) into occupational

Table 3. Recent reforms

	Reform measures
France	*1993*: Changes in benefit calculation: Base period extended from 10 to 25 years. Extension of contribution period to access full pension from 37.5 years to 40 years. From wage to price indexation. *1997*: 'Thomas Law': contribution to optional private retirement funds exempted from income taxation and social security contributions (later suspended by the Jospin government). *1998*: Partial retirement: elderly workers may opt to reduce their working hours until reaching retirement age in exchange for a partial pension. *2003: Fillon Reform*: disincentives for early retirement and incentives to retire later, increase in the number of years of contributions needed for a full pension and in the number of years over which the reference wage is calculated. Introduction of some discretion in the benefit indexation ('coup de pouce').

Table 3. *Continued*

	Reform measures
Germany	*1992*: Progressive increase of the retirement age up to 65 for both men and women; early retirement at 62 with a penalty clause. Net income indexation for benefits. *1997*: Restricted accrual of pension rights, not based on contributions (e.g. credits for education, unemployment). *1997*: *Pension reform law (Blum Reform)*: Replacement rate reduced from 70% to 67% (in 30 years). Higher transfers from the federal budget to the pension system, covered by higher VAT rate. *1999*: Suspension of the pension reform law; for the years 2000 and 2001 pensions are indexed to inflation rather than net wages. *2001*: *Old-Age Provision Act*: promotion of additional funded pensions through subsidies and tax treatment; individual right of workers to an occupational pension, and (Extension Act) lower adjustment of pensions (replacement ratio from 70% to 64%). *2002*: Incentives for occupational and private schemes.
Italy	*1992*: *Amato Reform*: Introduction of occupational private schemes (with tax advantages); increase in retirement age from 55 to 60 for women and 60 to 65 for men; pension benefits reference period gradually increased to the entire working career; minimum period to get a contributive pension raised from 15 to 20 years; from wages to inflation indexed pension benefits. *1995*: *Dini Reform*: flexible retirement age (from 57 to 65 for both men and women); from defined benefit to defined contribution (see Table 2); Seniority Pension: Eligibility raised to 40 years of contributions (or 35 if aged 57); fiscal incentives for contributions paid to private pension funds. *1997*: *Prodi Agreement*: Increase of the early retirement age; harmonization of public and private pension regimes and increased pension contributions paid by the self-employed; temporary measures to postpone access to early retirement benefits and to suspend inflation adjustment for high pensions; more stringent requirement for access to seniority pensions; increase of contributions for self-employed workers and other categories; increase of the amount of social and minimum pensions, tax deductions for pensioners with lower income; tax incentives to convert the TFR (end-of-career severance payment) into supplementary pensions. *2000*: Tax incentives for returns of pension funds (taxed at 11% instead of the standard 12.5% tax rate for returns of financial activity) and TFR (end-of-career severance payment) invested in pension funds.
Spain	*1997*: 'Toledo Pact': gradual extension of the basis to calculate pensions from the last 8 to the last 15 years of contribution. Automatic price indexation. Reserve fund built with contribution surplus. *1997*: Reduction of the incentives to retire early. *1999*: New partial retirement scheme aimed at persuading older workers to continue working. *2000*: Creation of a fund for the transition to a mixed system combining PAYG and funding.
UK	*1995*: Pension Act: State pension retirement gradually increased for females from 60 to 65 years; introduction of a personal pension and regulation of the occupational schemes. *1999–2002*: Welfare Reform and Pension Act: introduction of Minimum Income Guarantee and of a Pension Credit aimed at rewarding savings; SERPS replaced by the New State Second Pension (S2P) to help lower income; introduction of the New Stakeholder pension scheme (SPSs) for middle-income earners with no existing private pension provision.
US	No significant reforms.

Source: EC (2002); FRdB (2000).

pension plans. Despite having a well-developed second pillar, in 1995, the UK has
passed a Pension Act which allows for the possibility of opting out of (part of) the
state pension system and of contributing in personal pension funds.

   In addition to these reform measures, there has been a common trend towards price
rather than wage indexation of pension benefits. Other more limited reforms included
small increases of the contributory tax rates (Germany) and of years of contributions
and reference salary periods for pension calculation (Italy and Spain). Structural meas-
ures have been introduced in Italy with the 1995 Dini reform, which radically changed
the benefit formula from defined benefit to defined contribution. However, the reform's
transition period is so long as to imply that most of its effects will be observed only
in 30–40 years (see Brugiavini and Galasso, 2003, for a critical assessment).

2.4. Official projections

Public opinion feels that further reforms are needed: according to a recent survey
conducted in Germany and Italy by Boeri *et al.* (2002), a large majority of the
population (85% in Germany and 63% in Italy) expects the system to face a crisis in
10–15 years. Many governments, however, appear confident about the long-run
financial sustainability of their systems. Official projections of social security spending
(as a percentage of GDP) over the next 50 years and their partition into demographic,
employment and policy factors, as provided by OECD member countries, are dis-
played in Table 4. Italy stands out as the most striking case: in spite of having the
largest demographic effect – capable of increasing the pension spending by 10% of
GDP – the pension spending is expected to decrease in the year 2050, due to the
projected increase in the employment rate of elderly workers and to the measures
introduced by the Amato–Dini reforms. Also the UK is expected to reduce its pen-
sion spending, as the policy measures counterbalance a mild ageing effect. In all other
countries, the estimates suggest an increase in the amount of resources devoted to

Table 4. Official pension spending projections

			Contribution to changes in spending from 2000 to 2050 of:			
	2000	2050	Old age dependency ratio	Employment rate	Benefit formula	Eligibility
France	12.1	15.9	7.6	−0.5	−3.4	0.4
Germany	11.8	16.8	6.4	−0.7	−2.7	2.1
Italy	14.2	13.9	10.1	−3.2	−5.5	−1.5
Spain	9.4	17.4	8.6	−2.6	0	2
UK	4.3	3.6	1.7	0.1	−2.5	0.1
US	4.4	6.2				
OEC			2.4	−0.1	−0.2	−0.3

Source: OECD (2002).

pensions. In Spain, a strong demographic effect is even magnified by a policy that extends pension eligibility, while in Germany and France the reform measures are not sufficient to neutralize the ageing process. Not surprisingly, in the US the increase in spending is below the OECD average.

3. POLITICAL SUSTAINABILITY OF SOCIAL SECURITY SYSTEMS

A recent literature has suggested that the reasons for the introduction of unfunded social security systems and their development into the most widespread instrument of social insurance belong to the realm of politics (see Galasso and Profeta, 2002, for a comprehensive review). The key intuition is that the social security systems we observe need not be welfare enhancing: they only need to be sustained politically. In democracies, this support is represented by the approval of a majority of the Parliament or, more directly, of the electorate.[3]

The starting point in this literature is to evaluate how PAYG social security systems affect the individuals' economic well-being. The direct effect of unfunded systems is to tilt the agents' net income profile towards their old age: contributions to the system decrease the individuals' net labour income during their working life, while pension benefits provide income at retirement. This purely mechanical result is accompanied by behavioural effects, as individuals adjust their economic decisions to the characteristics of these systems. A large economic literature has in fact established that pension systems affect the individuals' saving and retirement decisions (see Blöndal and Scarpetta, 1998; Feldstein and Liebman, 2002; and Gruber and Wise, 1999).

Pensions of course increase the economic well-being of elderly citizens who receive a benefit at no current cost. Despite the ageing process, however, retirees do not constitute a majority of the electorate: thus, pensions systems need the support of some young or middle-aged voters. For young agents at the beginning of their working career, the implicit return from contributing to social security is very likely to be lower than the return from financial assets of comparable risk (see Abel, 1989). But the literature has identified some economic channels for social security to enhance these individuals' well-being. Systems where contribution rates are proportional to labour income but pension benefits are nearly uniform can offer high returns to low-income individuals and win their support for social security (see Tabellini, 2000). Social security systems may also redistribute income between workers and capitalists: as unfunded systems tend to reduce capital accumulation, the resulting lower wage rates and higher private-asset return benefit individuals who hold large portfolios at the expense of those who rely more heavily on labour income (see Cooley and Soares, 1999). Finally, a traditional justification for the political support of social security by

[3] Mulligan and Sala-i-Martin (1999) suggest that, since these systems exist also in non-democracies, they do not depend on voting, but on the lobbying activity by the elderly.

citizens who do not yet draw pensions, but will soon, is based on the idea that voters view past contributions as sunk costs, and only consider future contributions and benefits: over the shorter horizon of relatively old workers who need only a few additional years of contributions to receive full pension benefits, social security may easily provide a better deal than financial assets (see Browning, 1975).

Individuals' preferences over social security are then to be aggregated through a political mechanism. Three broad categories of political institutions have been adopted in this literature: majority voting, veto-power and lobbying. Majority voting models posit that pension reforms may be implemented only if backed by a majority of the voters; while veto power models further qualify the majority requirement by allowing for some veto power, for instance to block reforms, to be awarded to some key veto players. Lobbying models suggest instead that intense political pressure activity of such a powerful minority as the elderly may win the political game, and obtain sizeable redistributive transfers.

This paper introduces a detailed theoretical framework, featuring all these economic channels for social security to enhance individuals' well-being, to examine the economic and political choices of the agents, in their double role of consumers and voters. Individuals' preferences over the social security system are aggregated at simple majority voting. Hence, *political sustainability* of a social security regime or reform identifies the existence of a political majority willing to support the system in all its provisions – such as retirement age, contribution rate and benefit calculation method.

The novelty of our analysis with respect to the existing literature rests mainly with its quantitative approach. Our calibrated model aims at capturing the main economic and demographic aspects, the institutional features of the social security systems and the political scenario of the different countries. Within this theoretical framework, we simulate the effects of ageing on the economic channels creating the individuals' support for social security, such as the changes in the internal return from social security for the different individuals, on the political process, such as the modification in the identity of the pivotal political individual (the median voter) and ultimately on the voting outcome: the social security contribution rate. These simulations provide a useful benchmark to discuss the political effects of ageing on social security. For each country, they compare the political constraints at initial steady state equilibrium, describing the economy around the year 2000, with the political constraints that may arise because of the ageing process in a steady state equilibrium around the year 2050.

3.1. Economic environment

We choose to characterize the economic environment by a large overlapping generations general equilibrium model (see Appendix A for a formal description and Box 1 for the calibration strategy). The model economy is populated by several overlapping generations of workers and retirees. Workers supply labour during their working years and then retire. Depending on the specification of the model, individuals either

work a fixed number of hours, regardless of the tax burden (see results in Section 4.2), or are allowed to choose their labour supply (see Section 4.3). Agents differ across cohort in working ability: at any given time, middle-aged workers are more productive than young and elderly workers. In the simulations for Italy and the UK (see Section 5.1), agents also differ within each age cohort by level of education and, accordingly, by retirement age, working history, longevity, income and degree of political participation.

As in all lifecycle economic models, agents – depending on their expected lifetime horizon and income – decide how much to save for future consumption, with the goal of smoothing consumption over time. The production side of the economy is represented by a constant returns to scale aggregate production function, which transforms productive factors – labour and capital – into the production of a final good. The economy enjoys an exogenous technical progress that enhances labour productivity. The economy is closed to capital flows, and the labour market is assumed to be perfect. Thus, profit maximization by the firms and market clearing determine equilibrium factor prices – that is, wages and rate of return on capital.

Demographic aspects are summarized by population growth rates, by age-specific survival probabilities, and by dependency ratios. We model a private-sector employees' PAYG social security scheme. Workers contribute a fixed fraction of their labour income to the system – total contributions thus depend on contribution rate and average labour income in the economy – and pension benefits are awarded to retirees as an annuity. Other institutional features of the system are summarized by: (1) statutory and effective retirement age; (2) pension benefit calculation; and (3) pension indexation criterion.

Our model economy is rather detailed, but we do abstract from some potential interactions between the economic structure and the social security system. In particular, by concentrating on a closed economy, we disregard the role of international capital flows: ageing and social security affect individual savings, we let these changes induce variations in the aggregate stock of capital – hence in factor prices (wages and rates of return) – rather than capital movements. The labour market is perfectly competitive in the economy we model here, which features neither minimum wages, nor employment protection legislation, nor trade unions: this reduces the potential redistributive effects of social security (for instance, if higher contribution rates led to higher unemployment rates there would be an additional channel of redistribution between employed and unemployed people). As we take the growth rate of the economy to be exogenous, we rule out negative repercussions on growth of higher contribution rates. We also abstract from considering the possible interactions between social security and other welfare programmes targeted to the elderly: for instance, by providing an annuity social security increases the value of longevity, and therefore induces the elderly to raise their demand for health care (Philipson and Becker, 1998).

This theoretical framework is common to all countries. The parameters of the model are calibrated to the main demographic and economic features and to the

social security system of each country – France, Germany, Italy, Spain, the UK and the US, as described in Box 1. Each country is analysed as a closed economy, with no international capital movements, although migration is accounted for in the population projection data. Within this modelling framework, countries may differ in several economic and demographic features, such as average employment rate, productivity growth, capital share of income, population growth and age specific survival probabilities; and in some elements of their social security systems, such as pension indexation criterion and effective retirement age. In order to match country-specific long-run capital/production ratios, we allow the parameters of individuals' utility to differ across countries. Other important differences, such as those in the countries' trade and industry structures, are not captured by our single-good, closed-economy framework.

Box 1. Calibration and simulation methodology

Our quantitative assessment proceeds in two stages: (1) calibration of the model; and (2) simulation of the model under different policy specifications. The calibration exercise considers each country as a closed economy and pins down the values of key parameters in its initial steady state so as to match the country's main economic, demographic and political characteristics, and the crucial features of the private employees' scheme of the social security system, around the year 2000. For each country, the first line in Tables 5 and 7 provides the country's characteristics as calibrated in the initial steady state.

Demographics. Every period in the model corresponds to one year. Agents are born at age 18 and may live up to age 95, according to age specific probability of survival. For each country, these probabilities are averages by gender of 1999 official estimates. To simulate the ageing process, we use official 2050 surviving probabilities for France and the US, while for Germany, Italy, Spain and the UK, we calculate them by reducing by 10% the 1999 official mortality rate. For Italy and the UK, we also calculate surviving probabilities by education level according to the following procedure: official survival probabilities obtained are assigned to agents in the intermediate education group. Survival probabilities of agents in the low education group are obtained by increasing the mortality rate by 5% at every age; while the survival probabilities of the agents in the third group – the high education level – are obtained by reducing it by 5%. The population growth rate used in the calibration (for 1999) and in the simulation (for 2050) is calculated to match – given the corresponding surviving probability – the elderly dependency ratios displayed

in Figure 2. The figure in this box displays the 1999 actual and 2050 fore-casted population pyramid, as well as the 1999 and 2050 population pyramid used in the model for France.

France: Population Profile
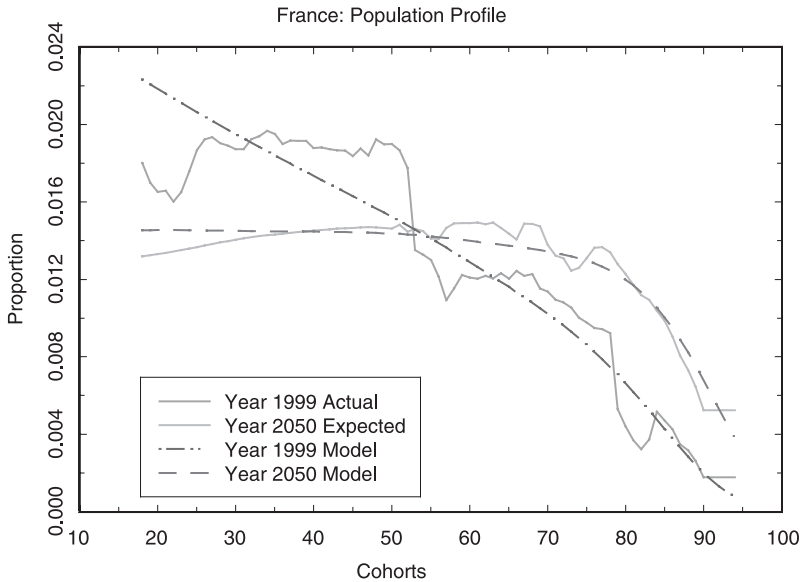
Labour market. In the model with exogenous labour supply (see the Appendix and Section 4.2), the average amount of time dedicated to product-ive activities equals the average employment rate. Agents differ in labour efficiency by age and – in the case of Italy and the UK (see Section 5.1) – education. This index, which corresponds to the labour income lifetime profile, is obtained by using country-specific microeconomic data on labour income by age. In the endogenous labour supply model (see the Appendix and Section 4.3), the *endogenous* amount of time dedicated to productive activities by age is calibrated to the average employment rate by age. The labour efficiency index by age (and education) is obtained on microeconomic data by combining wage income and employment rate by age. The retirement age in 1999 is set at the median effective retirement age for each country. For Italy and the UK, we also consider the median retirement age and the working history according to the education level. The 2050 simulations are instead provided for several retirement ages.

Technology. In the constant return to scale production function, the value of the average capital share is taken from national accounts. The exogenous productivity growth is given by the average per-capita GDP growth rate in the 1990s, while in the simulations we use EC projections. The long-term charac-teristics of each economy are described by its capital-output ratio (see Cooley

and Prescott, 1995), which we obtain from several publications (see Appendix B). Depreciation rate is set at 5%.

Pension systems. We concentrate on the *equilibrium* rather than on the legal contribution rate. At each point in time, the equilibrium tax rate equates the total contributions paid to the system to the total pension benefits awarded to the retirees. If a country (e.g., Italy) runs a pension deficit, we impute the transfer from the general taxation to the tax rate, thereby having that the equilibrium tax rate is higher than the legal one.

Political features. As in Galasso (1999), the model is calibrated so that the tax rate chosen by the median voter is equal – for every country – to the actual (equilibrium) contribution rate in 1999. If agents only differ by age, the political system is easily parameterized to the median voter's age; whereas if individuals differ also by education, as in the case of Italy and the UK (see Section 5.1), the median voter has to be identified in terms of age and education class. In computing the median voter, we always consider the electoral participation rate by age – and, when relevant, by education classes.

Estimated parameters of the model

	France	Germany	Italy	Spain	UK	US
Productivity growth (%)	1.6	1.8	1.92	2.2	2.6	1.94
Avg. employment rate (%)	65.4	71.4	45.6	43.5	64.7	60
Capital share (%)	31	34	38	34.7	30	36
Capital-output ratio	2.21	2.32	3.18	2.37	1.81	2.43
Effective retirement age	58	61	58	62	63	63
Equilibrium tax rate (%)	22.4	23.8	38.0	21.3	14.5	9.7
Population growth (%)	1.04	0.62	0.7	0.8	0.5	1.35
Median voter's age	47	46	44	44	45	47

Source: See Appendix B.

For each country, the model is calibrated to match two basic parameters: capital-output ratio and equilibrium contribution rate (as chosen by the median voter). These restrictions pin down two parameters of utility function: the subjective time discount rate and the coefficient of relative risk aversion. All other parameters are obtained from independent empirical estimates.

In the simulation exercise, we retain the calibrated parameters and feed the model with forecasted values of economic, demographic and political variables – such as, individual survival probabilities, population growth rate, productivity growth rate and median voter's age – for the year 2050, as reported in the table below. With this new set of parameters, the model simulates – in a new steady state – the political sustainability of the social security system, under different policy scenarios characterized by the contribution tax rate chosen by

Calibrated parameters of the model

		France	Germany	Italy	Spain	UK	US
Exogenous labour supply	Coefficient of relative risk aversion	4.0	2.41	2.70	1.86	3.65	4.17
	Subjective discount factor	1.08	1.01	1.07	1.00	1.04	1.08
Endogenous labour supply	Coefficient of relative risk aversion	6.62	3.18	2.42	2.42	4.84	9.95
	Subjective discount factor	1.16	1.04	1.06	1.01	1.08	1.35
	Preference elasticity of consumption	0.71	0.82	0.61	0.61	0.75	0.80

Source: Authors' calculations.

the median voter in the year 2050. For each country, all lines in Tables 5 and 7, but the first one, provide the results of our simulations in terms of social security contribution rate, replacement rate and employment rate (only in Table 7), in a new steady state, under the different policy scenarios.

Forecasted parameters of the model

	France	Germany	Italy	Spain	UK	US
Productivity growth (%)	1.8	1.8	1.8	1.8	1.7	1.94
Population growth (%)	−0.05	−1.44	−1.5	−1.69	−1.0	0.25
Median voter's age	56	55	56	57	53	53

Source: See Appendix B.

3.2. Individual voting behaviour and the political game

In our political environment, individuals are also political agents, expressing their preference over the size of the system. Specifically, they vote over the social security contribution rate. This choice will typically depend on individual characteristics, such as age and educational attainment, and on the main institutional features of the system, such as retirement age and indexation rule.

Since our analysis concentrates on steady state political equilibria, it is useful to examine a once-and-for-all election, whose outcome – the contribution rate – is binding for all future periods. In this environment, current voters need not foresee how future voters may modify their policy outcome. Box 2 discusses the extension of our one-time election to repeated elections, in which current voters consider how their voting behaviour may affect future voters' decisions.

In the calibrated model, the contribution rate arising at the initial steady state political equilibrium corresponds – for each country – to the average social security contribution rate in the 1990s (see Box 1). Our model evaluates the impact of ageing

Box 2. Political sustainability and repeated elections

A key element of these political games over social security is their dynamic nature. When elections are repeatedly held, agents consider how their voting decision will affect future voters' choices. In this case, as shown by Galasso (1999), sub-game perfect equilibrium outcomes of this repeated voting game coincide with those obtained in a once-and-for-all voting. In fact, a young voter will be willing to support a specific social security regime, and thus to pay the contribution to the system, if she expects her decision to induce future workers to sustain the system when she has retired. Since current retirees always support the system, a social security system may emerge as an intergenerational transfer from current workers to current retirees.

The (sub-game perfect) equilibrium outcome of this stylized political system is to be interpreted as a self-enforcing implicit contract among successive generations of agents. Sjoblom (1985), and later Cooley and Soares (1998), Galasso (1999), and Boldrin and Rustichini (2000) among others, suggested that this social norm emerges among the majority of the voters at each election. Thus, the social security system is not based on a constitutional right defined once and for all by some planner. Retirees' claims to a pension are rather the (sub-game perfect) equilibrium outcome of a political game played by successive generations of voters according to the majority rule and could potentially be amended in the future.

To see why voters have an incentive to comply with this implicit contract, consider what follows. With a pension system in place, the contract requires the voters to support the current system, if it is in their self-interest. Agents may also modify the system to improve on their current condition as long as this does not lead future generations – hurt by the changes – to dismantle the system. This is because the contract also requires the voters to punish those who have previously and 'inappropriately' changed the system by giving them no transfer.* With no social security in place, a majority of voters may choose to institute a system. This would lead to an implicit contract to be accepted, as argued above, by all future generations of electors.

* Notice also that future voters will have an incentive to cope with the contract. In fact, if they do not – for instance by deciding not to pay the pension benefits to the current retirees – the successive voters would give them no pension, and they would live in an economy with no social security. Voters also have an incentive to punish those who have inappropriately modified the system, otherwise they would be punished by future voters for this behaviour. In this case, they would have sustained the cost of contributing without receiving a pension: definitely a strategy to be avoided.
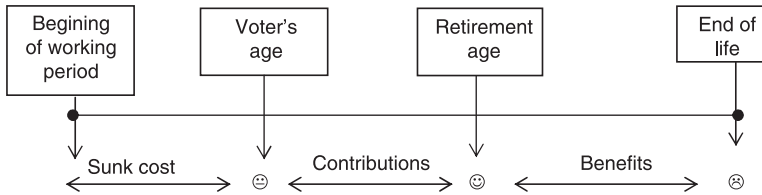
Figure 3. A voter's time horizon

on the political decisions over social security, by simulating the contribution rate that would arise in an election at a steady state featuring the projected economic and demographic scenario for the year 2050. The comparison between the political equilibrium outcomes – the social security contribution rates – obtained at the two steady states provides a useful benchmark to assess the order of magnitude of the ageing effect. However, these simulations do not address the political sustainability of the social security systems during the transition between steady states, nor do they evaluate the political feasibility of some alternative policy measures, such as the increase in the retirement age (see Section 6).

Individuals' voting behaviour depends on how social security affects their well-being. Since PAYG systems impose a cost on the young – the contribution – while providing a transfer – the pension benefit – to the elderly, retirees will typically support the system, whereas workers may be willing to incur a current cost only if they will be sufficiently compensated by future pension benefits. More specifically, every voter determines their most preferred contribution rate by comparing their residual return[4] from the system to the returns available on the capital market from assets with comparable risk.

Crucially, as originally suggested by Browning (1975), past contributions to the system do not affect the agents' voting decision: if the system were abandoned (or modified), past contributions could not be recovered by the voters, and thus represent a sunk cost. Hence, middle-aged and elderly individuals are more favourable to social security systems, as they will almost exclusively enjoy benefits in their remaining time horizon. Figure 3 describes the individual's residual horizon when taking their voting decision.

The choice of the political institution to aggregate individual preferences is not innocuous. In our model, we consider simple majority voting, although we recognize that decisions over social security systems are more complex than a simple majoritarian voting model would predict. Typically, political players, such as trade unions and employers' unions, may exert an intensive lobbying activity on the policy-makers in

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[4] In a partial equilibrium setting, a measure of the effectiveness of social security is given by the continuation internal rate of return (CIRR), which is the discount rate that equalizes the value of the stream of current and future contributions to the value of the stream of future benefits (see Galasso, 2002, for a calculation of the CIRR from the social security system for the US median voter). In our general equilibrium environment, we also take into account the effects on wage and rate of returns driven by changes in the stock of capital.

an attempt to affect the policy outcome, while elderly voters may enjoy disproportion-
ate political influence (see Azariadis and Galasso, 2002). In analysing the experience
of France, Switzerland and the UK, Bonoli (2000) has emphasized the importance of
veto players in social security reforms. Institutional features are suggested to play a
crucial role in shaping pension policies – particularly, potential retrenchments – as
they determine the existence of veto-players able to block any reform process, while
they are less relevant in the expansion phase of the welfare state.

Our modelling choice abstracts from these considerations, but has the advantage
of providing a coherent and transparent analysis of the impact of the demographic
dynamics on the political process. In fact, with single-peaked preferences, the equi-
librium outcome of the voting game coincides with the most preferred size by the
median voter. The political effect of ageing, that is, the ageing of the electorate, may
thus be directly measured by the change in the median voter's age. Its effects on the
outcome of the political process are evaluated in Section 4.

4. AGEING AND POLITICAL SUSTAINABILITY

In this section, we quantify the potential impact of ageing on the political support
for social security. Our theoretical framework identifies two major channels for the
ageing process to affect social security decisions. Through the economic channel,
the demographic process lowers the average return from contributing to the system:
faster ageing increases the number of retired recipients while reducing the fraction of
working contributors. This tends to reduce any positive effect of unfunded social
security on individual agents' well-being, and to reduce their support for the system.
Through the political channel, however, the ageing process will modify the relative
importance of the different age group in the political arena. An ageing electorate
increases the political influence of those who benefit from social security, because the
political process's pivotal individual – the median voter – becomes older.

Our simulation exercise presents a quantitative evaluation of the overall effect
of ageing on social security. The initial steady state political equilibrium – whose
characteristics are displayed for each country in the first line of Tables 5 and 7 – is
calibrated to the year 2000 scenario. Our simulations calculate the political equilibrium,
which would arise in new steady states, featuring the expected demographic, eco-
nomic and political characteristics for the year 2050, under different policy scenarios.
The comparison among different steady state political equilibria, displayed in Tables 5
and 7, provides a quantitative assessment of the potential magnitude of these effects,
if no reforms are undertaken. However, the simulations do not address the political
sustainability of the system during the transition between steady states, or the political
feasibility of alternative policy reforms, which may reduce the impact of ageing.

Before evaluating the future support for social security under population ageing, it is
useful to investigate whether these systems are currently sustainable. A Euro-barometer
survey conducted by Eurostat presented to the interviewed persons the following
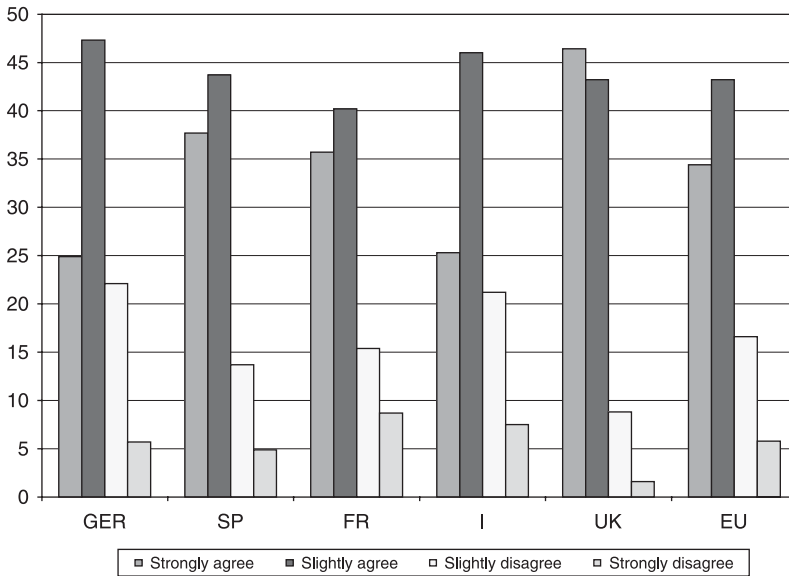
Figure 4. 'Maintain current pension even by raising contributions?'

statement: 'current pension levels should be maintained even if this means raising taxes or contributions'. As shown in Figure 4, three out of four Europeans agreed with maintaining the current pension levels even at the cost of a further hike in the contribution rate. These answers suggest that systems are currently sustainable. The defence of the current pension level is particularly strong in Spain and in the UK where respectively 81.5% and 89.6% of the population are willing to accept a tax increase in order to retain their pension benefits.

4.1. Ageing of the electorate

As population ages (see Section 2.1), so does the electorate. This indirect effect of ageing may have important repercussion on the political sustainability of the social security system, by increasing the political influence of the elderly voters and the relevance of pension spending on the agenda of the policy-makers.

A synthetic measure of the ageing of the electors is given by the median age among the voters. In 1999, the median age among potential electors ranged from 43 years in Spain and the US to 46 in Italy. However, not all potential electors actually vote. Interestingly, in some countries, elderly voters have a higher turnout rate at elections – defined as the percentage of people who actually vote among those having the right to – than the young, thus leading to an overrepresentation of the elderly.[5] This voting

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[5] Voting patterns are of course endogenous. Perhaps elderly people participate more at elections because they have more free time (as suggested for instance by Mulligan and Sala-i-Martin, 1999) but also because they care more about the issues at stake, which could imply interesting interactions in our context. In our simulations, however, we take the turnout rate at elections as given.
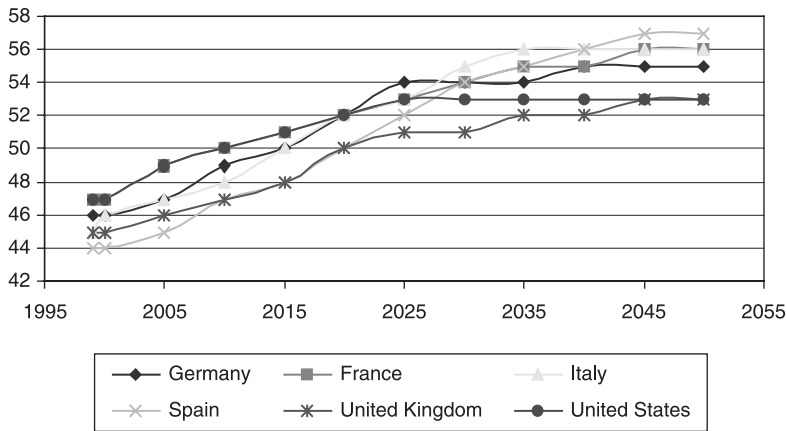
Figure 5. Median age among voters

pattern is strongest in the US, where turnout rates among those aged 60–69 years is twice as high as among the young (18–29 years). But significant differences appear also in other countries: in France, the turnout rate of the elderly (60–69 years) is almost 50% higher than that of the young (18–29 years).

   After accounting for the different turnout rates by age, the median age among the actual voters ranged from 44 years in Spain to 47 years in France and the US. The evolution over time of the median age among voters is displayed in Figure 5. The expected increase is striking. In 2050, the median age will be between 53 years – in the UK and the US – and 57 years in Spain. Unsurprisingly, Spain and Italy, which undergo the most dramatic ageing process, face the largest change in the median age, respectively 13 and 10 years, while in the US and in the UK, where the demographic dynamic is less extreme, the median age increases by 6 and 8 years respectively.

   In a simple majority election, ageing increases the political relevance of the elderly voters, as measured by their share of votes. The pivotal political agent – the median voter – becomes an individual who is closer to retirement age, and therefore considers a shorter time horizon in evaluating the social security programme. Figure 6 provides an illustration of the effect of ageing on the median voter's decisions for two repres- entative countries, Spain and the US. In the year 2000, the US median voter expected to face 18 years of residual contributions to the system and 9 years' worth of pension benefits; the Spanish decisive voter faced 19 years of contribution and could look forward to 12 years of benefits. The 2000 contribution rate to the social security system was 9.7% in the US and 21.3% in Spain. In 2050, for the US median voter the remaining years of expected contributions are 12 vis-à-vis 14 years of pension benefits. For the Spanish median voter, the years of contributions are down to 8 – even assuming an increase in the retirement age from 63 to 65 years – while the benefits period is expected to increase to 14 years.
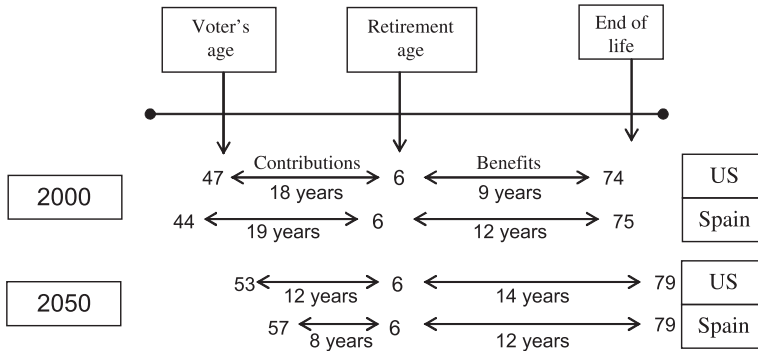
Figure 6. Ageing and voting behaviour

4.2. The direct impact of ageing

Demographic dynamics, labour market trends and economic conditions affect the long-run performance of unfunded social security systems. For a stable employment rate, the average long-run return of a PAYG social security system may be approximated by the sum of the population growth rate and the productivity growth rate. Individual returns from social security are also influenced by the survival probabilities that determine the length of time during which an individual will draw her pension benefits. Ageing therefore decreases the average return, while increased longevity extends the retirement period. Among the other determinants, higher productivity growth rate increases the profitability of the system, and may allow the same pension benefits to be provided with a lower contribution rate. Our political channel suggests instead that, due to the increase in the returns from social security, voters will have an incentive to raise the contribution rate[6] in order to transfer more resources into the future, through this improved saving instrument.

In this section, we concentrate on the two crucial economic and political effects of ageing: (1) the changes in the profitability of the social security system, induced by the rise in dependency ratio and by the higher longevity; and (2) the increased political influence of the elderly voters. The former effect typically induces the agents to reduce their support for social security, since an increase in the dependency ratio lowers the average profitability of the system. The increase in longevity – by enlarging the period during which retirees receive pension benefits – may, however, dampen this response. The latter aspect modifies the identity of the median voter, who becomes older, and leads to more support for social security. The real-life magnitudes of these two aspects of ageing were illustrated in Figures 2 and 5, while data on longevity were presented in Table 1.

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[6] This tendency may be reversed if pension benefits are indexed to inflation, and higher productivity growth leads to lower purchasing power for the pension of the very old.

Table 5. The direct impact of ageing: simulation results

		Median voter's age	Effective retirement age	Social security contribution rate (%)	Replacement rate (%)
France	2000	47	58	22.4	49.2
	2050	56	58	31.3	41.9
	2050	56	65	19.7	47.9
Germany	2000	46	61	23.8	68.3
	2050	55	61	37.7	55.4
	2050	55	65	32.6	81.2
Italy	2000	44	58	38.0	73.6
	2050	56	58	50.0	55.5
	2050	56	65	38.0	74.2
Spain	2000	44	62	21.3	67.9
	2050	57	62	45.5	64.6
	2050	57	65	40.7	77.3
UK	2000	45	63	14.5	75.8
	2050	53	63	33.2	95.2
	2050	53	65	31.1	114.3
US	2000	47	63	9.7	41.9
	2050	53	63	21.6	55.7
	2050	53	65	18.3	53.9

Source: Authors' calculations.

Our simulations provide a quantitative evaluation of how ageing affects social security. We compare the initial steady state political equilibrium for the year 2000 with the political equilibrium, which would arise in new steady states, characterizing the expected demographic, economic and political features for the year 2050, under different policy scenarios. In particular, we consider the political equilibrium for two exogenous levels of the retirement age: the median effective retirement age in the year 2000 and 65 years. Table 5 presents the results of our simulations: for each country, the first line corresponds to the country's characteristics calibrated for the year 2000.[7] The following lines provide the results of our simulations, in terms of social security contribution rate and replacement rate, in the new steady states, featuring the ageing process and the different policy scenarios.

The overall assessment from comparing these steady state political equilibria is that the political aspect – the increased political influence of the elderly voters – dominates in all countries, albeit with some differences. In fact, in all countries the social security contribution rate – hence the size of the system – increases. The largest hike (more than 20%) takes place in Spain, the fastest ageing country in our sample, although

[7] In Italy, the initial steady state is calibrated to the year 1992, since we aim at evaluating the political sustainability of the reforms, which took place in 1992 and 1995.

Table 6. Disentangling economic and political effects: simulation results

	Effects	Social security contribution rate (%)	Replacement rate (%)
France	Economic	+1.4	−17.3
	Political	+7.5	+10.0
Germany	Economic	−8.8	−46.2
	Political	+22.7	+33.3
Italy	Economic	−1.5	−33.1
	Political	+13.5	+15.0
Spain	Economic	−12.7	−55.7
	Political	+36.9	+52.4
UK	Economic	+4.3	−21.9
	Political	+14.4	41.3
US	Economic	+6.0	−1.4
	Political	+5.9	+15.2

Source: Authors' calculations.

the largest contribution rate, 50%, arises in Italy. Despite the hike in the contribution rate, however, in France, Germany, Italy and Spain, the replacement rate, that is, the ratio between the pension benefit and the (latest) wage income, decreases. This is due to the large increase in the dependency ratio. Social security contribution rates are higher but, since fewer workers contribute and more numerous retirees draw benefits, pensions are less generous. In the UK and the US, the demographic process is less dramatic (see Figure 2) and the increase in the contribution rate dominates, leading to more generous systems, as the replacement rates rise. In all countries, an increase in the retirement age mitigates the rise in contribution rates.

To assess the relative magnitude of the two economic and political effects – the higher dependency ratio, and the older median voter – we calculate the political equilibrium in a steady state featuring the year 2050 expected demographic and economic elements, but keeping the identity of the median voter, that is, their age, as in the year 2000. This simulation isolates the economic effect. Table 6 summarizes the results: for each country, the first line measures the impact of the economic effect on the contribution rate and on the replacement rate; while the second line refers to the political effect. In Germany and Spain, the large negative economic effect – inducing a reduction in the contribution rate respectively by 8.8% and 12.7% – is compensated by a sizeable political effect, leading to an overall increase in the size of the system. In Italy, a large political effect – calling for a hike in the contribution rate by more than 13% – dominates a small negative economic factor. France, the UK and the US display a different pattern, as the economic effect turns out to be positive. This is because the ageing process, as measured by the change in the dependency ratio, is moderate. Hence, the reduction in the average return is small, and the effect on the increase in the individual longevity prevails. The political effect is also positive, thereby causing a further hike in the tax rate, particularly relevant in the UK.

Our simulations convey an important policy-relevant insight: a higher retirement age leads to lower social security contribution rates, and may even make pension replacement rates more generous. As shown in Table 5, an increase in the retirement age to 65 years is particularly effective in those countries with a low initial effective retirement age, such as France and Italy, where the contribution rate would be reduced by almost 12%. The impact would also be large – around 5% – in Germany and Spain; while decreasing to around 3% in the UK and the US. Notably, despite reducing the contribution rate, in all countries but the US, this policy would also manage to increase the generosity of the system, as measured by the replacement rate. This is because the social security dependency ratio, that is, the ratio of retirees to workers, would be reduced, thereby counterbalancing the ageing process. Germany would enjoy the largest effect, with an increase in the replacement rate by more than 25%, followed by Italy and the UK.

The intuition for these results is straightforward: a rise in the effective retirement age mitigates both the economic and the political effects of ageing. The economic effect is reduced, since postponing retirement increases the share of workers, while lowering the share of retirees. The ratio of retirees to workers therefore decreases, with favourable implications for the average return from social security. An increase in the retirement age also moderates the political effect. In fact, postponing the retirement age increases the contribution period for the median voter, while reducing the period during which they will draw pension benefits (see Figure 2). The continuation return from the system for the median voter is thus reduced. Our simulations suggest that again the political effect dominates, so that postponing retirement lowers the contribution rate.

These comparisons among steady state political equilibria, featuring the 2050 expected demographic, economic and political aspects, and different effective retirement ages, are suggestive of the possible long-run magnitude of a policy, which postpones retirement age, on the size of the social security system. In our political economics model, however, we do not address the political feasibility of rising the retirement age. We shall return to this issue in Section 6.

A useful exercise within our theoretical framework is to evaluate how ageing influences individuals' consumption decisions. We identify three main effects of the ageing process on the demographic, economic and political structure of every society, and on the individual agent's economic decisions. First, the change in the age composition of the population towards more elderly people increases the proportion of net savers, and tends to increase the stock of capital. As a result, wages increase, and returns from capital decline. Second, since individuals' expected longevity increases, consumers will be induced to save more for (very) old age consumption, as they will be more likely to reach this old age. Again, the stock of capital increases. Third, as discussed above, ageing lowers the long-run returns from the social security system, due to the increase in the dependency ratio. Our simulations suggest that the combined effect of an increase in wages and a decrease in rate of returns from social security and
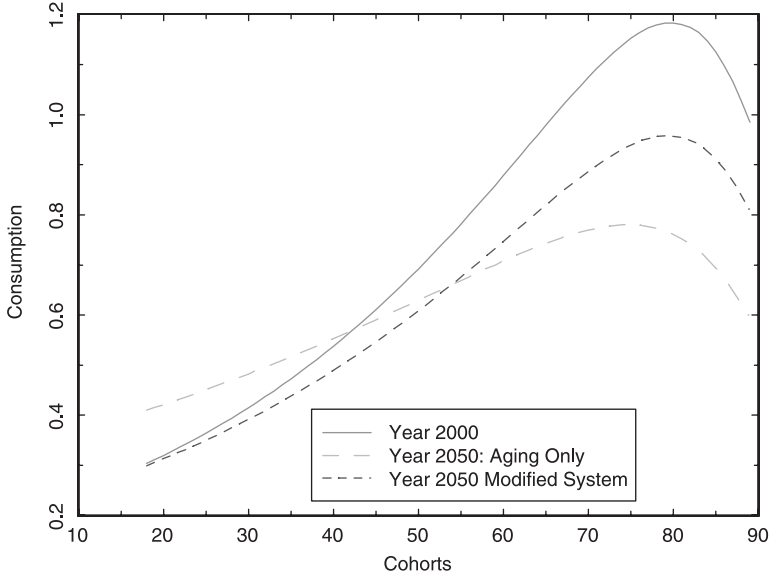
Figure 7. Consumption profile by age in Germany

from private capital reduces the individual lifetime wealth. Being poorer, individuals have to consume less. Figure 7 displays the consumption profiles by age for the case of Germany in the 2000 initial steady state, in the 2050 steady state characterized by no changes in the contribution rate and in the retirement age, which remains at their 2000 level (labelled ageing only in the figure), and in the 2050 steady state characterized by the contribution rate emerging from the new political equilibrium, and a retirement age of 65 years (see Table 5). Two interesting features emerge. Ageing shifts the consumption profile[8] down – due to the decrease in the lifetime wealth – while increasing the young consumption – because of the reduction in the rate of returns, which makes consumption in youth more convenient. However, the changes in the social security system – the increase in the contribution rate, from 23.8% to 32.6% and in the retirement age, from 61 to 65 years – partially counterbalance the impact of ageing. If compared to the case of ageing with an unchanged social security system ('ageing only' in Figure 7), the consumption profile ('modified system' in Figure 7) shifts upward and tilts towards more old age consumption.

4.3. Employment rate and tax distortions

In this section we add individual labour market behaviour to the economic environment, and explore whether and how economic behaviour may counterbalance political

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[8] The scale of consumption on the vertical axis of Figure 7 may be related to an annual average income, which is equal to 0.808 in the year 2000, to 0.765 in the year 2050 (ageing only) and to 0.773 in the year 2050 (modified system).

Table 7. Employment and tax distortion: simulation results

		Median voter's age	Effective retirement age	Social security contribution rate (%)	Replacement rate (%)	Employment rate (%)
France	2000	47	58	22.4	51.8	72.0
	2050	56	58	39.0	53.6	72.2
	2050	56	65	27.2	61.6	71.7
Germany	2000	46	61	23.8	67.6	81.7
	2050	55	61	35.7	50.0	81.9
	2050	55	65	29.2	55.4	81.1
Italy	2000	44	58	38.0	75.7	62.6
	2050	56	58	46.2	48.4	64.3
	2050	56	65	35.5	64.0	62.2
Spain	2000	44	62	21.3	89.7	60.3
	2050	57	62	37.5	65.2	60.4
	2050	57	65	33.8	89.8	58.7
UK	2000	45	63	14.5	74.8	73.4
	2050	53	63	31.7	91.6	72.5
	2050	53	65	29.0	104.2	71.9
US	2000	47	63	9.7	46.4	80.5
	2050	53	63	20.7	57.3	81.2
	2050	53	65	18.7	60.0	80.8

Source: Authors' calculations.

factors and prevent further increases of social security expenditures. In particular, if workers of all ages choose their employment rate, they may respond to the large increase in the social security contribution rate by reducing their labour supply.[9]

Does the political force of older median voters dominate the negative effect of the ageing process on the social security returns, even in an economic environment featuring labour market distortions? The results of our simulations suggest that the political aspect is still very relevant, albeit less than in the previous scenario. A comparison between the initial steady state political equilibrium characterizing the year 2000 and the political equilibrium which arises in the steady state featuring the year 2050 expected scenario – for each country, see the first two lines of Table 7 – indicates that the social security contribution rate rises in every country, while, as in the previous simulations, the replacement rate decreases in Germany, Italy and Spain. However, the magnitude of increase in the contribution rates is everywhere of a lower scale, as compared to the previous section, but in France. In Italy and Spain – the two fastest ageing countries – labour market considerations moderate the hike in the contribution rate, respectively by 4% and 8%. The increase in the size of the system is also reduced in Germany (by 2%), in the UK (by 1.5%) and in the US (by almost 1%). Surprisingly, the introduction of individual labour decisions magnifies the increase of the tax rate in France. This counterintuitive result is due to the large positive effects of the ageing process on the stock of capital. The resulting rise in

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[9] See Disney (2003) for a discussion of the distortionary effects of social security contribution on employment decisions.

wages counterbalances the distortionary effect of the hike in social security contributions on the labour supply.

The results in Table 7 confirm the insights emerging from the simulations of the previous section. In the political-economic environment we consider, postponing retirement age leads to lower social security contribution rates, while increasing the generosity of the system. For each country, the third line in Table 7 displays the political equilibrium, which would arise in a steady state featuring the year 2050 economic, demographic and political scenario, and a retirement age of 65 years. If compared with the political equilibrium arising under the 2050 steady state scenario with the retirement age at its year 2000 level (see the second line of Table 7), France and Italy, the countries with the lowest effective retirement age in 2000, i.e., 58 years, would experience a sharp reduction in the contribution rate, respectively 11.8% and 10.7%, while in the other countries the decrease would be between 2% (in the US) and 6.5% (in Germany). The simulation for Italy is particularly revealing, as it shows that, despite the ageing process, if the policy measures legislated by the Amato and Dini reforms are actually implemented, and the retirement age rises to 65 years, the size of the system may indeed be lower than in 2000 scenario. However, in our theoretical framework, we do not address the political feasibility of postponing retirement during the transition between the 2000 scenario and the expected 2050 scenario (see Section 6).

The theoretical framework featuring individual labour market choices offers a useful opportunity to evaluate how ageing influences individuals' employment decisions. We identify two main effects of ageing on the labour market: (1) an increase in wages, induced by the rise in the stock of capital; and (2) the change in the social security contribution rate, as described in Table 7. The impact on the agent's decision depends on the overall effect on the net wage. If the net wage increases, so will the individuals' labour supply. Clearly, workers have an incentive to raise their labour supply when they are more efficient, in order to benefit the most from the higher wages. Because of the steepness in the wage profile, which we estimate for each country (see Box 1), agents will thus prefer to work more in the second part of their working career, while decreasing their labour supply when young (and less efficient). This pattern is presented for the case of Italy in Figure 8, where we show the actual employment profile by age in the year 2000, the calibrated employment profile in the initial steady state corresponding to the year 2000 scenario, and the simulated employment profile in the steady state characterized by the year 2050 demographic and economic features and by an effective retirement age of 65 years. Finally, notice that this tilt in the employment profile towards more labour participation by the elderly workers and lower employment among the young is due to individual labour supply decisions.[10] A more detailed description of the labour market, accounting for

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[10] In our model, firms' labour demand does not depend on workers' age or seniority, and wage depend on the workers' labour efficiency units.
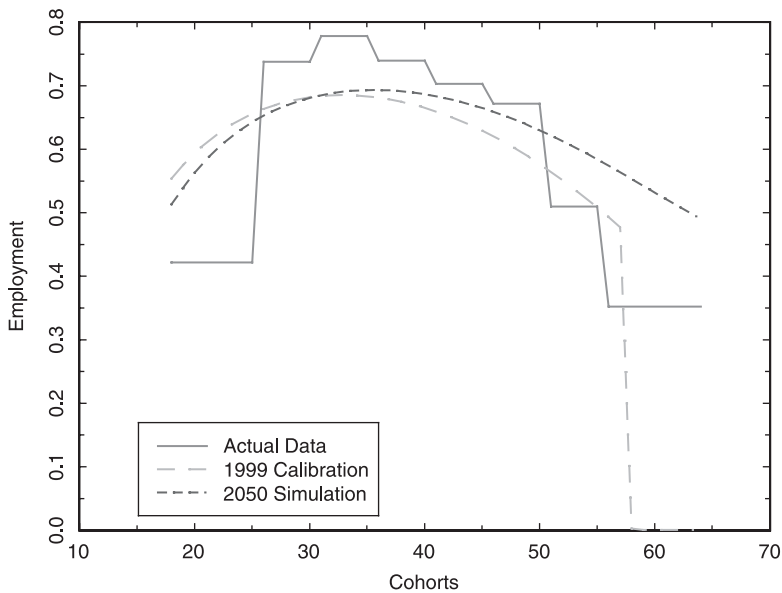
Figure 8. Employment rate by age in Italy

the role of the unions and for existing employment protection legislations, would be needed to capture additional effects.

5. COUNTRY-SPECIFIC FEATURES

The simulation exercise presented in Section 4 abstracts from some characteristic features of these social security systems and of these societies, which may potentially modify our results. To assess the effect of ageing, our simulations concentrated on the intergenerational aspect of social security – the flows of resource across cohorts. However, social security systems may also redistribute within cohorts – typically from low-income to high-income individuals or families.

In Section 5.1, we provide a quantitative evaluation of the redistributive effects of the reforms that took place in Italy and in the UK in the 1990s, by analysing how this new channel of redistribution may affect the long-run political sustainability of the reform measures. Section 5.2 addresses the fundamental difference between Bismarckian and Beveridgean social security systems; while in Section 5.3 we discuss the political coalitions supporting social security, which may arise in countries with strong family ties, where adult children still live with their parents.

5.1. Intergenerational redistribution and parametric reforms

In this section, we assess the redistributive effects of the Amato and Dini reforms in Italy and of the Welfare Reform and Pension Act in the UK, and their impact on the

future political sustainability of the Italian[11] and of the British social security system. In 1995, with the Dini reform (see Section 2.3 and Table 3) the Italian system switched from a defined benefit to a notional defined contribution scheme. This radical shift affected the generosity of the pension benefits depending – among other things – on the individual lifetime income profile and contribution history. In 1999, the Welfare Reform and Pension Act substituted the earnings-related element of the British pension system with a flat-rate pension. Clearly, this reform aimed at reshaping the pension system in a more redistributive way.

To assess the role of intragenerational redistribution in the Italian 1992 Amato and 1995 Dini reforms, D'Amato and Galasso (2002) partition individuals by age – from 18 to 95 years old – and education – low, medium and high. Within each age cohort, education level affects retirement age, working history, income profile, survival probability and participation rate at elections. Typically, more educated individuals retire later, enter the labour market at a later age, live longer, enjoy steeper income profiles and have a higher turnout rate at elections.

Using a model with intragenerational heterogeneity, D'Amato and Galasso (2002) estimate higher increases in the social security tax rate than predicted by our simulations in Section 4.2. If retirement ages remain at their 1992 (pre-reforms) level – 57 years for low, 56 for medium and 58 for high educated individuals – in the 2050 steady state political equilibrium, the social security contribution rate chosen by the majority of the voters would be equal to 61%. D'Amato and Galasso (2002) examine the effects of the reform on the generosity of the pension benefit, and highlight the existence of a redistributive effect. The replacement rate increases for low and medium educated people – respectively from 59% to 69% and from 69% to 77% – and decreases from 69% to 61% for high educated individuals. Thus, in spite of the declared goal of providing a tighter link between contributions and pension benefits by moving from a defined benefit to a defined contribution scheme, the reform has introduced an element of intragenerational redistribution from high- to medium- and low-education groups. D'Amato and Galasso's (2002) simulations also confirm that an increase in the retirement age to 65 for all individuals would moderate the hike in the contribution rate to 48.9% (rather than 61%), while increasing the replacement rate.

In 1999, the Welfare Reform and Pension Act modified the earnings-related element of the British pension system. While the flat-rate Basic State Pension (BSP) remained unchanged, that reform replaced the existing State Earnings Related Pension System (SERPS) with a new benefit, the State Second Pension (S2P). Unlike the SERPS, which was linked to the retirees' previous earnings, the S2P is a flat rate pension provided on top of the BSP. The aim of this reform was to guarantee additional pension benefits to the low-income retirees, while making the system more redistributive.

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[11] See Brugiavini and Galasso (2003) and D'Amato and Galasso (2002) for detailed discussions of the effects of these reforms.

Table 8. The UK 1999 pension reform: simulation results

	Scheme	Effective retirement age	Social security contribution rate (%)	Replacement rate (low) (%)	Replacement rate (high) (%)
2000	BSP & SERPS	63	17.1	66.7	48.5
2050	BSP & SERPS	63	39.0	75.3	54.5
2050	BSP & SERPS	64	36.5	78.1	58.0
2050	BSP & SERPS	65	34.3	81.4	62.2
2050	BSP & S2P	63	43.0	85.4	55.0
2050	BSP & S2P	64	40.0	88.2	58.5
2050	BSP & S2P	65	37.6	92.0	62.7

Source: Authors' calculations.

To assess the redistributive effects of this reform, we partition the individuals by age and education – low and high – and we model the British social security system as described in Appendix A to allow for differences in the individual pension benefits. A particular feature of the British system is that individuals may choose to opt out of the second tier of the pension scheme – SERPS or, after the reform, S2P. In this case, they only receive the basic benefit – the BSP – and no SERPS (or S2P), but their contributions (as well as their employer's contributions) to the pension system are reduced. Consistently with data from the UK Department of Welfare and Pension, we assume that high-educated agents contract out of the system, while low-educated individuals remain in the system and receive both pension benefits, BSP and SERPS or S2P.

We calibrate the model in its initial steady state to the year 2000 data; and then run simulations for two different steady state political equilibria, featuring the year 2050 demographic, economic and political elements: one for the reformed system – consisting of BSP and S2P; and one for a hypothetical 'unreformed' system – composed of BSP and SERPS. The results, summarized in Table 8, suggest that the political equilibrium associated with the reform is characterized by a higher contribution rate, and a higher generosity towards the low-educated retirees, as measured by the replacement rate. If the retirement age remains at its year 2000 level – 63 years for both low and high educated individuals – the normal contribution rate (i.e., the tax rate paid by those who do not opt out) would increase from 17.1% in 2000 political equilibrium to 39%, in absence of a reform, and to 43%, with the reform. According to our simulations, the substitution of the SERPS with the S2P would mainly benefit low-educated retirees, whose replacement rate would increase from 66.7% in 2000 to 85.4% in 2050, while the replacement rate of the high-educated would be almost unaffected.

To summarize, the introduction of elements of intragenerational heterogeneity in the analysis does change somewhat the picture obtained in our simulations in Table 5. In the case of Italy, D'Amato and Galasso's (2002) results confirm our view that the reforms of the 1990s may help to contain the expansion of the social security

expenditure, if the retirement age increases, as legislated by the reforms. Interestingly, the use of a model allowing for intragenerational redistributive elements captures an unexpected pattern of redistribution in the Dini reform: despite the move from a DB to a DC scheme, high-educated retirees' replacement rate decreases, while that of low and middle-educated agents increases. For the UK, the simulations results obtained using a model with intrageneration heterogeneity differ in magnitude from those provided in Section 4.2 (Table 5). When we account for the different role that the pension system plays for low and high educated agents – with high-educated individuals being able to contract out of the second tier – the political equilibrium contribution rate in the year 2050 steady state is larger (see Tables 5 and 8). A change in the design of the system, aimed at providing more income security to low-income retirees, modifies the political supports among the voters and leads to a large system.

The different results in terms of political sustainability of these two reforms, with the possible long-run retrenching of the Italian system and the expected increase in the size of British system, suggest that the existence of a Beveridgean or of a Bismarckian scheme may play a role in the long-term development of the social security system. In fact, Bonoli (2000) argues that reforms typically induce a polarization in the characteristics of the system, with Bismarckian schemes becoming less redistributive; while a Beveridgean system exacerbates their redistributive component. This issue is addressed in the next section.

5.2. Bismarckian versus Beveridgean systems

Social security systems are very different in their degree of within-cohort redistribution. A synthetic measure of the intragenerational redistributive component is given by the difference among the replacement rates at different income levels. Since contributions are typically proportional to earnings, up to a ceiling, if the replacement rates are high for lower earners and decrease with income levels, the system redistributes within cohorts from high to low income individuals; whereas if replacement rates are constant across income classes, the system does not redistribute. Systems of the latter type are called 'Bismarckian', while the former are 'Beveridgean'. Table 9 suggests that Italy, France, Germany and Spain enjoy similar replacement rates across income levels, although low-income individuals have often an advantage: this makes their systems Bismarckian, while the Beveridgean systems of the UK and the US provide higher replacement rates for low earners.

Our analysis in Section 4 disregards the redistributive features of the Beveridgean schemes. By abstracting from possible differences among individuals of the same age, our simulations capture more closely the functioning of Bismarckian systems, as all individuals of the same age enjoy the same replacement rate. Some insights, however, may be gained by examining Beveridgean systems. With their flat pension benefits, Beveridgean systems target mainly low-income individuals, while managing to keep the social security contribution tax – hence the size of the system – relatively small,

Table 9. Bismarckian versus Beveridgean systems: main features

	France	Germany	Italy	Spain	UK	US
Replacement rate (low income) (%)	103	67	105	107	216	64
Replacement rate (medium income) (%)	83	72	84	87	61	54
Replacement rate (high income) (%)	74	75	79	85	51	32
Gini Index	32.7	30	27.3	32.5	36.1	40.8
Pension funds assets as % of GDP (1993)	3.4	5.8	1.2	2.2	79.4	n.a.
Total value of pension funds (US$ billions in 2000)	85	188	n.a.	n.a.	1256	n.a.

Source: Replacement rates: France, Italy, Spain and UK: Conde Ruiz and Profeta (2002); Germany and US: Disney and Johnson (2001). Gini Index: World Development Indicators, World Bank 2000; Pension funds: EC (1997).

as shown in Table 5. Low-income voters clearly support this redistributive programme. More interestingly, also high-income individuals may prefer this scheme, since they receive low pension benefits, but pay in low contributions. The low tax burden on earnings allows wealthy individuals to free up resources to be invested more profitably on the private market, as suggested by the massive use of the 'contracting out' option by the high-income individuals in the UK (see also Table 9, for data on the size of pension funds). Such Beveridgean systems may therefore benefit both low- and high-income individuals and, as suggested by Conde Ruiz and Profeta (2002), be supported in countries with large income inequality (see Table 9) by a voting coalition of the extremes.

How would the ageing process modify the social security system in an environment, which accounts for the different nature of the Beveridgean systems? Our previous simulations in Tables 5 and 7 suggest that ageing leads to higher contribution rates. Following Conde Ruiz and Profeta's (2002) line of reasoning, an increase in the size of the system may lead to a change in its degree of redistribution.[12] In particular, when faced with a larger tax burden, high-income individuals have less incentives to support a Beveridgean system, since the low flat benefit is now associated with higher contributions, and may thus shift their support in favour of a more Bismarckian scheme. Ageing would then induce an increase in the size of the system and a movement towards a more Bismarckian scheme.

5.3. Family ties

In the simulations of Section 4, we took the view that voting on social security contribution rates represents a joint family decision of husbands and wives. This assumption may need to be modified, however, in societies with strong family ties.

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[12] See Casamatta *et al.* (2000a, 2000b) for an analysis of the effect of the redistributive feature on the size of the system.

A recent study by CSIS and Watson Wyatt (2003) shows that in some countries a significant portion of elderly individuals live with adult children: 50% in Japan, 42% in Italy, and 40% in Spain. In contrast, less than 15% of the elderly live with their children in France, Germany, the UK and the US. This suggests that the citizens of south European countries often receive support from their parents in their late twenties or early thirties, ages when other European children have already become emancipated. Regardless of the reasons why some adult children fail to become independent, non-emancipated young individuals whose parents are net recipients from the welfare state indirectly benefit from it through the private transfers from their parents.[13]

Family ties may thus induce those among the young voters who are not emancipated and whose parents are pension recipients to vote in favour of a generous social security system. Brugiavini *et al.* (2003) indeed find a positive and significant effect of private within-household transfers on the voting intentions in favour of pensions of non-emancipated young individuals in Italian survey data, namely the Boeri *et al.* (2002) survey on attitudes toward welfare policies and Bank of Italy SHIW Survey on economic and household information.

Our theoretical framework did not distinguish between emancipated and non-emancipated youth. Were we to include this additional element of heterogeneity in the model, the results of our simulations in Section 4 (Tables 5 and 7) would certainly change. As for the case of income heterogeneity described in Section 5.1, the median voter would not coincide with median age's voter and a voting coalition between elderly and non-emancipated young would emerge to support the pension system. To the extent that these within-family intergenerational arrangements will survive in the next 50 years and that they are more common in the fastest ageing countries – such as Italy and Spain – we expect these family ties to amplify the impact of ageing on social security expenditure.

6. FUTURE RESEARCH AND REFORM DIRECTIONS

The simulations in Section 4 and the further discussion in Section 5 portray a grim picture. Ageing will largely raise social security contribution rates, as policy-makers' political accountability will increasingly depend on elderly voters, who are highly supportive of pension spending. Comparison of steady state political equilibria, however, indicates that postponing the retirement age strongly moderates the hike in the contribution rates. According to our simulations in Tables 5 and 7, on average, an

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[13] Late emancipation may be due to different factors, such as high youth unemployment and uncertainty about future income, housing market characteristics, and inability to borrow against future income (see Becker *et al.*, 2002; Brugiavini *et al.*, 2003; Fogli, 2000; Manacorda and Moretti, 2001). As suggested by Brugiavini *et al.* (2003), the existence of a generous welfare state may engender loss of competitiveness, which in turn reduces job opportunities among the young. In their voting behaviour, rational young individuals would have to trade off these opposite effects.

increase of one year of the effective retirement age is associated with a reduction in the steady state political equilibrium contribution rate of one and a half percentage points.

Will a majority of the voters be willing to support an increase of the retirement age? Our analysis does not address the political feasibility of such policy reforms, but a recent strand of literature has examined the motivations behind the introduction of early retirement provisions. The initial introduction of generous early retirement provisions in the late 1960s and in the 1970s represented the political response to labour market shocks, which affected the employment status of several elderly workers, but the crucial element for the political success of these schemes was their persistence. Continued support for these programmes was guaranteed by young and middle-aged workers, who expected to benefit from these early pathways out of the labour marker later in their working career. According to Conde-Ruiz and Galasso (2003a, 2003b), an increase in the effective retirement age would amount to break this implicit intergenerational contract, and would therefore be opposed by perspective and current early retirees. The experience of some recent pension reforms – that occurred in Germany (1992), Italy (1992, 1995 and 1997), Spain (1997), and in the UK (1995) – aimed at removing the incentives to retire early, seems to support this view. These reform measures have been introduced with long phase-in periods, which avoid current elderly workers to retire according to the new, more stringent rules. As a result, in these countries, the effective retirement age has not significantly increased. Whether these legislated policy measures will actually be carried out in the future, when the ageing process turns more dramatic, and the pivotal political individual becomes older, it remains to be seen. As suggested by Cremer and Pestieau (2003) and Conde-Ruiz *et al.* (2003), new trade-offs may arise due to the ageing process, as future voters may find that an increase in the average effective retirement age is more efficient to retain the generosity of the pension benefits than further hikes in the contribution rates. Along these lines, further research should be devoted to provide a quantitative analysis of the joint political determination of social security contribution rate and retirement age.[14]

Our analysis suggests that the large impact of ageing on pension spending is due to the political accountability of the policy-makers. Office-seeking policy-makers choose the pension policy that pleases a majority of the voters – the median voter – in order to be re-elected. An ageing society thus leads to large increases in pension spending. In this scenario, the delegation of pension policies to a supranational institution may relax these political accountability constraints.

A shift of the political decision burden to the European Union might exploit the deficit of democratic representation enjoyed by the EU institutions and in particular by the European Commission which, unlike the European Parliament, is not directly accountable to voters and need not be composed of political representatives, although

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[14] See Profeta (2002b), for an analysis of the joint determination of the size of the social security system and of the retirement rule, within the context of a probabilistic voting model, but with no population ageing.

political career concerns clearly apply to single commissioners. On the one hand, the Commission may give voice and political weight to young or unborn individuals who do not vote, but who will be asked to foot the bill tomorrow. On the other hand, national policy-makers, acting to meet EU criteria on pension's financial sustainability, could blame the Europe for unpopular reforms, and thus be more willing to undertake reforms' measures, such as postponing retirement age, as they would bear a lower political cost among the losers from the reform. Pension reforms aimed at reducing large PAYG systems, however, unavoidably need to impose losses on some classes of individuals. Further studies may provide normative guidelines on a system of checks and balances meant to enhance the feasibility of such loss allocation through policy delegation.

Discussion

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The nightmare pensions scenario is rehearsed regularly in the popular media. It starts with the indisputable observation of an ageing population and concludes that, given the lower contribution revenues from smaller younger generations, pensions will have to fall. If this is the end of the story then the study of pensions should be confined to actuaries and demographers. What do economists have to say? This paper takes seriously the point that taxes are endogenous. In particular, the generosity of the pension system depends on the voting behaviour of those who benefit or stand to benefit from pensions. This seems to me an important contribution.

Broadly there are two opposing effects. First is the economic effect, namely that the system tends to get smaller as older populations cannot rely on the funding by the smaller groups of young people. Second is the political effect, namely that the system tends to get larger as an increased fraction of elderly people raise the median voter's age and so makes them more likely to vote for higher pensions. Which effect wins? A calibrated overlapping generations model with endogenous voting behaviour suggests that, under a range of different circumstances, the political effect dominates so that pension systems in fact become bigger. This is set out in Table 5. In Italy for example, with a current median voter age of 44, the simulated social security contribution rate is 38% in 2000. In 2050, with a median voter age of 56, the model suggests that the social security contribution rate should be 50%. The intuition of this is neatly illustrated in Table 6. The Italian contribution rate would fall by 1.5% between 2000 and 2050 if the median voter were 44 in both years. But since the median voter will in fact be 56 by 2050, the contribution rate increases by 13.5%.

Along the way the paper has a nice discussion of the different types of pension systems and pension reforms. One wonders whether this model can predict past

reforms, as a useful cross-check on its ability to predict future reforms. When the UK government abolished the State Earnings Related Pension scheme, for example, it was widely seen as reneging the promises of past governments. Since politicians may have obvious incentives to renege on such past promises, it would be nice to know how the model deals with such reforms.

The authors realize that the devil is in the detail and subject the basic simulation to a number of sensible robustness checks. I only have a few comments that might be directions for future study.

First, on productivity growth. Compounding implies that even small changes in productivity growth rates can have large effects on income changes over a couple of decades. The productivity growth rates chosen are all about 1.8% in Box 1, but given the possible relevance of 'New Economy' phenomena, it would be interesting to see what happens to the equilibrium at somewhat higher growth rates.

Second, I did wonder about the implications of bequests, which may well affect incentives for future old generations to choose high pensions for themselves and high tax rates for younger generations. The model in Appendix A supposes that individuals in each age and education class only draw utility from their own consumption, and that their assets accrue to individuals with same age and education level upon their death. I wonder whether a similar model could incorporate bequests to children and study the effects of this on household decision-making (and formation and dissolution), and on voting. Similarly, I found the discussion of differences between economies where children live longer with their families interesting. But such behaviour is of course endogenous. Might we see more of it as richer older generations vote themselves higher taxes from the young? This could of course affect the outcomes of the model.

It would also seem important to explore further the key voting-system mechanism. An obvious issue is endogenous participation by voters of different ages. There has in the UK, for example, been a collapse in the voting participation of the young. What are the consequences of this? Would making voting compulsory (as in Australia and other countries) be a good idea? And while the median voter model implies that large constituencies are more powerful, an interest-group approach would imply that small groups that are cheaper to subsidize can more easily draw a disproportionate share of resources. And reasons why every young generation doesn't simply vote to renege on past generations' commitment to the old also deserve more study.

Further, Table 6's many simulated contribution rates in the 30% range could usefully be put in context: alongside contributions to health and other public services, what sort of overall tax rates would this imply? Finally, the notion of delegating pension policy to Europe is not discussed as clearly as one would like. The paper notes that such delegation is appealing to domestic politicians, because the EU can take the unpopular decision not to raise pension contributions despite the wishes of increasingly numerous elderly voters. But since policies that raise contributions are the endogenous outcome of voting behaviour in the model, they are presumably popular, and delegation should be unpopular.

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Retirees finance their consumption with the return to productive assets or capital accumulated during their working years, and also by extracting resources from those that are still working. In this interesting paper, Galasso and Profeta equate this second source of old age consumption with social security and ask how the ageing of the population will affect its size. The result is somewhat surprising and even counter-intuitive. Despite the increasing costs of making transfers from a shrinking pool of young workers to an expanding class of old retirees, the authors predict the social security system will increase. The reason is that the increase in the size of the old will be translated in increased political power and this is enough to force larger social security systems on the young. In this brief discussion, I want to expand on a couple of related points that I find important.

The first one is that the effects of ageing on the size of social security systems depend on why the population is becoming older. Assume that ageing is mostly due to increase in life expectancy. Unless this increase is matched by a proportional increase in retirement age, ageing increases the retirement period relative to the working period and this means that the value of old age consumption increases. Assuming that the returns to capital and social security remain constant, this would be enough to induce an increase in the size of the social security system. But the returns to capital and social security are likely to be affected.[15] While the return to capital is likely to decline as the capital stock grows due to diminishing returns, the return to social security is likely to increase temporarily as the capital stock grows. This change in relative returns should induce a further increase in the size of the social security system.

Assume instead that ageing is mostly due to a reduction in fertility. In this case, ageing does not affect the relative size of the retirement and working periods and does not increase the value of old age consumption. Ageing simply reduces the number of young relative to old and, as a result, it lowers savings and the capital stock. Assuming that the return to capital and social security remain constant, this would lead to a reduction in the size of the social security system. But a reduction in the fertility rate lowers the growth rate of the economy and this should lead to a further reduction in the size of the social security system.

As these two examples show, it is crucial therefore to determine the reason for ageing before making predictions about its effects. Although the paper does mention both possibilities, it ends up focusing almost exclusively on ageing caused by an increase in life expectancy. The implicit assumption is that the current decline in fertility rates is mostly transitory and we need not pay too much attention to it. This

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[15] Remember the return to social security is roughly equal to the growth rate of the economy.

might end up being true, but assuming this definitely stacks the cards against finding a reduction in the size of the social security system.

A second and final point I want to make is that social security is not the only way through which the old can extract resources form the young. It is evident that there are many other forms of government interventions (spending and tax rules, regulations of many sorts) that have the effect of shifting resources from the young to the old. It is less evident but also true that government debt and stock market bubbles also transfer resources from young to old, very much in the same way that social security systems do. Once this is realized, it becomes clear that all the discussion above (and the paper as well) is not really about social security. It is instead about a comparison between using capital or young-to-old transfers to finance old age consumption. Social security is only one among many ways of effecting young-to-old transfers. What is the interaction between social security and other forms of young-to-old transfers? What determines the composition of these transfers? Is it possible that, even as the aggregate value of these transfers increase, social security declines? These are important questions that remain open.

Panel discussion

Richard Disney noted that the payroll contribution rates delivered by the paper's politico-economic equilibrium are, implausibly, even higher than those implied by the ageing process's actuarial effects. He complimented the authors' political economy approach to issues hitherto mostly studied from actuarial perspectives, but wondered whether people are sufficiently rational to correctly predict their expected benefits and vote accordingly. Survey evidence indicates that individuals tend to underestimate their expected benefits, while they might expect further benefits increases if the political economic mechanism of the paper is at work. To the extent that voters are rational, they might well consider more complex intergenerational trade-offs; for example, young people might be willing to support higher pensions if they are accompanied by more child-care benefits.

Tito Boeri raised the issue of whether endogenous labour market responses should not also allow retirement ages to respond to economic incentives and, more generally, view labour supply in forward-looking rather than static relation to taxes. He remarked that citizens' preferences as elicited by surveys conform well to the model assumptions in general, but that age-productivity profiles would deserve to be modelled more carefully than in the paper.

Several panellists questioned aspects of the model's calibration. Marcel Thum thought the rates of return assumed in the analysis were perhaps unrealistically high. He suggested that the burden imposed by ageing over an individual's lifetime may be measured better by implicit tax rates, which also depends on the size of contributions,

than by return rate. Karen Helene Middlefart Knarvik inquired about the assumptions regarding fertility rates, and wondered whether and how increasing female participation in the labour market should be taken into account. Fiona Scott-Morton agreed, and pointed out that high contribution rates exert a particularly negative influence on women's participation rates.

Marco Ottaviani also felt a need for more detailed empirical support of the assumptions underlying the simulation experiments, and wondered whether simulations of the type performed in the paper might explain past policy developments. Tullio Jappelli thought they might not fit those experiences well: while ageing is a gradual process common to most countries, reforms are occasional and diverse across countries. Stijn Claessens asked whether the paper's representation of steady-state politics may be inadequate to represent the processes leading to actual reforms, which are likely to be more or less forward-looking than those represented in the simulations. Georges de Ménil considers the lack of predictive power regarding the historic path of pension reforms as unproblematic for the model, which represents political pressures rather than of political processes.

Vincenzo Galasso replied that the model is not meant to study reforms and transitions towards the new steady state. In the steady states characterized by the simulations, however, voters do vote rationally in forward-looking fashion. And the political tensions that the model is indeed meant to represent do qualitatively fit past reforms triggered by exogenous shocks. For example, the Italian reforms were triggered by the fiscal crisis of the early 1990s, and were largely shaped by the political powers of different age groups.

Jappelli also questioned some of the specific assumptions of the model, such as allowance for different utility parameters across countries. He remarked that in many countries (and especially in Italy) pension systems are different for the self-employed, so that reforms may receive different support from them than from dependent employees. Riccardo Faini suggested that other political lobbies may take position on the relevant issues: in particular, employers are generally in favour of lower contribution rates, but resist delaying the retirement age. Ludger Schuknecht and Sandro Momigliano pointed out that, while assuming that prior contributions are irrelevant 'sunk costs' is technically correct, the rights of elderly workers (and in particular of retirees, whose pensions are untouchable) appear to carry considerable weight in real-life political processes.

APPENDIX A: THE MODEL

This appendix provides the technical details of the model. We describe the agents' utility function and budget constraints, the production function and the equilibrium conditions in the factor markets. Since agents may differ according to age and education, it is useful to use subscripts to indicate calendar date and superscripts to refer respectively to the agent's birth period and education level; hence, $c_{t+j}^{t,q}$ will denote the consumption at time $t + j$ of an

individual born at time t with education level q. Notice that, in Section 4, we do not differentiate by education group, $q = 1$, while different education groups are introduced to deal with intragenerational redistribution in Section 5.

Preference

Agents' preferences over lifetime consumption (see Section 4.2), or over consumption and leisure (see Section 4.3), are described by the following expected utility function:

$$\sum_{j=0}^{G} \beta^j \left[\prod_{i=0}^{j} \pi_t^{i,q} \right] U(c_{t+j}^{t,q}) \quad \begin{array}{l} \forall j = 0, \ldots, G; \\ \forall q = 1, \ldots, Q. \end{array} \tag{A1}$$

where c is consumption, β is the individual discount rate, and $\pi_t^{i,q}$ is the individual probability of surviving until the next period.

Agents are assumed to exhibit a constant degree of risk aversion. In the model with exogenous labour supply (Section 4.2), the utility function is:

$$U(c_{t+j}^{t,q}) = \frac{(c_{t+j}^{t,q})^{1-\rho} - 1}{1 - \rho} \tag{A2}$$

where ρ indicates the coefficient of relative risk aversion, while in the model with endogenous labour supply (Section 4.3), we have:

$$U(c_{t+j}^{t,q}) = \frac{[(c_{t+j}^{t,q})^{\alpha}(l_{t+j}^{t,q})^{1-\alpha}]^{1-\rho} - 1}{1 - \rho} \tag{A3}$$

where l is leisure and α represents the relative importance of consumption with respect to leisure.

Budget constraint

Every period, agents face the following budget constraint:

$$c_{t+j}^{t,q} + a_{t+j+1}^{t,q} = a_{t+j}^{t,q} R_{t+j} + y_{t+j}^{t,q} + H_{t+j}^{t,q} \quad \begin{array}{l} \forall j = 0, \ldots, G; \\ \forall q = 1, \ldots, Q. \end{array} \tag{A4}$$

where $a_{t+j+1}^{t,q}$ represents the end-of-period accumulated wealth, $y_{t+j}^{t,q}$ is the disposable income at time $t + j$, and R_{t+j} the interest factor on private wealth. Those individuals who do not survive until the next period leave an involuntary bequest $H_{t+j}^{t,q} = (1 - \pi_{t+j-1}^{q})a_{t+j}^{t,q} R_{t+j}/\pi_{t+j-1}^{q}$, which is divided among all living individuals with the same characteristics.[16]

Net disposable labour income is given by the following expressions, respectively for workers and retirees:

$$y_{t+j}^{t,q} = \varepsilon_{t+j}^{t,q} \cdot h_{t+j}^{t,q} \cdot w_{t+j}(1 - \tau_{t+j}) \qquad \begin{aligned} &\forall j = s^q, \ldots, \mathcal{J}^q - 1; \\ &\forall q = 1, \ldots, Q. \end{aligned}$$

$$y_{t+j}^{t,q} = P_{t+j}^q \qquad\qquad\qquad\qquad\qquad \begin{aligned} &\forall j = \mathcal{J}^q, \ldots, G; \\ &\forall q = 1, \ldots, Q. \end{aligned} \tag{A5}$$

where w_{t+j} indicates wage per efficiency unit, $\varepsilon_{t+j}^{j,q}$ is a measure of labour efficiency unit, s_q is the initial age at which agents in the education class q begin their working career and τ_{t+j} and P_{t+j}^q represent respectively the contribution rate to social security and the (annuity) pension benefit to be paid to the group q retirees. Moreover, in the exogenous labour supply model, h represents the number of worked hours, while in the endogenous labour supply specification $h_{t+j}^{t,q} = 1 - l_{t+j}^{t,q}$ is chosen by the agents.

Technology

In the economy, there exists a constant return to scale production function:

$$Q_t = f[n_t \cdot (1 + \lambda)^t, k_t] = b \cdot k_t^{\theta} \cdot [n_t \cdot (1 + \lambda)^t]^{1-\theta} \tag{A6}$$

where λ is the growth rate of labour productivity, n is a measure of per capita unit of labour measured in efficiency units, k denotes per capita stock of capital, b is a total factor productivity index and θ is the factor share to capital.

In the exogenous labour supply model of Section 4.2, the labour supply in efficiency units is determined by the sum of the share of workers of any age and education level, $\mu_t^{i,q}$, multiplied by the correspondent human capital coefficient and by the (exogenous) average number of worked hours:

$$n_t = h \sum_{i=1}^{\mathcal{J}^{q-1}} \sum_{q=1}^{Q} \varepsilon_t^{i,q} \mu_t^{i,q} \tag{A7}$$

In the endogenous labour supply model (Section 4.3), the average number of worked hours is endogenous, and hence we have:

$$n_t = \sum_{i=1}^{\mathcal{J}^{q-1}} \sum_{q=1}^{Q} (1 - l_t^{t-i,q}) \varepsilon_t^{i,q} \mu_t^{i,q} \tag{A8}$$

Aggregate capital stock in the economy is obtained aggregating individual net saving over education classes and generations:

$$k_t = \sum_{i=1}^{G} \sum_{q=1}^{Q} \frac{\mu_t^{i,q} a_t^{t-i,q}}{1 + n} \tag{A9}$$

Optimizing conditions for agents and firms, and equilibrium conditions in factor markets determine the usual expression for hourly wage, w_t, and rate of return on capital, r_t:

$$w_t = f_1[n_t \cdot (1 + \lambda)^t, k_t]$$

$$R_t = 1 + r_t = f_2[n_t \cdot (1 + \lambda)^t, k_t] + 1 - \delta \tag{A10}$$

where δ is the parameter of the physical depreciation rate in the economy and subscripts denote the partial derivatives with respect to the relevant variable.

Pension systems

We examine unfunded pension systems. At any time t, every agent contributes a fraction τ_t of her labour income; hence, total contributions depend on the tax rate τ_t and on the retirement age $\mathcal{J}^q$:

$$T_t(\tau_t, \mathcal{J}^q) = \tau_t \sum_{q=1}^{Q} \sum_{j=1}^{\mathcal{J}^q} \mu_t^{j,q} \varepsilon_t^{t-j,q} h_t^{t-j,q} w_t^j \tag{A11}$$

Under budget balance, the total amount of pensions to be paid to retirees is equal to the aggregate contributions paid by current workers:

$$T_t(\tau_t, \mathcal{J}^q) = \sum_{q=1}^{Q} \sum_{j=1}^{\mathcal{J}^q} P_t^{j,q} \mu_t^{j,q} \tag{A12}$$

where $P_t^{j,q}$ is the pension benefit. Notice that, if – as in Section 4 – individuals only differ by age, they all retire at the same time and receive the same pension.

As shown in Table 2, countries differ according to the pension indexation. In a system such as Italy before the reforms or Germany, where pension benefits are indexed to aggregate productivity (real wage) growth, λ, we have $P_{t+1}^{j,q} = P_t^{j,q}(1 + \lambda_t)$; whereas if pension benefits are only indexed to inflation, we have $P_{t+1}^{j,q} = P_t^{j,q}$.

Pensions in Italy and the UK

In Section 5, in the case of Italy and the UK, individuals differ by age and education, we hence need to fully characterize the pension benefit formulas.

Italy

Pre and post reform regimes differ in the computational criteria, in the retirement age and in the pension indexation (see Table 3). In the system prevailing before the Amato reform, pension benefits were computed as the product between the average wage in the last 5 years before retirement $\bar{w}_t^q$, the number of years of contributions to the system, v_t^q, and a coefficient, α, which translated the number of contributions years into a replacement ratio:

$$P_t^{\mathcal{J}^q,q} = \alpha v_t^q \bar{w}_t^q \tag{A13}$$

where q is the agent's education level and $\mathcal{J}^q$ her retirement age. Pension benefits were indexed to aggregate productivity (real wage) growth.

After the Dini reform, pension benefits are computed according to a notional defined contribution system, yet the system remains unfunded. The agent's contributions to the system, that represent a constant fraction of the labour income, are capitalized at an annual rate, g, and – at retirement age – are transformed into an annuity according to a conversion coefficient, γ, which depends on the residual life expectancy at retirement and on the actual retirement age:

$$P_t^{\mathcal{J}^q,q} = \gamma \sum_{i=s^q}^{\mathcal{J}^q-1} (1 + g)^{\mathcal{J}^q-i} w_{t-\mathcal{J}^q-i}^{q,i} \tau_{t-\mathcal{J}^q-i} \tag{A14}$$

where s^q is the initial period in the working career of an agent of education q. Moreover, after the Amato reform, pension benefits are only indexed to inflation.

It is important to notice that in our politico-economic model, voters determine the pension tax rate, τ, and, because of the budget balance, the conversion coefficients: α, in the pre reforms system, and γ, after the Dini reform.

UK

The Welfare Reform and Pension Act replaced the SERPS with a new programme (S2P), while leaving the Basic State Pension (BSP) untouched. The pension benefits for these three programmes are calculated as follows. For the BSP:

$$P_B^{q,t} = (\tilde{w}_t \mathcal{N}_q)/44 \tag{A15}$$

where $\tilde{w}_t$ is a threshold (the lower earning limit, LEL) and $\mathcal{N}_q$ is the number of years of contributions of a type-q retiree at time t (i.e., the number of years during which the earnings were above the secondary threshold, ST). For the SERPS benefit, we have:

$$P_S^{q,t} = \alpha \left(\sum_{i=s^q}^{J^{q-1}} (w_{t-J^q-i}^{q,i} - \tilde{w}_{t-J^q-i}) \right) / \mathcal{N}_q \tag{A16}$$

where α is a conversion coefficient equal to 25% and $w_{t-J^q-i}^{q,i}$ is between the lower (LEL) and the upper earning limit (UEL). For the S2P, the benefits are calculated as follows:

$$P_P^{q,t} = \gamma \left(\sum_{i=s^q}^{J^{q-1}} (w_{t-J^q-i}^{q,i} - \tilde{w}_{t-J^q-i}) \right) / \mathcal{N}_q \text{ with } \gamma = \begin{cases} 40\% & for & w_{t-J^q-i}^{q,i} \in [LEL, LET] \\ 10\% & for & w_{t-J^q-i}^{q,i} \in [LET, SET] \\ 20\% & for & w_{t-J^q-i}^{q,i} \in [SET, UET] \end{cases} \tag{A17}$$

Finally, recall that individuals who 'contract out' have their contribution rates reduced, however, they do not receive any SERPS or S2P benefits.

APPENDIX B: DATA SOURCES

This appendix gives the sources of the demographic, economic and political data used throughout the paper, as well as the source of information on the structure and the reforms of the social security systems.

Demographics

The actual and forecasted life expectancy at birth for all countries (Table 1) is taken from OECD (2002), 'Health Data' and from EC – Economic Policy Committee (2000). The actual and the forecasted structure of the population by age, for the percentage of elderly in the population (Figure 1) and the old age dependency ratio (Figure 2), have been obtained for the European countries from the Eurostat Data shop (Population projections version v.1999 DE base) and for the US online from the US Census Bureau at www.census.gov. For the European countries, the 2050 expected old age dependency ratio are taken from the EC – Economic

Policy Committee (2000). The latest survival probabilities by age have been obtained from the national statistical institutes, which, in the case of France and the US, provide also projections on survival probabilities by age for the year 2050. For all other countries, we use the methodology described in the calibration box.

Labour market

For the European countries, the average employment rate by age is calculated using European Commission Household Panel (ECHP) data, while for the US, we use the Bureau of Labour Statistics 'Employment and Earnings'. Analogously, the wage rates by age – needed to construct the labour efficiency unit profile by age – are obtained from ECHP data for the European countries, and from US Census Bureau 'Current Population Report' for the US. The working histories by education (Section 5.1) are calculated from ECHP for the UK and from the Bank of Italy Household Panel for Italy. Information on male retirement age in the 1990s and in the 1950s is taken from ILO data (Latulippe, 1996). Data on effective retirement age for the year 2000 are obtained from the Bank of Italy Household Panel for Italy (for 1992), from EC (2003) joint report for France, Germany, Spain and the UK, and from Gruber and Wise (1999) for the US.

Political and economic data

In the calculation of the median age among voters, we include the election's turnout rates by age, taken from IDEA (1999) 'Young Voters Participation' for European countries and from US Census Bureau 'Reported Voting and Registration' for the US. Regarding economic data, values of the average capital share are taken from national accounts. The long-term characteristics of each economy, as characterized by the capital-output ratio are taken from several sources: for France, Germany, the UK and the US from Maddison (1995); for Italy, from D'Amato and Galasso (2002); and for Spain, from Puch and Licandro (1997). Also the exogenous productivity growths, which are measured by the average per-capita GDP growth rate, are taken from different sources: the EC – Economic Policy Committee (2000) for the 1990s average value for France, Germany and the UK; D'Amato and Galasso (2002) for Italy; national accounts for Spain and Galasso (1999) for the US. In the simulations, we use the projections for the year 2050 in the EC – Economic Policy Committee (2000), while we keep the 1990s average value for the US.

Pension systems

Most of the information on the pension systems of the European countries is obtained from the SSA publication 'Social Security throughout the World' and from EC – Economic Policy Committee (2000); information on the US social security system can be obtained online from the US SSA website. Information on pension reforms are taken mainly from the EC – DG Employment and Social Affairs (2002) 'Social Protection in Europe 2001', from Economic Policy Committee (2002) 'Reform Challenges Facing Public Pension System' and from a Rodolfo De Benedetti report (2000) 'Monitoring Slow Pension Reforms in Europe'; information on the 2003 Fillon reform in France was obtained at www.ladocumentationfrancaise.fr.

REFERENCES

Abel, A.B. (1989). 'Assessing dynamic efficiency: theory and evidence', *Review of Economic Studies*.

Azariadis, C. and V. Galasso (2002). 'Fiscal constitutions', *Journal of Economic Theory*.

Bank of Italy (1995). *Household Panel Survey on Consumption and Wealth*.

Becker, S.O., S. Bentolila, A. Fernandes and A. Ichino (2002). 'Job insecurity and children's emancipation: the Italian puzzle', mimeo.

Boeri, T., A. Börsch-Supan and G. Tabellini (2002). 'Pension reforms and the opinions of European citizens', *American Economic Review*.

Boldrin, M. and A. Rustichini (2000). 'Political equilibria with social security', *Review of Economic Dynamics*.

Bonoli, G. (2000). *The Politics of Pension Reform*, Cambridge University Press, Cambridge.

Blöndal, S. and S. Scarpetta (1998). 'The retirement cecision in OECD Countries', OECD Working Paper AWP 1.4.

Browning, E. (1975). 'Why the social insurance budget is too large in a democracy', *Economic Inquiry*.

Brugiavini, A., J.I. Conde-Ruiz and V. Galasso (2003). 'Social security, private transfers and voting behaviour: the Italian case', in *Annual Report on Monitoring Italy*, ISAE, Rome.

Brugiavini, A. and V. Galasso (2003). 'The social security reform process in Italy: where do we stand?', University of Michigan Retirement Research Center Working Paper 2003-052.

Casamatta, G., H. Cremer and P. Pestieau (2000a). 'The political economy of social security', *Scandinavian Journal of Economics*.

— (2000b). 'Political sustainability and the design of social insurance', *Journal of Public Economics*.

Conde-Ruiz, J.I. and V. Galasso (2003a). 'Early retirement', *Review of Economic Dynamics*.

— (2003b). 'The macroeconomics of early retirement', forthcoming *Journal of Public Economics*.

Conde-Ruiz, J.I., V. Galasso and P. Profeta (2003). 'Economic development, aging and retirement decisions', mimeo.

Conde-Ruiz, J.I. and P. Profeta (2002). 'What social security: Beveridgean or Bismarckian?', Working Paper, Universitat Pompeu Fabra.

Cooley, T.F. and E.C. Prescott (1995). 'Economic growth and business cycle', in T.F. Cooley (ed.), *Frontiers of Business Cycle Research*, Princeton University Press, Princeton, NJ.

Cooley, T.F. and J. Soares (1999). 'A positive theory of social security based on reputation', *Journal of Political Economy*.

Costa, D. (1998). *The Evolution of Retirement*, University of Chicago Press, Chicago.

Cremer, H. and P. Pestieau (2000). 'Reforming our pension system: is it a demographic, financial or political problem?' *European Economic Review*.

— (2003). 'The double dividend of postponing retirement', *International Tax and Public Finance*.

CSIS and Watson Wyatt (2003). *The 2003 Aging Vulnerability Index*, Washington.

D'Amato, M. and V. Galasso (2002). 'Assessing the political sustainability of parametric social security reforms: the case of Italy', *Giornale degli Economisti e Annali di Economia*.

Disney, R. (2003). 'Are contributions to public pension programmes a tax?' presented at the 38th Panel Meeting of *Economic Policy*.

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

European Commission (1997). 'Supplementary pension in the single market' A Green Paper.

— (2000). 'Progress report to the Ecofin Council on the impact of ageing populations on public pension systems', Economic Policy Committee.

— (2002). 'Social security in Europe, 2001', DG Employment and Social Affairs.

— (2003). 'Joint report by the Commission and the Council on adequate and sustainable pensions'.

European Commission Household Panel. Wave 1993, 1994, 1995, 1996.

Eurostat 'Population projections version v.1999 DE base'.

Feldstein, M. and J.B. Liebman (2002). 'Social security', in A.J. Auerbach and M. Feldstein (eds), *Handbook of Public Economics*, North-Holland, Amsterdam.

Fogli, A. (2000). 'Endogenous market rigidities and family ties', mimeo, New York University.

Fondazione Rodolfo de Benedetti Report (2000). 'Monitoring slow pension reforms in Europe'.

Galasso, V. (1999). 'The US social security: what does political sustainability imply?' *Review of Economic Dynamics*.

— (2002). 'Social security: a financial appraisal for the median voter', *Social Security Bulletin*.

Galasso, V. and P. Profeta (2002). 'Political economy models of social security: a survey', *European Journal of Political Economy*.

Gruber, J. and Wise, D. (eds) (1999). *Social Security and Retirement around the World*, University of Chicago Press, Chicago.

IDEA (1999). *Young Voters Participation*. Stockholm.

Latulippe, D. (1996). 'Effective retirement age and duration of retirement in the industrial countries between 1950 and 1990', ILO Issues in Social Protection Discussion Paper No. 2.

Lindbeck, A. and M. Persson (2003). 'The gains from pension reform', *Journal of Economic Literature*.

Maddison, A. (1995). *Monitoring the World, 1820–1992*, OECD, Paris.

Manacorda, M. and E. Moretti (2002). 'Intergenerational transfers and household structure: why do most Italian youths live with their parents?', mimeo, LSE, London.

Mulligan, C.B. and X. Sala-i-Martin (1999). 'Gerontocracy, retirement and social security', NBER Working Paper No. 7117.

OECD, 'Health Data'.

OECD (2002). 'Policies for an aging society: recent measures and areas for further reforms', Working Paper No.1 on Macroeconomic and Structural Policy Analysis.

Philipson, T. and G. Becker (1998). 'Old-age longevity and mortality-contingent claims', *Journal of Political Economy*.

Puch, L. and O. Licandro (1997). 'Are there any special features in the Spanish business cycle?' *Investigaciones Economicas*.

Profeta, P. (2002a). 'Aging and retirement: Evidence across Countries', *International Tax and Public Finance*.

— (2002b). 'Retirement and social security in a probabilistic voting model', *International Tax and Public Finance*.

Sjoblom, K. (1985). 'Voting for social security', *Public Choice* 45, 225–40.

Tabellini, G. (2000). 'A positive theory of social security', *Scandinavian Journal of Economics*, 102, 523–45.

US Bureau of Labour Statistics, 'Employment and Earnings'.

US Census Bureau, 'US Population' at www.census.gov.

US Census Bureau, 'Current population report'.

US Census Bureau, 'Reported voting and registration'.

US Social Security Administration (1999). 'Social Security throughout the World'.

US Social Security Administration. Data available at www.ssa.gov