THE POLITICAL ECONOMY OF RETIREMENT AND SOCIAL SECURITY

Ph.D. Thesis

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The Political Economy of Retirement and Social Security

by

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Abstract

(i) Why there exist social security programs which transfer resources from young and middle-aged workers to the elderly? (ii) Why are the current social security programs always associated with retirement? What are the economic and political interactions between social security and retirement? (iii) What is the impact of the aging process on retirement and social security? (iv) What do empirical evidence suggest about the relevance of the demographic dynamics as a determinant of retirement and social security around the world?

This thesis contributes to shed some light on these questions, in a politico-economic environment.

First, it examines the state of the art, and reviews the main contributions in the literature of politico-economic models of social security.

Second, it focuses on the political elements that relate retirement and social security. Using a probabilistic voting approach, it analyzes why old people retire and receive pension transfers from the young. A crucial hypothesis is that leisure in old age represents a "merit good", i.e., a good that is positively valued by all agents in the society (young and old). This is a new approach, which can be applied to many public programs, as the thesis emphasizes. Since old age leisure is a "merit good", the young induce the politicians to set a positive tax on the labor income of the old, which induces them to retire. Retirement increases the level of ideological homogeneity of the old group. In fact, once retired, the elderly are more "single-minded", since they only care about redistributive issues, i.e., pensions. This increases their political power and therefore allows them to receive a positive transfer from the young (social security).

Third, the thesis analyzes the equilibrium level of retirement and social security in a dynamic economic and demographic environment. In an overlapping generations model with interest groups social security is derived by the interaction of the two groups of agents, young and old, which differ in size, wage and persistence. The model investigates the political solution which is likely to arise as the fraction of elderly in the population increases. I highlight two main effects. The more elderly in the economy, the more political power they will have (size effect). On the other hand, the dependency ratio increases and they will have to share a given amount of resources among more people (per capita effect). The interest group model suggests that this second effect induces the agents to decrease their use of the retirement provision. The overall impact of aging on the social security size is therefore ambiguous, since the positive direct effect due to more political power is compensated by the reduction in retirement, which induces lower pension transfers.

Fourth, the thesis provides new evidence on the determinants of the retirement level and the size of social security programs around the world. A new large data set collecting cross-country informations about demographics, retirement and social security is built. The results provides empirical support for the implications of the theory. In more aged populations, both retirement level and social security expenditures decrease after a large increase of the proportion of old in the population. The data suggest that these relations may be hump-shaped, due to the existence of opposite size and per capita effects.

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Contents

Chapter 1

Introduction

In almost every country in the world, there exist fiscal policies involving income redistribution, typically from young to old cohorts of the population. Unfunded social security systems represent the main instrument of intergenerational redistribution. A major feature common to virtually all these social security programs is the contemporaneous existence of social security and retirement. The elderly are forced, or sometimes induced, to exit the labor market and retire in order to collect their old age pensions. But, *why is social security always associated with retirement?*

Another issue which has lately dominated the social security debate in most industrialized countries is the impact of the current demographic dynamics on the sustainability of these unfunded systems. As the population grows old, the ratio of retirees to workers rises (the dependency ratio), therefore creating serious distress to the current social security systems. *What will be the impact of the aging process on the current social security and retirement programs?*

This thesis takes up this twofold challenge in a politico-economic environment.

The contemporaneous existence of social security and retirement is examined in the context of a multidimensional majoritarian voting game. Since old age leisure is valued both by the elderly and by the young (it is a "merit good"), politicians adopt a policy which induces the old to retire. The reduction in their labor income increases the concern of the elderly for redistributive issues, i.e., it increases their "single-mindedness" and thereby, like in Mulligan and Sala-i-Martin (1999a) their political power. As a result, an intergenerational redistributive

policy which favors the elderly is adopted, i.e. social security.

The impact of the demographic dynamics on retirement and social security is analyzed within an interest groups model. An aging population induces two opposite effects. It increases the political power of the elderly (size effect), and it rises the dependency ratio, i.e. the proportion of retirees per workers (per capita effect). The model suggests that this second effect induces the agents to decrease their use of the retirement provision. The overall impact of aging on the social security size is therefore ambiguous, since the positive direct effect due to more political power is compensated by the reduction in retirement, which induces lower pension transfers. These testable implications are validated by the empirical evidence.

1.1 Why is Social Security Always Associated with Retirement?

The association between retirement and social security is well documented in the publication "Social Security Programs throughout the World" issued by the U.S. Social Security Administration. In every country in which a social security program is in place, there exists an official retirement age at which the elderly have to retire from the labor market and can start to receive their old-age pensions (See table 5.2 in the appendix of chapter 5). Moreover, the informations contained in this publication suggest that the majority of the programs induces retirement. In fact, as explained by Mulligan and Sala-i-Martin (1999a), the formulas to calculate the social security benefits implicitly include incentives to retire in 75% of the 73 countries for which this information is available. There are different criteria, for instance benefits in a given year at or after the earliest retirement age decline with labor income ("retirement" or "earnings test").

The first purpose of the thesis is to provide a positive answer to the association between retirement and social security and to analyze what are the economic and political elements that determine the existence of retirement and social security.

To appropriately address this question, I first review the previous contributions in this literature (chapter one). The survey shows that this question has received surprisingly little attention in theoretical studies, although there exist many empirical studies on retirement and social security[1]. Moreover, this association has proved to be a big puzzle for existing positive

[1] In particular, many empirical studies have recently analyzed how several government programs influence

theories of social security. On one hand, efficiency theories, that consider social security as the solution to some market inefficiencies can account for the existence, and for some features of the social security system, but are not able to explain its association with retirement. If social security is a saving plan for the old age (Diamond 1977), why are the old forced to retire in order to collect their savings? If social security is a longevity insurance (Hamermesh, 1987), why are the transfers contingent on retirement? If it is a retirement insurance, why are the transfers associated with retirement and not with disabilities, which make work impossible? If social security is welfare provision for the retirement aged (Cohen, 1972), why are the transfers contingent on retirement rather than on poverty? On the other hand, political theories suggest that there may exist political elements that force or induce the old to retire from the labor market in order to receive their pensions. The survey in chapter one focuses on this literature. Social security is determined as an equilibrium outcome of the aggregation of individual preferences according to different political mechanisms. The first mechanism is majoritarian voting. These theories can explain why social security arises as the political equilibrium of a voting game, but since they adopt a one-dimensional approach, they cannot address why the elderly, who turn out to win the election, have to tolerate implicit taxes or forced retirement. An alternative way to aggregate individual preferences into a policy outcome is based on interest groups. In this framework, Mulligan and Sala-i-Martin (1999a) show that social security is the result outcome of the political competition between two groups, old and young, both exerting political pressure to obtain a positive transfer from the other group. Since political pressure is time-intensive, the old are politically more successful (gerontocracy) due to their lower wages that induce them to retire and to spend more time in lobbying to obtain transfers from the young (social security). Moreover, their lower probability to switch to the other group (every young expects to become old, while the old have no probability to become young) reduces the

labor supply decisions and induce retirement. Gruber and Wise (1997) suggest that this is due not only to old-age benefits, but also to disabilities and unemployment programs that provide early retirement benefits even before the official early retirement age. Samwick (1998) estimates the combined effect of social security and pension benefits on the probability of retirement in a cross-section of the population near retirement age: he finds that the significant economic determinant of the probability of retirement is the accrual of retirement wealth due to continued work. Changes in pension coverage have a substantial effect on the probability of retirement: one fourth of the decline in the American labor force participation in the early postwar period can be attributed to the contemporaneous growth of pensions. Finally, Brugiavini (1997) shows that the Italian social security program provides strong incentives to retire early and that the age-implicit tax profile fits very closely the estimated hazards out of the labor force.

opposition of the young group. This model has several implications for the design of social security programs, and it is able to explain many of the observed features of social security. In a politico-economic environment this pressure groups model represents the first attempt to solve the puzzle of the association between retirement and social security. There are no contributions adopting a majoritarian voting approach. In fact, because of the multidimensionality of the problem, retirement and social security are the two dimensions that have to be explained, Nash equilibria of a majoritarian voting game generally fail to exist. The literature provides three possible modelling device to overcome this problem: the agenda-setting, the structure-induced equilibrium and probabilistic voting[2].

This thesis develops a probabilistic voting model to explain the association between retirement and social security (chapter two). In this framework voters care about policy outcomes, but they also have political or ideological preferences over the candidates. The result derives from the following intuition. Both young and old are assumed to value old-age leisure, this is, young generations care about the level of leisure of the old, which represents a "merit good". Since the old do not take into account that their choice of leisure produces an externality on welfare of the young, a corrective public policy is implemented, which increases the level of leisure of the old and introduces retirement. Once retired, the old are a more ideologically homogeneous group than the young. In fact, with no wage income, they mainly care about distributive issues, and their political interests are not dispersed among the different issues related to their various jobs. Since they are more ideologically homogeneous, the old are also more politically successful, and they manage to gain the intergenerational voting game against the young, i.e., they receive a positive social security transfer from the young.

The model relies on two new features, which represent two of the original contributions of this thesis. First, old age leisure is a "merit good", i.e., a good that provides positive utility to all members of the society, not only to the members who directly enjoy it. In a sense, the young are paternalistic towards the elderly, since they like the elderly to enjoy their "merited" old age leisure. This feature explains the introduction of a tax on the wage income of the old and therefore the mandatory retirement. This is the first attempt to introduce the merit goods in a political context to explain the existence of retirement. However, an application of this idea in

[2]See Persson and Tabellini (2000) for a review of this literature.

the context of redistributive policies can be found in the recent contribution by Mulligan and Philipson (1999). They argue that many programs which transfer resources to the poor in a specific way (such as health insurance, compulsory schooling and public housing) belong to the category of merit goods.

The second idea is that the degree of ideological homogeneity of voters of the same group is endogenous, and depends negatively on the wage income. This is meant to reflect the fact that when the individuals in a group have lower wage income, they are on average more united in their ideological preferences, that is, they concentrate their attention on few issues. In the limit, if they don't work, they only focus on a single issue: redistribution. To my knowledge, this is the first attempt to endogenize the degree of ideological homogeneity. Clearly, this idea is closely related to Mulligan and Sala-i-Martin's (1999a) "single-mindedness". While workers care about several opposite issues, according to their different occupations, ability levels etc., the non-workers are more united in their political action. The degree of ideological homogeneity of a group will in turn determine the political power of each group, with the more ideologically homogenous groups being the more politically successful.

Using a probabilistic voting approach, the model shows that, given the externality that the old age leisure has on the young (because of the merit goods motives), there exists a positive tax on old wage income, which induces the old to retire. Retirement increases their ideological homogeneity, and thus their political power, which allows them to obtain a positive transfer from the young (social security). To summarize, this represents the first voting model that derives the existence and association of social security transfers and retirement.

1.2 What will be the Impact of the Aging Process on the Current Social Security and Retirement Programs?

Not only the relationship between retirement and social security is a common feature of the current social security programs, but it is also a reference to assess the reforms of social security in a general framework. In this context, the major factor that has to be analyzed is the impact of the aging process on the current retirement and social security systems. An overview and some data about the relevance of this phenomenon and its relation with retirement and social

security will clarify why this is an important question.

In the last decades, the majority of OECD countries have experienced a substantial aging of their populations. From 1950 to 1980, the average proportion of individuals aged 65 and over in the OECD area has risen by more than 40%, primarily because of a long-term decline in fertility. Demographic projections by the OECD Secretariat forecast a decline in average annual growth rate of population and significant changes in age structure, as shown by table 1.1. Throughout the OECD area the proportions of individuals aged 65 and over in 2040 are projected to be appreciably higher than in mid-1980s. The period of most rapid growth will be the second and third decades of the next century when the elderly population of the OECD area as a whole is expected to increase at a rate of about 1,6 per cent per annum.

Changes in population age structure have important implications for the structure of the labor force. In the past 25 years, the number of people in pensionable age in the OECD countries has risen by 45 million, whereas the population of working age has increased by 120 million. However, the effect of declining fertility and the aging of the baby-boom generation will have particularly large implications for policy-makers in future. In the next 25 years in fact, the number of persons of pensionable age is expected to rise by a further 70 million, while the working-age population by only five million. Additionally, people are retiring earlier and living much longer. As shown by table 1.2, estimations by the OECD predict that the employment rate that has been growing until now will only continue to grow until about 2010 and will then start to fall. A reversal of trends towards early retirement would be one major way to keep the employment ratio from falling. Studies by OECD (1998) suggest that "active aging", the capacity of people, as they grow older, to lead productive lives in the society and economy, should be encouraged through a higher degree of flexibility in how individuals and families choose to spend their time over life (in working, learning, leisure and in care-giving) and especially through a more flexible work-retirement transition. Any reform in this direction should take into account that age is a major determinant of retirement decisions, which in turn play an important role for the labor force structure.

The aging of the populations is especially likely to increase the demand for pensions. Table 1.3 reports simulations by OECD (Rosevare and oth., 1996) illustrating the possible evolution of public pension schemes until 2070 for 20 countries. Demography is a dramatic challenge for

social security systems; the actual Pay-as-you-go systems will have serious financial problems to support a more aged population with a reduced working-age population. Although there are several differences among the pension systems in OECD countries, in almost all of them, reforms have already been introduced to prevent expenditure on public pensions from running ahead of receipts, and in most of them, further significant reforms will be needed in the future. However, the consequences of the aging trends will not only be financial, but also political: current changes in the age structure imply more political power of the elderly, and increase the support for their most preferred policies. Thus, reforms have become one of the most politically dangerous topic in the current debate on social security.

The aging process, common to all western countries, and the labor force participation trends suggest that the current conditions of the social security programs cannot be maintained for much longer, and reforms are needed. Will it consist of a transition from PAYG to fully funded scheme, or rather of a cut in the benefits or of an increase of retirement age? To answer this question it is necessary to assess the impact of the aging process on the political determinants of the social security programs. This is the second purpose of the thesis, which is developed in chapters four and five.

The thesis analyzes, both at a theoretical and empirical level, the existing relationship between the evolution of the population's age structure on one hand, and retirement and the size of social security on the other hand. Chapter four introduces an interest groups model in an overlapping generations economy, and derives social security from the political interaction of the two groups of agents, young and old, which differ in size, wage and persistence. This model investigates the political outcome which is likely to be adopted in this political environment as the fraction of population above retirement age increases.

To understand the results we have to take a step back, and explain the intuition in the simple case, in which there are no demographic changes. Like in Mulligan and Sala-i-Martin (1999a) consider a society composed of two groups, young and old, which compete by exerting political pressure. The group exerting more pressure wins the political competition and receives a transfer from the other group. Individuals in each group undertake a time-intensive political activity in favor of their group, which gets converted into the political pressure of the group, through a pressure function. This process gives typically rise to a free-rider problem, since

the benefits obtained by each agent depend on her group aggregate political activity, i.e., the pressure, rather than on her own individual effort. In this context, in which political pressure is time intensive, the free riding amounts to choose a lower level of leisure than the one that is optimal from the group's point of view. However, the group may introduce a corrective tax on wage income to induce the individuals to enjoy more leisure. Since the old have lower wages than the young, they will set on themselves a higher wage income tax than the young. As a consequence, the old will choose a higher level of leisure than the young and retirement arises. Once retired, the old can exert more political pressure than the young, and they are therefore successful to obtain the transfer from the young.

We can now analyze what happens to this political equilibrium with retirement and social security when the population above retirement age increases. This represents the main contribution of chapter four, which generalize Mulligan and Sala-i-Martin (1999a) results to an environment with a demographic dynamics. I show that there are two opposite effects: on one hand, the more elderly in the economy, the more political power they have, both through their increased relevance in the transfer function and through larger incentives to free rider, which induces the old group to set a higher tax on wage income. Thus, retirement increases. The elderly will exert more political pressure and obtain a larger transfer from the young. I refer to these as the "size" effects. On the other hand, because of the increase in the number of elderly, they will have to share a given amount of resources among more individuals. Additionally, the increase in their number decreases the effectiveness of the average individual contribution to the aggregate political pressure of the old. These effects induce a lower tax on old wage income, which decreases the disincentives to work and reduces retirement. Therefore, the old will exert less political power to obtain transfers from the young and the social security size could decrease. I refer to these as the "per capita" effect. The analysis identifies two overall results. First, the aging of the population induces old people to retire less, and second, the overall effect on the size of social security depends on the size of the demographic change.

Chapter five provides an empirical analysis of these implications. The evidence are encouraging: there exist interrelated effects of demography on retirement and social security. Specifically, the results provide empirical support for the implications of the theory. Both retirement level and social security expenditures decrease after a large increase of the proportion

of old in the population. The cross-country analysis suggests that both relations, the one between the proportion of old in the total population and the length of retirement (i.e. years spent in retirement) and the one between the proportion of old and the social security size are hump-shaped, due to the existence of opposite size and per capita effects.

To summarize, the main contributions of the theoretical and the empirical analysis are the following. The theoretical analysis introduces a sensible framework to analyze the impact of demographic changes on retirement and social security, and provides some testable prediction. The main message from the chapter two is that any model which analyzes social security has to be able to explain retirement as well, since the two programs always coexist. Building on Mulligan and Sala-i-Martin (1999a), chapter four fills this gap in studying the effect of the aging population.

The empirical analysis develops a completely new data set, which collects informations on demographics, retirement and social security. Additionally, it provides empirical support for the implications of the theory in chapter four. This represents a first attempt to combine the two branches of existing empirical literature, on demography and social security[3] and on retirement and social security[4].

The thesis is organized as follows: Chapter two surveys the main contributions in the literature of politico-economic models of social security. The survey justifies the introduction of a new approach based on the study of the interactions between social security and other programs to shed some light on some features of the social security programs. The thesis focuses on an unexplored characteristic of the program: the relation between retirement and social security. Chapter three develops a positive theory to explain this relation. Chapter four develops a new theoretical model to analyze the impact of the aging process on retirement and social security. Chapter five provides new evidence on the determinants of the retirement level and the size of social security around the world and performs a simple empirical analysis to support the implications of the theoretical model. Finally, chapter six provides conclusions and directions for future research.

[3]European Commission (1997), OECD (1998), Rosevare and oth., 1996.
[4]Brugiavini (1997), Gruber and Wise (1997), Latulippe (1997), Samwick (1998).

Table 1.1: Percentage of Population Aged 65 and Over, 1980-2050[1]

COUNTRY	1980	1990	2000	2010	2020	2030	2040	2050
CANADA	9.5	11.4	12.8	14.6	18.6	22.4	22.5	21.3
FRANCE	14.0	13.8	15.3	16.3	19.5	21.8	22.7	22.3
GERMANY	15.5	15.5	17.1	20.4	21.7	25.8	27.6	24.5
ITALY	13.5	13.8	15.3	17.3	19.4	21.9	24.2	22.6
JAPAN	9.1	11.4	15.2	18.6	20.9	20.0	22.7	22.3
UNITED KINGDOM	14.9	15.1	14.5	14.6	16.3	19.2	20.4	18.7
UNITED STATES	11.3	12.2	12.2	12.8	16.2	19.5	19.8	19.3
AVERAGE OF ABOVE COUNTRIES[2]	12.5	13.3	14.6	16.4	18.9	21.5	22.8	21.6
AUSTRALIA	9.6	11.1	11.7	12.6	15.4	18.2	19.7	19.4
AUSTRIA	15.5	14.6	14.9	17.5	19.4	22.8	23.9	21.7
BELGIUM	14.4	14.2	14.7	15.9	17.7	20.8	21.9	20.8
DENMARK	14.4	15.3	14.9	16.7	20.1	22.6	24.7	23.2
FINLAND	12.0	13.1	14.4	16.8	21.7	23.8	23.1	22.7
GREECE	13.1	12.3	15.0	16.8	17.8	19.5	21.0	21.1
ICELAND	9.9	10.3	10.8	11.1	14.3	18.1	20.1	21.1
IRELAND	10.7	11.3	11.1	11.1	12.6	14.7	16.9	18.9
LUXEMBOURG	13.5	14.6	16.7	18.1	20.2	22.4	22.0	20.3
NETHERLANDS	11.5	12.7	13.5	15.1	18.9	23.0	24.8	22.6
NEW ZEALAND	9.7	10.8	11.1	12.0	15.3	19.4	21.9	21.3
NORWAY	14.8	16.2	15.2	15.1	18.2	20.7	22.8	21.9
PORTUGAL	10.2	11.8	13.5	14.1	15.6	18.2	20.4	20.6
SPAIN	10.9	12.7	14.4	15.5	17.0	19.6	22.7	22.9
SWEDEN	16.3	17.7	16.6	17.5	20.8	21.7	22.5	21.4
SWITZERLAND	13.8	14.8	16.7	20.5	24.4	27.3	28.3	26.3
TURKEY	4.7	4.0	5.0	5.5	7.0	8.9	10.2	11.5
OECD AVERAGE[2]	12.2	13.0	13.9	15.3	17.9	20.5	21.9	21.2

Source: OECD

[1] 1980 actual proportions; 1990 to 2050 projected proportions
[2] Unweighted average

Table 1. 2: Growth Rate of Working-Age Population, 1950-2050[3]

COUNTRY	1950 1960	1960 1970	1970 1980	1980 1990	1990 2000	2000 2010	2010 2020	2020 2030	2030 2040	2040 2050
CANADA	2.0	2.3	2.1	1.1	0.8	0.7	0.0	-0.3	0.2	0.3
FRANCE	0.3	1.1	0.8	0.7	0.2	0.3	-0.4	-0.5	-0.5	-0.3
GERMANY	0.8	0.7	0.6	0.4	-0.5	-0.7	-0.9	-1.7	-1.1	-0.5
ITALY	0.9	0.3	0.6	0.6	-0.2	-0.3	-0.6	-1.0	-1.1	-0.5
JAPAN	1.9	1.9	0.9	0.9	-0.1	-0.5	-0.4	-0.2	-0.6	-0.2
UNITED KINGDOM	0.1	0.3	0.3	0.4	0.0	0.2	-0.1	-0.3	-0.2	-0.1
UNITED STATES	0.9	1.6	1.7	0.8	0.8	0.7	0.0	-0.2	0.2	0.2
AVERAGE OF ABOVE COUNTRIES[4]	1.0	1.2	1.0	0.7	0.1	0.1	-0.4	-0.6	-0.4	-0.1
AUSTRALIA	1.7	2.2	2.0	1.6	1.1	0.9	0.4	0.3	0.3	0.5
AUSTRIA	0.1	-0.3	0.5	0.5	-0.1	-0.1	-0.3	-0.8	-0.5	-0.1
BELGIUM	0.0	0.3	0.6	0.2	-0.1	0.0	-0.4	-0.8	-0.6	-0.4
DENMARK	0.7	0.8	0.4	0.3	-0.1	-0.5	-1.0	-1.2	-1.2	-0.6
FINLAND	0.9	1.0	0.6	0.3	0.1	-0.2	-1.0	-0.9	-0.5	-0.5
GREECE	1.2	0.3	0.9	0.7	-0.1	0.0	-0.1	-0.4	-0.5	-0.4
ICELAND	1.2	1.8	1.8	1.4	1.1	0.8	0.0	-0.5	-0.3	-0.3
IRELAND	-0.9	0.6	1.4	1.3	1.3	0.8	0.2	-0.1	-0.2	-0.2
LUXEMBOURG	0.2	0.4	1.1	0.4	-0.2	0.1	-0.4	-0.6	-0.2	0.0
NETHERLANDS	0.9	1.6	1.4	0.9	0.1	0.0	-0.6	-1.0	-0.8	0.0
NEW ZEALAND	1.6	1.9	1.7	1.5	0.9	0.6	0.1	-0.4	-0.4	-0.2
NORWAY	0.5	0.7	0.6	0.6	0.4	0.2	-0.4	-0.5	-0.49	-0.10
PORTUGAL	0.6	-0.2	0.6	1.1	0.2	0.2	-0.1	-0.6	-0.68	-0.47
SPAIN	-0.7	0.8	1.1	1.0	0.4	0.4	-0.1	-0.6	-0.76	-0.35
SWEDEN	0.6	0.7	0.1	0.2	0.1	-0.2	-0.4	-0.4	-0.41	-0.10
SWITZERLAND	1.2	1.3	0.5	0.6	-0.2	-0.4	-0.8	-1.0	-0.82	-0.45
TURKEY	2.4	2.3	2.7	3.4	2.2	2.0	1.3	0.7	0.71	0.75
OECD AVERAGE[2]	0.8	1.0	1.0	0.9	0.3	0.2	-0.3	-0.5	-0.43	-0.17

Source: OECD

[3] Average annual compound growth rates; 1950-1960 to 1970-1980 actual rates; 1980-1990 to 2040-2050 projected rates

[4] Unweighted average

Table 1.3: Pension Expenditures (as a Percentage of GDP in 1994 prices)[5]

COUNTRY	1995	2000	2010	2020	2030	2040	2050	2060	2070
UNITED STATES	4.1	4.2	4.5	5.2	6.6	7.1	7.0	7.2	7.4
JAPAN	6.6	7.5	9.6	12.4	13.4	14.9	16.5	15.5	14.4
GERMANY	11.1	11.5	11.8	12.3	16.5	18.4	17.5	16.5	15.5
FRANCE	10.6	9.8	9.7	11.6	13.5	14.3	14.4	14.2	14.0
ITALY	13.3	12.6	13.2	15.3	20.3	21.4	20.3	18.7	17.0
UNITED KINGDOM	4.5	4.5	5.2	5.1	5.5	5.0	4.1	3.6	3.1
CANADA	5.2	5.0	5.3	6.9	9.0	9.1	8.7	8.4	8.1
AUSTRALIA	2.6	2.3	2.3	2.9	3.8	4.3	4.5	4.6	4.6
AUSTRIA	8.8	8.6	10.2	12.1	14.4	15.0	14.9	14.2	13.5
BELGIUM	10.4	9.7	8.7	10.7	13.9	15.0	15.1	14.7	14.3
DENMARK	6.8	6.4	7.6	9.3	10.9	11.6	11.5	11.6	11.7
FINLAND	10.1	9.5	10.7	15.2	17.8	18.0	17.7	17.7	17.8
ICELAND	2.5	2.4	2.4	3.1	4.2	4.8	5.2	5.4	5.5
IRELAND	3.6	2.9	2.6	2.7	2.8	2.9	3.0	2.6	2.2
NETHERLANDS	6.0	5.7	6.1	8.4	11.2	12.1	11.4	11.2	11.0
NEW ZEALAND	5.9	4.8	5.2	6.7	8.3	9.4	9.8	10.3	10.7
NORWAY	5.2	4.9	6.0	8.6	10.9	11.8	11.5	11.1	11.1
PORTUGAL	7.1	6.9	8.1	9.6	13.0	15.2	16.5	15.6	14.8
SPAIN	10.0	9.8	10.0	11.3	14.1	16.8	19.1	17.6	16.0
SWEDEN	11.8	11.1	12.4	13.9	15.0	14.9	14.5	14.8	15.1

Source: Rosevaeare, Leibfritz, Fore and Wurzel(1996). OECD W.P. 168

[5] Simulations are run under a "baseline" scenario developed for each country, using data from national sources to model contribution and benefit rates, taking into account differences in retirement ages and eligibility criteria, legislation reforms. The population projections used for each country are taken from the World Bank.

Chapter 2

Politico-Economic Models of Social Security

2.1 Introduction

This chapter provides a survey of the main contributions in the literature of politico-economic models of social security. My purpose is to show that the existing literature (a part from few exceptions) has generally neglected the crucial association between retirement and social security programs, which is the focus of this thesis.

I first review the models, which analyze the institution of the unfunded social security systems and their rapid development into the most widespread instrument of social insurance. The fundamental challenge common to this entire line of research is to understand why there exist social security programs, which transfer resources from young and middle-aged workers to the elderly. An appropriate theory should explain, or at least to be able to do it, why these social security transfers are contingent on retirement. However, the majority of these models do not explore this feature.

I then turn to the literature that studies the response of the existing social security systems to changes in the economic and demographic scenario, and to models of social security reforms. In particular, I focus on the following questions: How does the political sustainability shape the social security systems in a dynamic economic and demographic environment? Which social security reforms would be politically feasible? Again, although I think that an appropriate answer

should include the sustainability of retirement systems, the literature provides no contributions in this direction.

Finally, I review a recent body of literature, which analyzes the interactions between social security systems and other redistributive programs of the welfare state. The common theme of these multidimensional models is to recognize that the different programs of the welfare state may be economic and political complements or substitutes. These aspects are crucial in determining the size and composition of the welfare state. Although this framework would be the more natural to analyze the contemporaneous existence of retirement and social security, I am surprisingly unable to find contributions with this purpose.

I choose to survey the main politico-economic models of social security along two lines. First, I take the parameters of the social security system (generally, payroll tax rates and transfers) as exogenous, and I spell out the economic environment. The aim is to classify the models according to which economic factors induce young and/or middle aged agents to favor positive levels of social security[1]. I identify five major economic reasons: i) Aaron (1966) recognized that, in dynamically inefficient economies, unfunded systems represent a better saving technology than alternative assets, and would thus be supported by all net savers[2]. ii) Unfunded system may also be used to improve on the allocation of resources when young agents are altruistic towards the elderly, and they adopt Stackelberg behaviors in their saving decisions, as suggested by Hansson and Stuart (1989). iii) A widely used economic argument, due to Browning (1975), suggests that middle aged individuals may favor unfunded systems even in dynamically efficient economies, because they take into account a reduced time horizon. In fact, in evaluating social security policies, they only consider current and future contributions and future benefits, and they regard previous payments to the system as a sunk cost[3]. The other two economic reasons involve some form of redistribution. iv) Tabellini (1990) shows that the within-cohort redistribution element shared by many social security schemes may induce low income young individuals to support the system. v) As initially suggested by Cuckierman and Meltzer (1989) in the context of public debt decisions, the institution of an unfunded system

[1] As I will argue in section 3, not all politico-economic theories require that young and/or middle aged agents prefer positive levels of social security. In fact, interest groups models rather derive the existence of social security from the political success of the old.

[2] See also Browing (1975), Sjoblom (1985) and Azariadis and Galasso (1997).

[3] Sjoblom (1985), Boadwin and Wildasin (1989), and Cooley and Soares (1999) belong to this tradition.

tends to crowd out private capital accumulation, thereby affecting the factor prices. Net savers would gain from the corresponding increase in the real rate of interest, whereas wage earners would lose from a decrease in the wages. Net gainers from the overall change in the factor prices would sustain the system[4]. The economic factors seem not relevant to explain the existence of retirement, since none of the above economic reasons may account for the association of social security and retirement.

Therefore, I turn to the political structure of the models. Agents' individual preferences over the social security system, induced by the different economic factors, can be aggregated according to several political mechanisms. The political institutions encountered in the literature, in the case of a one-dimensional issue space, can be classified in three broad groups: majoritarian voting, veto-power or constitutional rules, and interest groups models. There is fundamental difference between models of voting (majoritarian or veto-power) and interest groups. In the former ones, social security arises if there are sufficient economic reasons to induce at least a majority of the electorate to support the system. The latter models focus more on the political process, which allows a powerful minority, the elderly, to carry through an intergenerational redistribution policy. The political institutions seem not more helpful than the economic elements to explain the contemporaneous existence of retirement and social security. There exists only one political model, the interest group model by Mulligan and Sala-i-Martin, (1999a), which provides a positive explanation to it. This is a drawback of the literature, and I will show in chapter three and four that there exist political elements which may explain the tight link between retirement and social security.

The combination of these two lines of classification, i.e., economic factors and political institutions, provides a natural way to catalogue the different models. Table 2.1 summarizes how the models in this literature tackle the first question: why there exist social security programs transferring resources from young and adult to retirees? Notice that, although voting models may display several of the economic features, this characterization does not apply to interest groups models, which rely instead on the political power of the old. Additionally, table 2.1 illustrates that there is only one model that may also account for the existence of retirement.

This survey complements a previous work by Breyer (1994a), who carefully reviewed the

[4]This line of reasoning can be found in Cooley and Soares (1999) and Boldrin and Rustichini (2000).

existing literature on the political economy of social security. In fact, on one hand, I concentrate on the most recent body of contributions, and, on the other hand, I adopt a broader view of the literature that includes models of policy reforms, as well as multidimensional models examining the political determination of social security within a more complete welfare state. In this line, I especially focus on the relation between social security and retirement. Also Persson and Tabellini (2000) provide a comprehensive treatment of the political economics of intergenerational transfers. Their work, however, serves mainly a didactical purpose. It focuses on specific economic aspects to explain the raise of social security as an equilibrium outcome of a majoritarian election, and it comes short of constituting a survey of the literature.

The chapter proceeds as follows: Section 2 introduces a general economic environment to examine the crucial economic elements embodied in the voting models. Section 3 analyzes the three different political arrangements encountered in the literature. In section 4 and 5 I discuss respectively models of social security reforms, and models of welfare state determination. Section 6 concludes.

2.2 The Economic Environment

In this section, I introduce a simple, yet quite general economic environment to examine some of the economic factors which may induce young and adult individuals to support unfunded social security systems. Then, I analyze how these economic factors may explain the existence of social security, and I examine whether they can also account for the existence of retirement. Since altruism is a more significant element in my context, the setting developed in this section abstracts from altruistic preferences, that I discuss in section 2.2.5.

I consider an overlapping generations model with capital accumulation. Every period three generations are alive, I call them "Young", "Adult", and "Old". Population grows at a constant rate μ. It follows that in any given period t for every young there are $1/(1+\mu)$ adult individuals and $1/(1+\mu)^2$ old. Agents work during the first two periods of their life, and then retire in old age. Individuals differ in their working ability. Working abilities are distributed on the support $[\underline{e}, \overline{e}] \subset \Re_+$, according to the cumulative distribution function $G(.)$. An agent born at time t is characterized by a level of working ability and will therefore be denoted by $e_t \in [\underline{e}, \overline{e}]$. The

distribution of abilities is assumed to have mean $\widehat{e}$, and to be skewed, $G(\widehat{e}) > 1/2$.

Non altruistic agents value leisure, l, and consumption, c, according to the following time separable utility function:

$$U\left(l_t^t, c_t^t\right) + \beta U\left(l_{t+1}^t, c_{t+1}^t\right) + \beta^2 U\left(c_{t+2}^t\right) \tag{2.1}$$

where β represents the individual time discount, subscripts indicate the calendar time and superscripts indicate the period when the agent was born.

The budget constraints of a type e individual born at time t during her lifetime are:

$$\begin{aligned} c_t^t + a_{t+1}^t &= e_t w_t (1-\tau_t)\left(1-l_t^t\right) \\ c_{t+1}^t + a_{t+2}^t &= e_t w_{t+1}(1-\tau_{t+1})\left(1-l_{t+1}^t\right) + a_{t+1}^t(1+r_{t+1}) \\ c_{t+2}^t &= a_{t+2}^t(1+r_{t+2}) + P_{t+2} \end{aligned} \tag{2.2}$$

where a_{t+1}^t represents her asset holding at the end of period $t+1$, r_t and w_t are the real interest rate and the wage rate at time t, τ_t is the social security payroll tax rate at time t, and P_t is the pension transfer at time t. Agents maximize their utility, eq. 2.1, with respect to their asset holdings and to their labor supply, subject to the budget constraints, eq. 2.2, and taking the social security system as given.

The social security system consists of a sequences of tax rates and transfers $\{\tau_t, P_t\}_{t=0}^{\infty}$. These models assume that a payroll tax, τ_t, is imposed on the labor earnings of the active generations, young and adult, and the collected amount is transferred lump sum to the retirees, P_t. Although the mere assumption of the existence of this tax can be criticized, since there is no reason why this type of tax should be assumed (why not an income tax?) rather than explained, I need to keep this assumption to explain how these models work. The budget is balanced every period, and thus the pension transfer can be related to the payroll tax rate as follows:

$$P_t = \tau_t w_t \left((1+\mu)^2 \int_{\underline{e}}^{\overline{e}} e_t\left(1-l_t^t\right) dG(e_t) + (1+\mu)\int_{\underline{e}}^{\overline{e}} e_{t-1}\left(1-l_t^{t-1}\right) dG(e_{t-1})\right)$$

or

$$P_t = \tau_t w_t \widehat{l}_t$$

where $\widehat{l}_t$ denotes the average labor supply in efficiency units in the economy.

An economic equilibrium of this economy is a sequence of allocations and prices, $\left\{l_t^t(e_t), l_{t+1}^t(e_t), c_t^t(e_t), c_{t+1}^t(e_t), c_{t+2}^t(e_t), w_t, r_t\right\}_{e_t \in [\underline{e},\overline{e}]}^{t=0,..,\infty}$, such that, for a given sequence of social security tax rates, $\{\tau_t\}_{t=0}^{\infty}$: (i) the consumer problem is solved for each type-e individual in each generation; (ii) the social security budget constraint is balanced every period, and (iii) goods market clears every period.

For a given sequence of social security tax rates, I can identify the utility level obtained in an economic equilibrium by every agent with her indirect utility function. These indirect utility functions characterize the young, adult, and old agents' preference relations over current (and future) tax rates. In particular, $W_t^t(e;\tau_t,\tau_{t+1},\tau_{t+2})$, $W_t^{t-1}(e;\tau_{t-1},\tau_t,\tau_{t+1})$, and $W_t^{t-2}(e;\tau_{t-2},\tau_{t-1},\tau_t)$ denote the indirect utility functions at time t of a type-e young, adult, and old individual, respectively.

To highlight the different economic factors at work, I concentrate on constant sequences of social security tax rates, $\tau_t = \tau\ \forall t$, and analyze individual preferences over these sequences. This amounts to assume that young and adult agents form their preferences over the social security tax rate under the assumption that the current scheme will never be modified in the future. Young individuals who do not expect the system to be in place in their old age perceive the current tax rate as a net cost, and would generally not be willing to support the system[5]. In the next section, I shall discuss the political arrangements under which sequences of positive tax rates may arise.

Clearly, elderly individuals support social security systems which award them a pension at no cost. When do young and/or adult agents favor positive levels of social security? To review the answers provided in the literature, it is useful to consider the maximization of the agents' indirect utility functions with respect to the (constant sequence of) tax rates. At time t, the first order condition[6] for a type-e young is:

[5]The exception is Tabellini (1990), see section 2.5.

[6]In obtaining eq. 2.3 and 2.4, I assume that the economic maximizations yield interior solutions, i.e., $l_t^t(e_t) >$

$$
\begin{aligned}
0 \;=\; & -e_t w_t\left(1-l_t^t\left(e_t\right)\right)-\frac{e_t w_{t+1}\left(1-l_{t+1}^t\left(e_t\right)\right)}{1+r_{t+1}}+\frac{\frac{\partial P_{t+2}}{\partial \tau}}{\left(1+r_{t+1}\right)\left(1+r_{t+2}\right)}+ \\
& +\frac{\left[e_t\left(1-l_{t+1}^t\left(e_t\right)\right)\left(1-\tau\right)\frac{\partial w_{t+1}}{\partial k_{t+1}}+a_{t+1}^t\left(e_t\right)\frac{\partial r_{t+1}}{\partial k_{t+1}}\right]\frac{\partial k_{t+1}}{\partial \tau}}{1+r_{t+1}}+ \\
& +\frac{\left[a_{t+2}^t\left(e_t\right)\frac{\partial r_{t+2}}{\partial k_{t+2}}+\frac{\partial P_{t+2}}{\partial w_{t+2}}\frac{\partial w_{t+2}}{\partial k_{t+2}}\right]\frac{\partial k_{t+2}}{\partial \tau}}{\left(1+r_{t+1}\right)\left(1+r_{t+2}\right)}
\end{aligned}
\tag{2.3}
$$

and for a type-e adult is:

$$
-e_{t-1}w_t\left(1-l_t^{t-1}\left(e_{t-1}\right)\right)+\frac{\frac{\partial P_{t+1}}{\partial \tau}}{\left(1+r_{t+1}\right)}+\frac{\left[a_{t+1}^{t-1}\left(e_{t-1}\right)\frac{\partial r_{t+1}}{\partial k_{t+1}}+\frac{\partial P_{t+1}}{\partial w_{t+1}}\frac{\partial w_{t+1}}{\partial k_{t+1}}\right]\frac{\partial k_{t+1}}{\partial \tau}}{\left(1+r_{t+1}\right)}=0 \tag{2.4}
$$

where

$$
\frac{\partial P_t}{\partial \tau}=w_t\widehat{l_t}+\tau\frac{\partial \widehat{l_t}}{\partial \tau}w_t \tag{2.5}
$$

Equations 2.3 and 2.4 show the different marginal effects that an increase in the sequence of tax rates has on the indirect utility function of a type-e young and adult individual. Specifically, the first two terms in eq. 2.3 represent the disutility associated with the labor income tax in young and adult age, whereas the third element is the discounted utility associated to the increase in the pension transfer. All other terms characterize the changes in the factors' prices induced by an increase in the tax rate through changes in the stock of capital. Typically, an increase in the tax rate crowds out capital $\left(\frac{\partial k_t}{\partial \tau}<0\right)$, thereby affecting factors' prices, since a decrease in the capital stock reduces the wage rate $\left(\frac{\partial w_t}{\partial k_t}>0\right)$ and increases the real rate of return $\left(\frac{\partial r_t}{\partial k_t}<0\right)$. The same forces are at work in equation 2.4 for the case of an adult individual, over a reduced time horizon. Equation 2.5 says that an increase in the tax rate has a direct positive effect on the pension benefits, and a negative indirect effects on the average labor supply due to the distortionary taxation $\left(\frac{\partial \widehat{l_t}}{\partial \tau}\right)$.

I can now review some of the economic factors emphasized in the literature.

0, $l_{t+1}^t\left(e_t\right)>0$, $c_t^t\left(e_t\right)>0$, $c_{t+1}^t\left(e_t\right)>0$, and $c_{t+2}^t\left(e_t\right)>0$, $\forall t$ and $\forall e_t\in[\underline{e},\overline{e}]$.

2.2.1 Dynamic Inefficiency

Since Samuelson (1958) and Aaron (1966), it is well known that social security may improve the welfare of every individual if the economy is dynamically inefficient, that is, if the implicit rate of return from social security is larger than the real rate of return from capital accumulation. To see this, assume that there is no heterogeneity, $e_t = e$, and that social security does not affect the capital stock, $\frac{\partial k_t}{\partial \tau} = 0$. If the economy is at a steady state and there is no growth in real wages, eq.2.3 can be written as $[(1+\mu)(2+\mu) - (1+r)(2+r)] + \frac{\tau \frac{\partial \widehat{l}_t}{\partial \tau}}{(1-\widehat{l})} = 0$. Since the implicit return from social security is equal to the population growth rate, μ, the economy is dynamically inefficient if $\mu > r$. In this case, since $\frac{\partial \widehat{l}_t}{\partial \tau} < 0$, young individuals prefer positive level of social security: $\tau > 0$.

In this context, the models are not able to explain why social security transfers are contingent on retirement: if social security is a better alternative to capital accumulation, why do the old have to retire in order to collect their savings?

Moreover, the use of this economic element to explain the support to unfunded systems has largely been challenged on empirical grounds. There is in fact weak evidence that this is a realistic assumption[7]. Nevertheless, Azariadis and Galasso (1997) rely on a dynamically inefficient economy to examine the difference in policy outcomes induced by alternative specifications of the political process. Browning (1975), and Sjoblom (1985) consider an extreme case of dynamic inefficiency: in their economy there is no alternative saving technology, i.e., $\mu > 0 > r = -1$. However, this assumption is not crucial, and allowing for private saving would not change their main message, which I analyze in the next subsection.

2.2.2 Reduced Time Horizon

Browning's (1975) seminal contribution suggests that, even in a dynamic efficient economy, adult individuals may prefer positive level of social security, since they only value current and future contributions to and benefits from the system, whereas past contributions represent a sunk cost. In other words, adult individuals do not take into account the entire cost of social

[7]Imrohoroglu, Imrohoroglu and Joines (1995) constitute a notable exception. They calibrated a large overlapping generations model to the US economy and showed that the institution of social security can be beneficial to young cohorts, due to dynamic inefficiency.

security, since they only consider a reduced time horizon.

To isolate this effect, consider a dynamically efficient economy, $\mu < r$, with no heterogeneity, $e_t = e$, no growth in real wages, and where social security does not affect the capital stock, $\frac{\partial k_t}{\partial \tau} = 0$. The implicit return from social security for an adult who considers previous contributions as a sunk cost, denoted by i^A, is equal to the ratio between future benefits and current contributions. At steady state, I have that $1 + i^A = (1 + \mu)(2 + \mu)$, and the first order condition for an adult individual, eq. 2.4, becomes: $-1 + \frac{1+i^A}{1+r} + \frac{\frac{\partial \widehat{l}}{\partial \tau}\tau}{(1+r)(1-\widehat{l})} = 0$. Thus, an adult individual favors a positive amount of social security, $\tau > 0$, if the implicit return from the system (calculated on her reduced time horizon) is larger than the real return on capital accumulation, $i^A > r > \mu$.

Since Browning (1975), this line of reasoning has been exploited in several work. In particular, Boadway and Wildasin (1989) have generalized this result to an economy with borrowing constraints; whereas Hu (1982), and more successfully Sjoblom (1985) have tried to provide a more convincing specification of the underlining political process. Cooley and Soares (1999) have combined this idea with the crowding out effect to replicate some quantitative features of the US social security system. Finally, Galasso (2000) has calculated the internal rate of return from "investing" in social security for the median voter at several US presidential elections. His results support Browning's idea: for an adult individual (a 44 years old median voter) the internal rate of return from social security often exceeds the returns from alternative assets, $i^A > r$.

To summarize, this approach can improve the previous in some respects. However, it assumes a similar perspective, i.e., it justifies social security as a better investment with respect to capital accumulation. Therefore, it is still unable to explain why social security transfers are contingent on retirement.

2.2.3 Crowding Out

Cuckierman and Meltzer (1989) claim that when individuals evaluate public debt policies, they take into account the effect that these policies have on the stock of capital and thereby on the factors' prices. Cooley and Soares (1999) and Boldrin and Rustichini (2000) have extended this idea to social security decisions. They argue that the existence of intergenerational redistribution schemes, such as public debt or social security, tends to crowd out capital, and thus

reduces wages and increases real returns. This creates a redistribution in favor of assets-holders ("capitalist") and against individuals who rely heavily on labor income ("workers").

To appreciate the positive effect on the rate of returns, consider a two periods version of the economy described in this section, assuming a steady state dynamically efficient economy with no heterogeneity. The first order condition for a young individual becomes:

$$-w(1-l)+\frac{w(1-l)(1+\mu)+\tau w(1+\mu)\frac{\partial(1-l)}{\partial\tau}}{1+r}+\frac{\left[a\frac{\partial r}{\partial k}+\frac{\partial P}{\partial w}\frac{\partial w}{\partial k}\right]\frac{\partial k}{\partial\tau}}{1+r}=0$$

Because of dynamic efficiency, the sum of the first two terms in this equation is always negative. The third term characterizes the positive effect of an increase in the tax rate on the returns on the young individuals' assets, and the negative impact on their future pension, due to the decrease in the wages. If their asset holdings, a, and the crowding out effect, $\frac{\partial r}{\partial k}\frac{\partial k}{\partial \tau}$, are large enough, young individuals are willing to use a return-dominated saving technology, i.e., social security, in order to boost the returns on the private assets, and thus $\tau > 0$.

In a two periods overlapping generations model, Boldrin and Rustichini (2000) fully characterize politico-economic equilibria with social security, which arise exclusively because of this crowding out effect. Cooley and Soares (1999), on the other hand, use a four period overlapping generations economy to combine this effect with the idea that adult individuals take social security decisions considering only a reduced time horizon. Although they underline the importance of the former element for the sustainability of the system, the empirical relevance of this crowding out effect remains to be tested.

Moreover, as the previous elements, crowding out is another factor which may explain why it can be convenient, in terms of rate of return, to support the social security system. Therefore, as the others, it cannot account for retirement.

2.2.4 Within Cohort Redistribution

Tabellini (1990), and later Persson and Tabellini (2000), suggest that some young individuals may favor positive social security systems because of the within cohort redistribution element they entail. In fact, Boskin et al. (1987) have shown that the US social security system redistributes within cohort across different family types. Specifically, the system yields higher

returns to low income individuals than to high income ones. A direct consequence of the existence of this intragenerational redistribution component is that, even in a dynamically efficient economy, for low income individuals social security may be more profitable than capital accumulation.

In this case, the coalition supporting the social security is represented by the old and the low income young individuals. This is a different element, but is still based on the same assumption: the social security system arises since enough people find it more profitable than capital accumulation. The unsolved question is always why do this coalition force or induce the old to retire before they can collect their pensions.

These models consider a two period, dynamically efficient overlapping generations economy, with no growth in real wages, and no crowding out effects, $\frac{\partial k_t}{\partial \tau} = 0$, at steady state. Denoting the implicit return from social security for a type-e young individual with i_e, I have: $1 + i_e = \frac{(1+\mu)\widehat{e}(1-l(\widehat{e}))}{e(1-l(e))}$, which implies $i_e > \mu$ if $\widehat{e}(1-l(\widehat{e})) > e(1-l(e))$. In words, agents whose labor income is below the mean labor income in the economy receive a higher implicit return than the average return μ. The first order condition for a type-e young individual can be written as $-1 + \frac{1+i_e}{1+r} + \frac{\tau(1+\mu)\widehat{e}}{e(1-l(e))(1+r)} \frac{\partial(1-l(\widehat{e}))}{\partial \tau} = 0$. Thus, a type-$e$ young individual favors a positive amount of social security, $\tau > 0$, if the implicit return she yields from the system is larger than the real return on capital accumulation, $i_e > r > \mu$.

2.2.5 Altruism

Altruism basically relies on the assumption that the young individuals' preferences include the utility of the old. The existence of social security systems is attributed to young agents' altruistic preferences towards the old. However, if this is the economic reason behind the existence of the social security systems, why don't we observe private transfers? Additionally, why are the old forced to retire, rather than beneficiated by a lump sum transfer? In chapter three I introduce "merit goods" as a new economic element, which shows some similarity with altruism, but suggests a reason to explain the contemporaneous existence of retirement and social security. Merit goods in fact rely on the assumption that the young individuals' preferences include the consumption of leisure of the old, rather than the utility of the old. This means that the young feel that it is meritorious for the old not to work, and they are willing to redistribute income

in favor of the old, but only for this specific purpose. In this way, the existence of mandatory retirement can be explained.

The main contributions that have assumed altruistic preferences of the young towards the ols are Hansson and Stuart (1989) and Tabellini (1990). In Hansson and Stuart (1989), young agents, in choosing their current savings, take into account the behavior of future altruistic young individuals. As Veall (1986) had previously suggested, agents recognize that future young will be willing to provide them with an old-age transfer, if they have not saved enough for old-age consumption. This Stackelberg behavior leads to an inefficient allocation of resources, since every individual would benefit from shifting resources from youth to old-age. In this context, a social security would arise under unanimity rule to improve the allocation of the resources.

Tabellini (1990) combines weakly altruistic preferences with intragenerational redistribution. In his model, heterogeneous, altruistic agents vote every period on the current social security level, which they believe to be unrelated to any future benefit. Since their altruism is weak, young individuals are not willing to award a private transfer to the elderly. However, low-income young support a positive social security level, since the utility associated to their parents receiving a pension outweighs the direct (utility) cost of the tax.

2.3 The Political Institutions

Economic elements seem not able to explain the existence of retirement. I now turn to the political institutions and analyze how they have been described by the literature. In every specification, I examine whether there exist political elements which may account for the existence of retirement.

In the literature of politico-economic models of social security, political institutions are to aggregate individual preferences over social security into a policy outcome. I examine three broad class of political arrangements: majoritarian voting, veto-power or constitutional rules, and interest groups or lobbying. There exists a crucial difference between voting and interest groups models. In models of majoritarian elections or veto power, political equilibria with social security require at least a majority of the voters to be in favor of the system. Interest groups models, on the other hand, concentrate on the political pressure which may allow a minority,

the elderly, to implement an intergenerational redistribution policy even against the will of the majority.

2.3.1 Majoritarian Voting

In these models, agents cast a vote over social security tax rates (or transfers), and the policy outcome corresponds to the tax rate (or the transfer), which obtains a majority of the votes. These models solve a one-dimensional problem (the optimal tax rate or transfer), and therefore in their framework it is impossible to account for the contemporaneous existence of retirement and social security, which is a bi-dimensional problem. However, I argue that this "impossibility" may be solved in a multi-dimensional framework, as suggested by section 2.5 and as developed in chapter three.

In this section I explain how do these models use the political institutions to aggregate preferences over social security.

As I argued in the previous section, except in Tabellini (1990), young and adult agents are not willing to sustain a social security system unless they expect the system to exist in their old age. Early models, as Browning (1975), overcame this problem by examining once-and-for-all voting. This amounts to assume full commitment over future policies. In casting their ballot, voters understand that the system they determine will still be in place in the future. Clearly, the assumption that only stationary policies are candidates for the election is unrealistic. Moreover, Browning shows that the proposal to create a social security system is supported by young and middle-aged individuals and therefore wins the election (it wins the election now, and, under the assumption of stationarity, it will be permanent), but he does not consider that this result would be overcome by a temporary suspension of the program for one period, which can win the election against the policy of continuing the social security, since young and middle aged would be in favor of it. Later contributions have tried to amend this unrealistic feature by considering that elections take place ever period, and that previous policy can be changed at zero cost. Hu (1982) introduced revoting opportunities in Browning's (1975) setting. However, his voters are not fully rational. He postulates that future votes are uncertain (a stochastic variable) and depend on today's policy.

In 1985, Sjoblom made a big step forward in explaining the voting behavior of rational

agents in repeated elections over social security. He extended Hammond's (1975) seminal idea of implicit contracts among successive generations of individuals to a repeated voting environment. This idea is simple, yet quite intriguing. The voting game gives rise to a social contract which implicitly defines a system of rewards and punishments. Young voters may agree to transfer resources to current retirees because they expect to be rewarded with a corresponding transfer in their old age. Failures to comply with the contract, and therefore to provide pensions to current retirees, are punished with no old age transfers.

These contracts can be enforced in an overlapping generations model by a sequence of trigger strategies. To see this, I introduce a formal definition of a majority voting game over social security tax rates. I concentrate on a two periods version of the overlapping generations model described in the previous section with no heterogeneity. Players in this voting game are all agents alive at every election. As Boldrin and Rustichini (2000), for each generation at time t, I identify a representative player, young and old. An action at time t for a young player is a tax rate, $a_t^y \in [0,1]$, and analogously for an old player $a_t^o \in [0,1]$. At time t, the public history of the game is given by the sequence of tax rates until $t-1$: $h_t = (\tau_0, \tau_1, ..., \tau_{t-1}) \in [0,1]^t$. A time t strategy for a young voter is a mapping from the history into the action space, $\sigma_t^y : h_t \rightarrow [0,1]$; and analogously for an old voter, $\sigma_t^o : h_t \rightarrow [0,1]$.

In a majority voting game, the political outcome has to be preferred to any other outcome by a majority of voters. The outcome function is given by the median of the distribution of actions, and, since the young constitute a majority of the voters, by the action of the young, $\tau_t = a_t^y$. For a given sequence of actions profiles, $(a_0^y, a_0^o, ..., a_t^y, a_t^o, a_{t+1}^y, a_{t+1}^o, ...)$, and corresponding outcomes, $(\tau_0, ..., \tau_t, \tau_{t+1}, ...)$, the payoff function of a young player at time t is given by her indirect utility function, $W_t^t(\tau_t, \tau_{t+1})$, and analogously for an old player, $W_t^{t-1}(\tau_{t-1}, \tau_t)$. Finally, the equilibrium concept I use is subgame perfection.

In this voting game, what kind of strategy profile would support an implicit contract, and thus a positive level of social security?

Consider any strategy profile $\left(\sigma_s^{y*}, \sigma_s^{o*}\right)_{s=t}^{\infty}$ such that:

$$\sigma_s^{y*} = \begin{cases} \tau_s^* & \text{if } \tau_{s-i} = \tau_{s-i}^* \text{ for } i = 1, ..., s-t \\ 0 & \text{otherwise} \end{cases} \tag{2.6}$$

Since old voters are a minority, their actions cannot affect the outcome of the game, $(\tau_s^*)_{s=t}^{\infty}$ is the sequence of taxes associated with any such profile, and the resulting payoffs are $(W_s^*)_{s=t}^{\infty}$. This strategy profile requires the young at time s to vote for a tax rate τ_s^* provided that the sequence of tax rates $(\tau_i^*)_{i=1}^{s-1}$ has been played in the past, and to vote a zero tax rate otherwise. For this strategy profile to be an equilibrium, no agent has to gain from deviating from it. That is, no young has to be the first to vote for a tax different from the optimal policy $\tau_s \neq \tau_s^*$, and it has to be incentive compatible to punish all defectors.

The young best deviation is to vote for zero tax rate, $\tau_s = 0$, in which case she receives no old age transfer, and the associated payoff is her indirect utility level $W_s^s(0,0)$; whereas the payoff from the strategy σ_s^{y*} is W^*. Thus, if $W^* \geq W_s^s(0,0)$, a young will not deviate. The utility of punishing a defector is again $W_s^s(0,0)$ which exceeds the utility from not punishing because $W(\tau^*, 0) \leq W_s^s(0,0)$ for $\tau^* \geq 0$. Hence, if $W^* \geq W_s^s(0,0)\ \forall s$, $(\sigma_s^{y*}, \sigma_s^{o*})_{s=t}^{\infty}$ is a subgame perfect strategy profile. Notice that the condition $W^* \geq W_s^s(0,0)\ \forall s$ amounts to say that, at any time s, the existence of a social security system provides more utility to the young than no social security. The economic reasons which may lead to this result were reviewed in the previous section.

This approach typically generates a high degree of indeterminacy, since many tax rate sequences can be sustained as an equilibrium outcome of the voting game. Cooley and Soares (1999) concentrate on constant sequences. They let the initial voters choose the social security tax rate, then the implicit contract only allows future voters to continue or abandon the system. Boldrin and Rustichini (2000), in an early version, consider voting equilibria in which the first generation to introduce the system extracts all the gains, and leaves future generation of voters indifferent between continuing with the system or dismantling it. Azariadis and Galasso (1997) examine the complete set of equilibrium tax rates which may arise, and be sustained, through these implicit contracts. They show that this set includes dynamically inefficient, cyclical and chaotic sequences. They propose an alternative political specification which reduce the degree of indeterminacy, and which will be examined in the next subsection.

2.3.2 Veto Power

In democratic societies, substantial changes in economic policy often require much larger approval than simple majority. This is especially true when the policy adjustments adversely affect the vested interests of a politically significant group, thus drawing their loud objection. Changes in social security may be a good example of this kind of policies.

A political arrangement that partly precommits fiscal policy by awarding veto power over policy changes to the old voters was initially applied to social security decisions by Hansson and Stuart (1989). They view legislation as a trade (an implicit contract in the terminology used in the previous section) among living generations, in which a minority, the elderly, can block policy modifications which would make them worst off. In their economic setting, reviewed in section 2.2.5, the existence of a constitutionally awarded veto power is crucial to obtain a political equilibrium with a Pareto improving social security system. In fact, in a majoritarian voting game, a social security would still arise, since the young median voter would substitute the private transfer to the old with a social security transfer, however, the allocation of resources would be inefficient.

Azariadis and Galasso (1997) compare the set of equilibrium social security tax rate sequences obtained in a majoritarian and in a veto-power voting game. To see this, consider a formal definition of the majoritarian voting game with veto power. An action for a young at time t is a tax rate proposal $a_t^y \in [0,1]$, whereas an action for an old player is whether or not to veto the young proposal $a_t^o = \{Y, N\}$. The public history of the game at time t is given by the sequence of taxes until $t-1$: $h_t = (\tau_0, \tau_1, ..., \tau_{t-1}) \in [0,1]^t$. A time t strategy for a young voter is then a mapping from the history into the action space: $\sigma_t^y : h_t \rightarrow [0,1]$. For an old voter at time t, a strategy is a mapping from the history and from the current young agents' action into the action space: $\sigma_t^o : h_t \times a_t^y \rightarrow \{Y, N\}$.

In this majoritarian voting game with veto power, the political outcome is the tax preferred by the old between the two taxes on the agenda. Therefore, the outcome function is given by the action of the old, given the action of the young, and the status quo. For a given sequence of actions profiles, $(a_0^y, a_0^o, ..., a_t^y, a_t^o, a_{t+1}^y, a_{t+1}^o, ...)$, and corresponding outcomes, $(\tau_0, ..., \tau_t, \tau_{t+1}, ...)$, the payoff functions for a young and an old player at time t are given by their indirect utility functions, respectively $W_t^t(\tau_t, \tau_{t+1})$, and $W_t^{t-1}(\tau_{t-1}, \tau_t)$. Again,

the equilibrium concept is subgame perfection.

In this setting, Azariadis and Galasso (1997) show that a constitutional grant of veto power to the minority eliminates all cyclical sequences and all dynamic inefficiency from majoritarian politico-economic equilibria. This political arrangement can however be challenged on empirical grounds, since we do not observe any constitutional awarded veto power in social security policy decisions. To answer this criticism, Azariadis and Galasso (1997) endogenize the voting structure, by allowing the electorate to choose between a majoritarian and a constitutional veto power system in every period. They show that the potential introduction of a constitutional veto power system is sufficient to reduce the set of equilibria, even if the veto power is never effectively awarded.

2.3.3 Interest Groups Models

In these models, social security systems arise from the political competition between two groups, young and old, each one exerting political pressure on the policymakers to obtain a positive transfer from the other group. The difference between this approach and the voting models lies in the question they pose. Interest groups models ask why the old turn out to win the political process, rather than why young and/or adult workers agree to transfer resources to the old. Moreover, unlike the voting models, these models are able to account for the existence of social security programs in nondemocratic countries. Finally, among these models I can find a contribution which focuses on explaining the existence of retirement (Mulligan and Sala-i-Martin (1999a)).

An early model of competition among special groups (the taxpayers and the subsidized) for political influence is due to Becker (1983, 1985). This model stresses the importance of political pressure rather than voting as a determinant of the political equilibrium when redistribution policies, although not specifically social security, are analyzed. Applications of this approach to social security issues are provided by Becker and Mulligan (1998) and Mulligan and Sala-i-Martin (1999a). Other interest groups models of social security are developed by Verhoeven and Verbon (1991), Verbon and Verhoeven (1992) and Grossman and Helpman (1996, 1998).

Interest groups models derive the existence of social security from the political competition between two homogeneous groups, young and old. Individuals in each group undertake a

political activity to favor the interests of their group. A pressure function regulates how the political activity of each individual is converted into the group's pressure. This process gives typically rise to a free-rider problem, since the benefits obtained by each agent depend on her group aggregate political activity, i.e., the pressure, rather than on her own individual effort. Finally, the political influence exerted by each group on the policymaker, and thus the policy outcome, depends on each group's pressure, size and on other characteristics, through an influence function. The group exerting more influence wins the political competition and receives a transfer from the other group. As I will show, each model in this literature highlights different economic and/or political forces leading to the political success of the old.

Consider the following simple, yet quite general model. Society is composed of two groups, young (y) and old (o). Individuals are identical within groups. Every group j exerts a political pressure, p^j. The level of pressure is determined by the amount of resources dedicated to the pressure activity by each individual in the group, m^j, and by the number of individuals in the group, n^j:

$$p^j = p^j(m^j, n^j) \qquad j = y, o$$

where the pressure exerted by each group depends positively on both factors.

There are different interpretations of m^j in the pressure function. On one side, pressure can be good-intensive. Then m^j represents the amount of resources spent by a member of group j in maintaining lobby, attracting favorable votes, contributing to campaign expenditures, cultivating bureaucrats and politicians (Becker 1985, Becker and Mulligan 1998, Verbon and Verhoeven 1992, Grossman and Helpman 1998). On the other side, pressure can be time-intensive. Then m^j constitutes the leisure dedicated to political activity by every individual in group j. In this case, the amount of time dedicated to political activities, rather than the amount of resources spent in lobbying, determines the political pressure and therefore the political success of a group (Mulligan and Sala-i-Martin (1999a)). Active participation is the fundamental determinant of the success.[8] Leisure may represent the effort, such as political

[8] Empirical studies support this view: see Peterson (1994), Day (1990) and the results of the polls in Mulligan and Sala-i-Martin (1999a).

advertising and moral persuasion, by some members of each group to induce other agents to endorse their preferred policies. Alternatively, it can be interpreted as the degree of "political single-mindedness" in each group. If every citizen has a fixed amount of political resources to allocate among different issues, then the issue that abstracts the largest share of the group's political resources will be politically more successful. Then, the group whose members turn out to be focused on a single issue (single-minded) will also be the more politically successful, with respect to groups whose members care about different issues.

The role of the size in the pressure function was initially in Becker (1983, 1985), although it has often been neglected in the context of social security (with the exception of Verbon and Verhoeven (1992)). This represents a drawback of these models, since the size of each group is crucial in analyzing the impact of demographic changes on the political equilibrium. A time-intensive interest groups model including size effects will be developed in chapter 4.

The political activity of creating pressure typically involves a free rider problem, due to the positive externality, which each member enjoys from the activity of other members in her group. Every individual knows that the transfer she receives is determined by her group pressure, regardless of her individual effort or resources allocated. Thus, she will have an incentive to choose a lower level of political activity than it would be optimal from the point of view of the entire group. This effect becomes larger as the size increases, since members of a more numerous group have more incentives to free ride. The existence of a free rider problem justifies the use of distortionary policies by each group, in order to align their members' individual interest with the group's interest. For instance, in Mulligan and Sala-i-Martin (1999a) each group sets a labor income tax on its members in order to induce the individuals to choose the (higher) level of leisure which is optimal from the group's perspective.

The political influence exerted by each group on the policymakers depends on the pressure of both groups, on their size and other characteristics through the following influence function:

$$I^j = I^j(p^o(m^o, n^o), p^y(m^y, n^y), n^o, n^y, x) \qquad j = y, o.$$

Clearly, the influence exerted by each group depends positively on its own pressure and negatively on the pressure exerted by the opposite group. Notice that the size has an indirect effect

on the influence, through the level of pressure, and a direct one. The direct effect captures the idea that the political outcome may depend on the number of votes in favor of a policy as in a majoritarian voting model.

In this literature, influence functions have been given different specifications. In Mulligan and Sala-i-Martin (1999a) the influence functions are symmetric, that is, the way in which the pressure exerted by a group is converted into the influence is the same for both groups. This symmetry means that the two groups share the same "political technology". They are given the same fundamental political power, and the justification of the intergenerational transfer has to be based on economic reasons leading a group to exert more pressure than the other. In Grossman and Helpman (1998), this symmetry is dropped, and one group, typically the old, is assumed to be more efficient in exerting pressure (for instance, because they are the only group organized in a lobby or participating in political campaigns).

The two groups compete for political influence in order to induce policymakers to implement opposite policies. Thus, the political budget constraint implies that the aggregate influence has to be zero, $I^o + I^y = 0$. If one group succeeds in influencing the policymaker, the other one fails. In this simple framework, the influence exerted by the two groups determines the equilibrium policy chosen by the government, i.e., the intergenerational transfer, as follows:

$$\begin{aligned} F^o &= I^o \text{ transfer from young to old} \\ F^y &= I^y \text{ transfer from old to young} \end{aligned}$$

The constraint on aggregate influence implies that the sum of transfers must be zero, i.e. one group is paying the transfer to the other: $F^o = -F^y$. In other words, political competition leads to an equilibrium where there is one group of payers and one group of beneficiaries. However, the equilibrium transfer may also depend on the deadweight cost resulting from the distorting effects of payments (made or received) on hours worked, investments, and other choices by the agents. In this case, the effective amount of resources transferred to a group does not coincide with the amount of resources paid by the other group (Becker (1983, 1985), Becker and Mulligan (1998)).

The amount of pressure exerted by the agents, and the resulting political influence, depend on how agents expect their influence to affect the current and future policy decisions. Interest groups models typically assume no commitment: today's policymakers cannot pin down future policies. In fact, in these models, as Verbon and Verhoeven (1992) showed, political equilibria with social security may arise even when current politicians take future policies as given, if the political pressure of the old is sufficiently large. Mulligan and Sala-i-Martin (1999a) provide a complete characterization of the political equilibrium according to a parameter, which measures the degree of commitment: from lack of to full commitment. In Grossman and Helpman (1998), the successive governments have short time horizon: they care about the welfare of the currently living generations and possibly about campaign contributions from the lobbies representing the interests of the two generations, but they are unable to precommit the future course of redistributive taxation. They adopt a Markov-perfect-equilibrium concept. Agents condition their political actions on the current state of the economy and they expect future policies to depend on the state of the economy that will prevail when later decisions are taken.

Clearly, in all these models, in equilibrium social security arises because the old win the political competition and receive a positive transfer from the young. Models differ, however, in their focus on the political and economic elements that may induce a different political behavior across groups, and ultimately determine the political success of the old. Economic factors include lower labor productivity, less deadweight costs for the old, and the high probability for the young to eventually become old. Political elements include more efficiency in producing pressure, and more lobby-organization for the old.

Mulligan and Sala-i-Martin (1999a) consider a symmetric political process, and derive the political success of the old from two economic elements. First, old have lower human capital, and thus labor productivity. Because of their lower wages, it is less costly for the old group to set a higher tax rate on their members and to induce them to retire. Once retired, they will spend more time in lobbying to obtain transfers from the young group. Under this time-intensive hypothesis on pressures, social security is therefore associated with retirement. Second, since the young will eventually become old, they exert less opposition. These two elements increase the pressure exerted by the old group and its relative influence on the policymaker, which in turn determines their political success, the gerontocracy. This is the first model in the literature

reviewed so far that can explain the contemporaneous existence of retirement and social security.

Becker and Mulligan (1998) emphasize the role of a different economic element, the deadweight cost. Taxes and subsidies are assumed to induce a deadweight cost, which affects the political behavior of the two groups. In particular, taxpayers and recipients increase the amount of resources spent in lobbying activities, respectively to reduce tax payments and to rise subsidies. As a result, the old exert excessive pressure, which determines their success, whereas the young favor social security policies associated with large marginal deadweight costs (such as distortions of elderly work) in order to limit the size of the program.

Grossman and Helpman (1998), on the other hand, derive the success of the old from political elements only. They consider an asymmetric political process, which favors the old and determines their success. Specifically, successive generations of old are organized in lobbies, whereas the young are always politically unorganized. This assumption implies that when governments are unable to commit, it is difficult to guarantee transfers to the young, since these transfers could be undone tomorrow. Moreover, since they are the only ones to contribute to political campaigns, the old receive more transfers. Finally, the political process can give extra weight to the well-being of the old, for instance because the old care less than young about ideological issues and therefore they are more willing to compromise their party affinity in return for particularistic benefits (as discussed by Dixit and Londregan, 1996).

Verbon and Verhoeven (1992) combine both economic and political elements to determine the political success of the old. The social security system is more efficient than alternative savings schemes and the preferences of the politicians are biased towards the elderly.

2.4 Political Sustainability and Reforms

The current worldwide debate over social security has focused on the response of these systems to current and future demographic and economic dynamics. In particular, western democracies have devoted large attention to the impact of the baby boomers and of the aging population on the economic or financial sustainability of these systems.

In this section, I first survey the recent literature on the politico-economic models of social security response to demographic changes. The common question addressed in these works is:

Will current systems be politically sustainable given the demographic dynamics? I then turn to a new strand of literature that analyzes the political viability of social security reforms. As always, I ask whether these contributions can address the issue of the politically sustainability of retirement programs, together with social security.

In virtually all western populations, aging is due to the combined effect of a decrease in the fertility rate and an increase in the survival rate. These demographic changes have the following relevant implications for social security: i) the dependency ratio, i.e., the proportion of retirees per worker, increases; ii) the stock of capital raises, thereby increasing the wages and decreasing the interest rate; and iii) the size of the elderly population, and thus their political power, increases.

Bohn (1999) analyzes these aspects in the context of several economic models, in which preferences are aggregated through majoritarian elections. Specifically, these economic environments study the features described in sections 2.2.2 and 2.2.3. Bohn (1999) recognizes that the age of the median voter over social security increases as the population ages. He considers an environment in which changes in the dependency ratio do not affect the pensions benefits, because the social security payroll tax rate increases to compensate for the increase in the proportion of retirees per worker[9]. In this partial equilibrium setting, Bohn (1999) follows Browning (1975) methodology, and shows that, after reasonable demographic changes, the internal rate of return from social security for the new (older) median voter still exceeds the return on alternative safe assets. According to Cooley and Soares (1998) and Boldrin and Rustichini (2000), Bohn (1999) argues that extending the analysis to include the general equilibrium effects described in section 2.2.3 reinforces the evidence in favor of the political sustainability of the system.

In his comments to Bohn (1999), Joines (1999) raises two fundamental questions: What does political sustainability exactly mean? And how can the political sustainability of a current system be tested?

To answer these questions, consider the majoritarian voting model described in section 2.3.1, in which elections take place every period and there is no commitment over future policies. In

[9] Clearly, adopting the alternative assumption of leaving the tax rate constant and letting the pension benefits adjust to an aging population would affect the results, since the entire burden of the demographic change would be carried by the retirees.

a deterministic economic environment, a social security system can be introduced, and then sustained over time, only if current voters believe the system to be in place in the future[10]. Therefore, if political sustainability identifies the support of a voting majority, then lack of future sustainability is not compatible with current sustainability, unless either a stochastic environment is considered or the collapse of the system is induced by unexpected (demographic) shocks.

Boldrin and Rustichini (2000), for instance, analyze a stochastic two-periods overlapping generations model, in which the population growth rate is weakly decreasing, according to a Markov chain. They show that forward-looking rational voters choose to introduce a social security system, which is expected to be eventually abandoned.

Cooley and Soares (1996) adopt a four-periods stochastic overlapping generations model to quantitatively assess the sustainability of the US social security system to the post-war demographic shocks. In their model, the share of each generation in the total population is stochastic, and social security systems are allowed to award pension benefits that are contingent on the realizations of these shares, i.e., on the demographics. Initial voters determine the (linear) rule, which links the pension benefits to the realized shares of each generation in the total population. The payroll tax rate then adjusts to keep the budget balanced every period. For computational reasons, Cooley and Soares (1996) do not solve the maximization problem corresponding to entire stochastic process, but rather consider the path of the economy corresponding to the *expected* sequences of the stochastic variables. Interestingly, the social security system, which retains the majority under the expected demographic changes, associates increasing tax rates to an aging population, in order to maintain sufficiently large pension benefits. However, when compared with the post-war realizations of the demographic shocks, this demographic-contingent system would *not* obtain a majority of votes, and therefore it would not be politically sustainable.

Meijidam and Verbon (1996) and Galasso (1999) examine how social security systems need to be modified to retain political support under reasonable demographic dynamics. In the context of an interest groups model (see section 2.3.3), Meijidam and Verbon (1996) analyze the effects of expected and unexpected decreases in the population growth rates on the social

[10]Tabellini (1990) represents again the exception.

security tax rates. They suggest that if the initial size of the system is small, relatively to the savings, an anticipated decreases in the population growth rates (aging) rises the tax rate, whereas the effect is ambiguous for unexpected shocks. The intuition is straightforward. Aging increases the assets per capita, reduces the interest rate, and rises the dependency ratio and the political influence of the elderly. In their interest groups model, the first effect causes a reduction in the tax rate, whereas the remaining effects induce an increase. Therefore, the total impact is ambiguous, unless agents anticipate the future changes and can modify their asset holding decisions accordingly. In this case, the effects on the dependency ratio and on the political influence of the elderly dominate, and the tax rate increases.

In a large overlapping generations model calibrated to the US economy, Galasso (1999) compares the social security systems that would be supported by a majority of voters at steady state under different demographic dynamics. He shows that an aging population, characterized by lower population growth rates and higher survival probabilities, is associated to higher social security tax rates. In fact, the increase in the age of the median voter strongly dominates the negative effect on the dependency ratio, which reduces the implicit returns from social security.

Finally, Breyer and Stolte (1999) suggest that the current sustainability of most social security systems relies on the endogeneity of the labor supply, an element disregarded by most other models[11]. They argue that as the population ages, workers becomes poorer, since they expect their future pensions to be reduced. As a result, they are willing to supply more labor, and their labor supply becomes less elastic. Therefore, in a majoritarian voting model, in which the median voter belongs to the elderly, the social security tax rate increases as the population growth rate decreases, because the elderly are able to exploit the workers who have become more vulnerable.

Though it is a relevant issue, and strictly related to social security, none of these models talk about the political sustainability of retirement policies. In chapter four, I provide a politico-economic environment in which to analyze the impact of aging on both retirement and social security programs.

Moreover, all these models share a common feature. They assess the political sustainability

[11] Breyer (1994) suggests that social security systems were not too large, as argued by Browning (1975), because of their distortionary effect on the labor supply.

of social security systems by comparing the existing systems to a scenario in which there is no social security, and previous contributions are a sunk cost, i.e., they are not even partially refunded. Clearly, as argued by Cooley and Soares (1996) and Bohn (1999), current systems become less sustainable if compared to alternative schemes, which allow for partial refund of previous contributions.

This approach has been used by Cooley and Soares (1999) and Conesa and Krueger (1999) to study the political implementability of alternative reform proposals to privatize social security.

Before the analysis of these models, I have to highlight a common drawback of them: they identify social security reforms with privatization. Starting from this assumption, they don't analyze the proposals to reform the retirement programs, which may have impact on the social security system and on reforms of it, nor they examine the impact of the social security reforms on retirement programs. The results may be largely different in a context where social security and retirement are jointly analyzed. However, there exist no contributions in this spirit.

Cooley and Soares (1999) assume a four periods overlapping-generations economy with endogenous labor supply. The level of benefits is a constant proportion of the average labor income per worker, $b = \theta \overline{whe}$, where b is the level of benefit, θ is the replacement rate and $\overline{whe}$ is the weighted average earnings of the working generations. In this context, they address two questions: (i) will the system still be politically supported as the demographics change? and (ii) what transition policies that gradually eliminate social security benefits and replace them with private savings would be politically implementable? Since I already discussed the sustainability issue, I turn directly to the second question.

They first define a reform to be implementable if it is welfare improving for a majority of the current population. In this context, they analyze a gradual reform, which reduces the existing social security replacement rate over three periods. This reform reduces the workers' future benefits, but also their lifetime contributions to the social security system. The overall result is that in the first two periods the majority of the population opposes the reform, while from the third to the fifth period the reform is supported. However, this result depends on whether the benefits are financed by taxes, which can be on labor income, capital income, and consumption, or by issuing debt. Policies that use labor income taxes turn out to be opposed by the young, while those taxing capital income and consumption meet the resistance of the

older generations. Cooley and Soares (1999) argue that a condition for a privatization reform to be implementable is to have it partially financed by debt. In this case part of the costs of the privatization are transferred to future generations, therefore enlarging the support from current generations.

Alternatively, they consider a reform to be implementable if it is preferred by all agents in the economy, rather than by a simple majority. In fact, there may be policies not politically feasible because of the opposition of a minority of the population. Here, the transition to a private system can be financed through labor income or consumption tax, or by issuing debt. As in the previous case, the political feasibility of a reform relies on the use of debt to finance the transition. Debt shifts the burden to future generations, which will accept to bear it due to higher capital stock induced by the privatization. Under some conditions, which they argue to be verified in their computations, there exists a minimum share of the benefits financed by debt such that all current generations are indifferent between the reform and the status quo. Notice that, despite the reduced replacement rate (θ decreases), even the current older workers favor the reform, because as they expect future replacement rates to decrease, they increase their labor supply and accumulate more assets for their retirement. As a consequence, labor income and interest rates increase and the average earnings increase ($\overline{whe}$ increases). This effect offsets the direct effect of the decrease in the replacement rate and allows for higher benefits (b increases).

In a large overlapping generations economy, Conesa and Krueger (1999) analyze the political implementability of three alternative transition reforms. Reform A is an immediate termination of the social security system; the replacement rate is set equal to zero, and no pensions benefits are paid out. Reform B is a gradual termination of the social security system: the current replacement rate (equal to 50%) is reduced by one percentage point a year over 50 years and payroll taxes are accordingly reduced. Reform C consists of an initial announcement of the elimination of the system: the replacement rate maintained at the current level (50%) for 20 years, and it reduces to zero afterwards. The authors argue that the support for these alternative reforms depends on several of the elements surveyed in section 2.2. In fact, these reforms involve (i) intergenerational redistribution, since older agents who have contributed to the social security system lose part (Reform B) or all (Reform A) their entitlements; (ii)

intragenerational redistribution from high to low productivity agents, since payroll taxes are proportional while benefits are not related to contributions; and (iii) general equilibrium effects, since during the transition wages and interest rate change. Additionally, the termination of the social security system involves an efficiency gain from the abolition of the distortionary payroll tax to finance social security benefits.

The crucial element, however, is that the current social security system acts as a partial insurance device, since it substitutes for missing annuity markets and partially insures against idiosyncratic income uncertainty. Therefore, more within-cohort heterogeneity due to idiosyncratic uncertainty on individual labor productivity, i.e., agents of similar age have significantly different labor earnings and wealth, reduces the political support to a reform.

Their overall result is that, due to the large intergenerational and intragenerational redistribution effects induced by the reforms, none of these reforms will be supported by a majority of the population. However, reforms B and C will have less political support than A, since they involve a larger loss for middle-aged (reform B and reform C) and young (reform C) generations.

2.5 Social Security and the Welfare State

A drawback of the literature I reviewed so far is that it neglects the association between retirement and social security. This may be considered a more general drawback, since that literature abstracts from any interaction between social security and other redistributive programs. To the extent that these interactions take place, the use of one-dimensional models represents an important limitation to understanding the politico-economic determinants of these systems. A recent stream of literature has taken up this challenge, and has tried to identify the politico-economic complementarities, or sustitutabilities between social security and other programs. However, the most important association, the one between retirement and social security, has not yet received attention. The model in chapter three represents an attempt to fill this gap in this recent stream of literature.

I now review the existing contributions.

Lambertini and Azariadis (1998), and Conde Ruiz and Galasso (1999a) have focused on the joint determination of social security and an income redistribution scheme. Specifically, Lam-

bertini and Azariadis (1998) analyze a welfare system, composed of pure intragenerational and intergenerational transfers, to account for the rapid expansion in the government redistributive expenditure of the last decades. They attribute this increase in the welfare transfers to a shift of political power among the different voting coalitions which sustain the welfare system. Their political system is the agenda setting model of Baron and Ferejohn (1989). One of the three groups (old, skilled and unskilled young) is randomly chosen to make a policy proposal, which is then voted against the status quo at simple majority. The randomly chosen agenda setter exploits her power by proposing her most preferred policy among those which would be approved by a minimum winning coalition. In particular, the agenda setter "proposes" a policy alternative which will be accepted by the group whose bliss point is further away from the status quo. As a result, members in a voting coalition do not have to share similar preferences over the policy; they rather agree to enter a coalition because of a mutually advantageous political bargaining. Lambertini and Azariadis (1998) show that, although unskilled young voter dislike any intergenerational scheme, a coalition of old and unskilled young supports an equilibrium with positive intragenerational and intergenerational transfers.

Conde Ruiz and Galasso (1999a) examine a welfare system composed of a within-cohort redistribution scheme and an unfunded social security system. Their aim is to determine why in many democracies the largest welfare program, social security, selects its recipients by their age, rather than by their earnings or wealth. They argue that social security owns its wide spread support to two factors: (i) the political power of the elderly, and (ii) the intragenerational redistribution component of social security. They analyze a more complex welfare state to generalize Tabellini's (1990) idea (see section 2.2.4) that within-cohort redistribution induces low-income young to support social security to a more complete welfare state. In their political system, Shepsle's (1979) structure-induced equilibrium is combined with subgame perfection in a repeated voting game. In a dynamically efficient economy, they show that, for sufficient income inequality and enough elderly in the population, a welfare system composed of a within-cohort redistribution scheme and an unfunded social security system constitutes the political equilibrium of a two-dimensional majoritarian election. Social security is sustained by a majority of retirees and low-income young; intragenerational redistribution by low-income young.

Boldrin and Montes (1998) build on early work by Becker and Murphy (1988) to argue

that social security and public education should be analyzed together. They construct a model where public education and social security are implemented through an intertemporal political game. Young individuals are credit constrained, and thus could not borrow to finance their human capital accumulation. Public financing of education constitutes a way for these young to borrow from the adult generation the resources to invest in human capital. When adult, agents work, and pay an income tax to finance current young's education, and current old's pensions. Finally, they receive an old age pension upon retirement. This system of intergenerational transfers allows human capital accumulation to take place, promotes economic growth, and thus improves the performance of the social security system as a saving device. Boldrin and Montes (1998) show that such an intergenerational agreement can arise as an equilibrium of a majoritarian voting game, in which only adult and old are allowed to vote.

Finally, Conde Ruiz and Galasso (1999b) examine a welfare state in which the size of the social security system and the existence of an early retirement provision are determined in a two-dimensional majoritarian voting game. Using a notion of political equilibrium which combines Shepsle's (1979) structure-induced equilibrium with subgame perfection, they show that a social security system with an early retirement provision may initially be adopted, and be sustained over time. The voting majority is composed of elderly agents with incomplete working history, who are not entitled to old age pensions, and low-income young workers, who expect to retire early.

This new, multidimensional approach to the analysis of social security is, however, subject to a main drawback. In the context of a multidimensional issue space, Nash equilibria of a majoritarian voting game generally fail to exist. In these cases, there is no general consensus on which political institution should be used to aggregate individual preferences. Chapter three will adopt a probabilistic voting approach to handle political equilibria when the policy is inherently multidimensional.

2.6 Concluding Remarks

The recent contributions in the literature on politico-economic models of social security have certainly improved our understanding of the political determinants behind this widespread

phenomenon. However, they are still unable to explain the tight link between retirement and social security: What are the economic and political interactions between social security and retirement? This question has received little attention in the politico-economic literature of social security. Interest groups models provide a first answer to this question (Mulligan and Sala-i-Martin (1999a)), while majoritarian voting are unable to explain it. An appropriate framework to analyze this issue may be related to a recent body of literature which has analyzed social security systems within the context of a more integrated welfare state, composed of several redistributive programs. To the extent that a political mechanism can adequately aggregate individual preferences over multiple issues, these models are able to pin down the political and economic complementarieties among redistributive systems. The current literature, however, includes only a few stylized contributions and none of these focuses on the complementarieties between retirement and social security.

On the other hand, the literature on politico-economic models of social security has improved our understanding of the political sustainability of social security reforms. Calibrated politico-economic models have emerged to quantitatively assess the political sustainability of current social security systems and reforms, in the same spirit as Auerbach and Kotlikoff (1987) have studied their financial sustainability. However, these models focus on the impact of the aging process on social security, but neglect the sustainability of retirement programs. In most voting models, an aging population induces two opposite effects: (i) the dependency ratio increases, thus reducing the profitability of the system, and (ii) the median voter's age rises, inducing preference for more social security. Using a large overlapping generations model calibrated to the US, Galasso (1999) suggested that the total effect will lead to a larger social security system. Interest groups models provide a different insight: Becker (1983, 1985) argues that the rapid aging of population will reduce, rather than increase, social security, even though the old will have more voters, since the larger group will experience higher deadweight costs and larger free rider effects and therefore will be less efficient in exerting pressure. However, I will show in chapter four that that these effects may reduce retirement, rather than social security. The overall effect of aging on social security is instead ambiguous, due to opposite size and per capita effects.

The main message of this chapter is that, as a common feature of all past and current

programs around the world, the tight link between retirement and social security needs to be explained in any positive theory of social security and to be considered in any analysis of reforms. However, the politico-economic literature has so far provided very few contributions in this direction. This thesis takes up this twofold challenge: chapter 3 develops a model to explain the association between retirement and social security in a multidimensional voting framework; chapter four provides a model to study the impact of the aging process on retirement and social security and delivers testable implications, which will be supported by the empirical analysis in chapter five.

Table 2.1: Why do Social Security Systems Exist?

	Political Institutions		
Economic Factors	Majority Voting	Veto Power	Interest Groups Models
Dynamic Inefficiency	Browning (1975) Sjoblom (1985)	Azariadis-Galasso (1997)	
Reduced Time Horizon	Browning (1975) Sjoblom (1985) Boadway-Wildasin (1989) Cooley-Soares (1998) Galasso (1999)		
Altruism	Tabellini (1990)	Hansson-Stuart (1989)	
Within Cohort Redistribution	Tabellini (1990) Persson-Tabellini (2000) Conde Ruiz-Galasso (1999)		
Crowding-Out Effects	Boldrin-Rustichini (2000) Cooley-Soares (1998) Galasso (1999)		
Political Power of the old			Verhoeven-Verbon (1991) Verbon-Verhoeven (1992) Grossman-Helpman (1998) Becker-Mulligan (1998) Mulligan Sala-i-Martin (1999)[1]

[1] This is the only model which can explain retirement.

Chapter 3

Retirement and Social Security: A Probabilistic Voting Model

3.1 Introduction

The main common feature of the current social security programs is that retirement is associated with social security transfers. In countries all around the world, the elderly are forced or induced to exit the labor market in order to collect their pensions. As shown in the publication "Social Security Programs Throughout the World", in spite of differences in many other relevant features of social security programs, the association with retirement is common to all countries. Therefore, the following question is fundamental to understand the determinants of the current social security programs:

Why is social security always associated with retirement?

This chapter formulates a new model to jointly analyze retirement and social security programs in a multidimensional voting theory. The model provides a politico-economic explanation of why old people retire and receive social security benefits from the young.

The intuition for the result is the following. In a society composed of young and old individuals, both groups give a positive value to old-age leisure. When making their optimal choice of leisure, the old do not consider that their consumption of leisure provides a positive externality on the welfare of the young. As a consequence, the young induce the politicians to impose a positive tax on the wage income of the old, so that the old increase their level of leisure. There-

fore, retirement at old age arises as a result of an externality problem. Additional political aspects turn out to be crucial to explain the existence of social security. Since they retire, the old are a more ideologically homogeneous group than the young. This is because with no wage income they do not have to care about different issues related to their occupations or jobs, and thus can focus only on distributive issues. Thus, the old can exert more political power than the young, and can obtain a positive transfer financed by the young (social security).

There are two fundamental elements in the model which drive the results. They represent two original contributions of this model. First, leisure when old is a "merit good". The young value the consumption of this good by the elderly, and they support policies which induce retirement to favor old age leisure. This policy takes the form of a tax on old age labor income, which increases the leisure of the old. In this way, the model explains the existence of mandatory retirement regulations in all western countries. This hypothesis of merit goods has never been adopted in the context of politico-economic theories of social security. From the traditional theory of public finance (Musgrave, 1988) the fundamental idea is that the evaluation of those goods derives not simply from the norm of sovereignty, but it involves an alternative norm, mainly a community value as a restraint on individual choice. In the context of distribution, it implies in-kind redistribution of the goods which the doner considers meritorious for the donee. In this context, this hypothesis has been recently discussed by Mulligan and Philipson (1999). They argue that many programs rendering services to the poor, e.g. government health insurance, compulsory schooling, public housing, can be considered of this type. The rich seem to value consumption of these goods by the poor, and are willing to redistribute income to the poor, but only for these specific purposes. Mandatory retirement related to social security can also be interpreted as a program of this type. The government program redistributing from the young to the old represents the mechanism (a "merit-good contract") that the young use to "help" the old to enjoy old-age leisure, as they feel to be meritorious. These merit goods motives for redistribution are supported by evidence from the private non-profit sector, in which several private organizations (churches or others) complement or even substitute for the mandatory government programs in gathering help from rich to poor and elderly individuals. Similar reasoning, in the spirit of merit goods, may justify redistribution in the public sector. To summarize, merit good motives for the rich (or the young) may explain why many government

programs are designed to induce the poor (or the old) to modify their behavior (i.e., to increase old-age leisure).

The second crucial new idea is that the political power of each group depends on the degree of ideological homogeneity of members in the group, which in turn depends negatively on the level of wage income. To my knowledge this is the first attempt to formally endogenize the degree of ideological homogeneity. This hypothesis resembles Mulligan and Sala-i-Martin's (1999a) "single-mindedness" idea. While workers care about several opposite issues, related to their different occupations and industries, non-workers (e.g. retirees) are more united in their political action. The old turn out to be more politically successful because they focus on a single issue, i.e. pensions. Mulligan and Sala-i-Martin (1999a) provide empirical support for this "single-mindedness" hypothesis using cross-country government finance data and cross-country political participation surveys.

The model is developed as follows. The society is divided in two groups of voters, young and old. Today's young will be tomorrow's old. The two groups have different wage and size. Every individual in a group has a specific political preference, i.e. an ideology, which contributes to her voting decision. The degree of ideological homogeneity of members of the same group is captured by a density function. This function is endogenous. It depends negatively on the wage income, reflecting the fact that when the individuals in a group have lower wage income, they are on average more united in their ideological preferences, since they all care mainly about redistribution policies. In the limit, when they don't work, they focus on a single issue. This density function determines the political power of each group, since more ideologically homogenous groups are more politically successful. Two candidates are involved in the electoral competition. They act simultaneously and do not cooperate. Before elections take place, they make binding commitments to policy platforms; rational voters select their most preferred policy platform. Policy platforms are multidimensional. They include two instruments of intragenerational redistribution, the group-specific tax rates on wage income (with taxes rebated lump-sum to members of each group) and an instrument of intergenerational redistribution, the lump-sum transfer. The first policy depends on the "merit goods" motives. Since there exists an externality, a corrective positive tax on old age wage income is introduced, which increases leisure of the old. On the contrary, the wage income tax rate for the young has

value zero, since the tax is a distortionary instrument. Therefore, the old will choose a higher level of leisure than the young. I interpret as retirement the positive difference between the level of leisure chosen in old leisure and in youth. The outcome of the second policy depends on the political power of each group. Since they are induced to retire, the endogeneity of the density function implies that the old will have a higher level of ideological homogeneity, which in turn increases their political power and allows them to receive a positive transfer from the other group (social security). This explains the contemporaneous existence of social security transfers and retirement.

This relevant feature for all social security systems around the world is surprisingly an unsolved puzzle for the voting politico-economic theories: they mainly show why the elderly win the elections, as reviewed in the previous chapter, but do not explain why the transfers are contingent on implicit taxes or forced retirement. To the extent that the interaction between retirement and social security take place, the use of one-dimensional models represents an important limitation to understanding the politico-economic determinants of these systems. This is a drawback of all traditional politico-economic models of social security based on the median voter's theorem: in the context of multidimensional issue space, Nash equilibria of a majoritarian voting game generally fail to exist. The literature provides three types of solutions of this problem: the agenda-setting, the structure-induced equilibrium (Shepsle (1979)) and probabilistic voting[1]. This model is the first to use the probabilistic approach to explain the association between retirement and social security.

The chapter proceeds as follows: Section 2 introduces the model, its general features and the individual's and group's problem. Section 3 solves the model for the optimal choice of the multidimensional policy platform. Section 4 concludes.

3.2 The Model

3.2.1 General Features

I consider a two-periods overlapping generations model. Society is composed of two groups of voters, young and old, denoted by $i = y, o$. Today's young will be tomorrow's old. In each group

[1] See Persson and Tabellini (2000) for a review of this literature.

there is a continuum of voters with unit mass. The two groups have different size: $n^o \neq n^y$, where n^i is the size of group i. Individual's preferences are identical within groups and depend on consumption and leisure, according to a quasi-linear utility function[2]. They are endowed with one unit of time in youth and old age.

The preferences of the old depend on their consumption (c^o) and leisure (l^o):

$$u(c^o, l^o) = c^o + \psi^o H(l^o) \tag{3.1}$$

where ψ^o represents the intrinsic preference of old for leisure and H is increasing and concave in leisure: $H' > 0, H'' < 0$.

The old consume all their income:

$$c^o = w^o(1 - \tau^o)(1 - l^o) + A^o + b^o + T^o \tag{3.2}$$

where c^i is private consumption of group i , l^i is leisure of group i, w^i is the unitary wage per hour worked, τ^i is the tax rate on wage income, A^i is the asset income, b^i and T^i are transfers to the individual in group i.

The preferences for the young are given by:

$$u(c^y, l^y) = c^y + \psi^y H(l^y) + \varphi^y H(l^o) + \beta u(c^{o'}, l^{o'}) \tag{3.3}$$

where β is the individual's discount factor , ψ^y is the intrinsic preference of young for leisure and $'$ refers to the next period: young knows that they will be old in the next period.

The intrinsic value of leisure for the old is assumed not to be lower than the intrinsic value of leisure for the young: $\psi^o \geq \psi^y$. Individuals desire to supply less labor when old, because old-age leisure has an higher value for them than leisure in youth (for example, because effective time endowments in old age is reduced due to health considerations).

The utility function of the young includes leisure of the old, weighted by the parameter φ^y. Following Mulligan and Philipson (1999) I assume that leisure of the old is a "merit good" and

[2]Quasi-linearity simplifies the model since the income effects only show up in the linear component, i.e. consumption. It is a common assumption in this kind of redistributions models. See Persson and Tabellini (2000) for a review of these models.

it therefore gives positive utility to both old and young. Young enjoy if the old work less and spend more time in leisure.

The young can consume or accumulate their income. Their budget constraint is:

$$c^y + RA^{o\prime} = w^y(1-\tau^y)(1-l^y) + b^y + T^y \tag{3.4}$$

where R is the discount rate.

There are two types of transfers: intergenerational, i.e. across cohorts, and intragenerational, i.e. within cohorts. The intergenerational transfer, b^i, is a transfer across groups, mainly the social security transfer. Its budget is balanced every period, and it is equal to:

$$n^o b^o + n^y b^y + \alpha \left| n^o b^o \right| \left| n^y b^y \right| = 0 \tag{3.5}$$

where $\alpha > 0$ represent the deadweight loss of the tax and $b^o b^y \leq 0$, i.e., a generation is a net payer and the other a net recipient.

The intragenerational transfer, T^i is a within group transfer, which is financed through a labor income tax, τ^i, and is rebated lump-sum to the members of the group. The budget constraint is $T^i = w^i \tau^i (1-l^i)$.

In this way I introduce contemporaneously a tax on labor income and a social security transfer. The use of those instruments allows to take into account the fact that the majority of social security programs around the world combine transfers from young to old with strong inducement to retire (Mulligan and Sala-i-Martin (1999b)) and social security benefits are only weakly related to contributions.

A further assumption is that the old have lower unitary wages than the young. Specifically, when an individual becomes old, her unitary wage is not larger than the wage received in her youth, and not larger than the wage received by the current young: $w^o \leq w^y$ and $w^{o'} \leq w^y$. The lower labor productivity of the old can be justified by growth and depreciation of human capital. In Mulligan (1998) this hypothesis is supported by cross-sectional age-average hourly earnings. Mulligan and Sala-i-Martin (1999a) argue that the labor productivity of the old is lower than what age-earnings profile often suggest, due to Lazear-type (1979) long-term employment contracts, which imply that earnings are not just payment for labor services

rendered at the time, but also a return on past investment. Kotlikoff and Gokhale (1992) provide estimations which support this hypothesis.

The public policy vector q is defined by

$$q = (\tau^o, \tau^y, b^o, b^y)$$

To handle political equilibria since the policy is inherently multi-dimensional, I use a model with probabilistic voting (as in Persson, Roland and Tabellini (1998), Lindbeck and Weibull (1987), which in turn build on probabilistic voting models by Hinich et al.(1972) Coughlin and Nitzan (1981a, 1981b), Coughlin (1992)).

Consider two parties, or candidates, labeled A and B. Before elections take place, the parties commit to policy platforms, q^A and q^B. They act simultaneously and do not cooperate. Each party chooses the platform which maximizes its expected number of votes[3].

When platforms are chosen, the election outcome is uncertain, since the two parties are intrinsically different in some dimension other than the announced policies (reflecting ideologies), which voters care about. Voters are heterogenous with respect to their ideological preferences: voter j in group i votes for party A if

$$W^i(q^A) + \delta + \sigma^j > W^i(q^B) \tag{3.6}$$

where $W^i(q^A)$ is the indirect utility of voters in group i under government policy q^A and the term $(\delta + \sigma^j) \gtrless 0$ reflects voter j's ideological preferences for party A. This term includes two components, δ, which is common to all voters, and σ^j, which is idiosyncratic.

The first component, δ, reflects the general popularity of party A. This is a random variable with a uniform distribution on $(-1/2d, 1/2d)$. The expected value is zero and the density is d. This component is the source of the electoral uncertainty (parties announce their platforms under uncertainty about the election outcome), since it is assumed that δ is realized between the announcement of the party platforms and the election.

[3] As in a large literature (see Couglin (1992) for a review). Alternatively, and without changing the results, the objective of the party can be to maximize the probability of winning, which in turn depends on the electoral rule, as in Persson, Roland and Tabellini (1998).

The second component, σ^j, reflects the individual ideology of voter j. Voters are distributed within each group according to a uniform distribution on $(-1/2s^i, 1/2s^i)$. The density is s^i and the means is zero.[4]

I assume that the density is a positive and concave function of the inverse of the level of labor income, since it depends positively on the level of leisure and negatively on the wage rate:

$$s^i = s^i\left(\frac{1}{w^i(1-l^i)}\right)$$

with $s^{i\prime} > 0$, $s^{i\prime\prime} < 0$.

This is a crucial assumption, that I motivate as follows: s^i can be seen as representing the level of "political single-mindedness" of the group i. I think of every citizen as having a fixed amount of political resources which she must allocate among different issues. Higher s^i means that individual in group i are more homogeneous in their political action, focusing on a single "issue". Higher level of labor income means lower ideological homogeneity. Here, I generalize the "single-mindedness" hypothesis, introduced by Mulligan and Sala-i-Martin (1999a): while workers care about several opposite issues (members of different industries and different occupations tend to focus on issues that subsidize their own industry or occupation), nonworkers do not have such special interest and are united in their political action. They mainly care about redistributive programs. In this framework, not only higher level of leisure, but also lower level of wage rate, i.e. lower level of labor income, induces higher level of single-mindedness. In this way, I take into account that workers care about several opposite issues depending on the level of their labor income: low income agents rely more on redistributive programs, while high income agents care about several issues (labor income, property taxes, etc..). On the contrary, nonworkers who do not have other sources of income than the transfers are more homogeneous in their economic interests.

Each group has "ideologically neutral voters", who are indifferent between party A and B, called "swing voters". The identity of the swing voters is crucial when a party considers

[4]In general, both δ and σ^j may have expected values different from zero. Suppose σ^j is a random variable with uniform distribution on $(-1/2s^i+\overline{\sigma}^i, 1/2s^i+\overline{\sigma}^i)$. The density is s^i and the means is $\overline{\sigma}^i$. The specific means $\overline{\sigma}^i$ reflects the across groups difference in average ideology. Here, I assume that voters of both groups are on average ideologically neutral: $\overline{\sigma}^o = \overline{\sigma}^y = 0$.

whether to deviate from a common policy announcement $q^A = q^B$. Suppose party A decides an unitary increase of transfer to group o financed by a budget-balanced decrease of transfer to group y. Party A expects a gain of votes from group o equal to the number of swing voters in group o and a loss of votes from group y equal to the number of swing voters in group y. If group o has a higher number of swing voters, this is a net gain of votes. As a consequence, the party tries to attract the more mobile voters. Formally, the swing voter[5] in group i is identified by $\sigma^{s.w.}$ where

$$\sigma^{s.w.} = W^i(q^B) - W^i(q^A) - \delta \tag{3.7}$$

Voters with σ^j lower than $\sigma^{s.w.}$ vote for B and voters with σ^j higher than $\sigma^{s.w.}$ vote for A. Therefore, the vote share of party A in group i can be expressed by

$$\pi^{A,i} = s^i \left[W^i(q^A) + \delta - W^i(q^B)\right] + \frac{1}{2} \tag{3.8}$$

3.2.2 The Party's Problem

Each party maximizes the expected total number of votes, which is the sum of the expected total number of votes from the current young and old. Given the definition of $\pi^{A,i}$, the objective function of party A can be expressed as follows:

$$\max E(\sum_{i=y,o} n^i \pi^{A,i}) \tag{3.9}$$

Substituting the expression for $\pi^{A,i}$ and given the previous assumptions about the distributions, party A will choose q^A such as to maximize the following objective function:

$$\sum_{i=y,o} n^i s^i \left[W^i(q^A) - W^i(q^B)\right] \tag{3.10}$$

Clearly, if the number of swing voters is the same, the two groups get equal weight in the candidate's decision, which turns out to be maximizing the average voter's utility. However if the two groups differ in how easily their votes can be swayed, the group more ideologically

[5]Notice that the existence of a swing voter depends on the support of the distribution of δ.

homogeneous has more swing voters, it is more responsive to policy and gets a higher weight in the party's objective. In other terms, parties seek to please the more mobile voters.

Any feasible policy must satisfy the following constraints:

$$\begin{aligned} T^o &= \tau^o w^o (1 - l^o) \\ T^y &= \tau^y w^y (1 - l^y) \end{aligned} \tag{3.11}$$

$$\begin{aligned} n^o b^o + n^y b^y + \alpha |n^o b^o| |n^y b^y| &= 0, \alpha > 0 \\ b^o b^y &< 0 \end{aligned} \tag{3.12}$$

The constraints make explicit that the tax τ is an instrument of intragenerational redistribution and the transfer b is a policy for intergenerational redistribution. The first and the second equations indicate that labor income tax revenues are rebated lump-sum to the members of the group. The old and the young set a distortionary tax on income and redistribute revenues lump sum to the members of their group. Therefore, this policy is in principle inefficient and the optimal level of tax rate should be zero for both groups. However, as it will be shown below, a positive tax rate of the old may be induced by the externality of old age leisure in the young utility.

The third equation is the budget balanced constraint of the intergenerational program. Total transfers between groups and the amount of resources necessary to allow this process have to sum up to zero. The intergenerational transfer involves an efficiency loss. In other words, resources can be shifted from one group to another, but this procedure entails a deadweight cost. The cost is represented by the term $\alpha |n^o b^o| |n^y b^y|$, i.e. it depends in a quadratic way on the size of the transfer system. This term may represent bureaucracy's costs, or rents to the politicians. Thus, social security is a system which redistributes resources from the young to the old group and/or viceversa, at a cost which depends to its own size. The last constraint rules out the case of both negative transfers, which would represent a system in which bureaucracy extracts resources from both groups and there is no redistribution.

3.2.3 The Individual's Problem

From now on I specify $H(l^i) = \log l^i$.

Consider first the problem of the old. Each individual in group *old* solves the following problem:

$$\begin{aligned} \max_{\{c^o, l^o\}} u(c^o, l^o) &= c^o + \psi^o \log l^o \\ s.t.\ c^o &= w^o(1-\tau^o)(1-l^o) + A^o + b^o + T^o \end{aligned} \tag{3.13}$$

w^o, τ^o, b^o, T^o given. From the first order condition and the budget constraint, the optimal levels of leisure and consumption are:

$l^o = \frac{\psi^o}{w^o(1-\tau^o)}$

$c^o = w^o(1-\tau^o) - \psi^o + A^o + b^o + T^o$

From them, the indirect utility function is the following:

$W^o = w^o(1-\tau^o) - \psi^o + A^o + b^o + T^o + \psi^o \log \psi^o - \psi^o \log w^o - \psi^o \log(1-\tau^o)$

Each individual in group *young* solves the following problem:

$$\begin{aligned} \max_{\{c^y, l^y\}} u(c^y, l^y) &= c^y + \psi^y \log l^y + \varphi^y \log l^o + \beta(c^{o'} + \log l^{o'}) \\ s.t.\ c^y + RA^{o'} &= w^y(1-\tau^y)(1-l^y) + b^y + T^y \end{aligned} \tag{3.14}$$

w^y, τ^y, b^y, T^y given

$l^{o'} = \frac{\psi^{o'}}{w^{o'}(1-\tau^{o'})}$

$c^{o'} = w^{o'}(1-\tau^{o'}) - \psi^{o'} + A^{o'} + b^{o'} + T^{o'}$

$w^{o'}, \tau^{o'}, b^{o'}$ given.

Without loss of generality I assume that the discount rate equals the rate of time preferences, $\beta = R$, and that the parameter measuring the intrinsic preference for leisure is constant over time, $\psi^{o'} = \psi^o$.

From the first order conditions and the budget constraint it is:

$l^y = \frac{\psi^y}{w^y(1-\tau^y)}$

$c^y + RA^{o'} = w^y(1-\tau^y) - \psi^y + b^y + T^y$

From the first order conditions, the indirect utility function for the young is the following:

$W^y = w^y(1-\tau^y) - \psi^y + b^y + T^y + \psi^y \log \psi^y - \psi^y \log w^y - \psi^y \log(1-\tau^y) + \varphi^y \log \psi^o - \varphi^y \log w^o - \varphi^y \log(1-\tau^o) + R(w^{o'}(1-\tau^{o'}) - \psi^o + b^{o'} + T^{o'} + \log \psi^o - \log w^{o'} - \log(1-\tau^{o'}))$

3.3 Solving the Model

Consider the problem for party A (and symmetrically for party B):

$$\max_{\{q^A\}} \sum_{i=y,o} n^i s^i \left[W^i(q^A) - W^i(q^B)\right] \tag{3.15}$$

$$\begin{aligned} s.t. T^o &= \tau^o w^o (1-l^o) \\ T^y &= \tau^y w^y (1-l^y) \\ n^o b^o + n^y b^y + \alpha \left|n^o b^o\right| \left|n^y b^y\right| &= 0,\ \alpha > 0 \\ b^o b^y &< 0 \end{aligned}$$

Since individuals decide their optimal allocation of resources between consumption and leisure taking as given the policy platforms offered to them, the individual's indirect utility function is substituted into the party's problem. Moreover, the expressions for $T^o, T^{o\prime}$ and T^y in the equilibrium are:

$T^o = \tau^o w^o (1-l^o) = \tau^o w^o - \frac{\tau^o \psi^o}{1-\tau^o}$

$T^y = \tau^y w^y (1-l^y) = \tau^y w^y - \frac{\tau^y \psi^y}{1-\tau^y}$

$T^{o\prime} = \tau^{o'} w^{o'} (1-l^{o'}) = \tau^{o'} w^{o\prime} - \frac{\tau^{o\prime} \psi^o}{1-\tau^{o\prime}}$

The political equilibrium depends on the agents' expectation about future policy decisions. Here, the equilibrium concept is based on the following two assumptions. On one side, there is no commitment for the intragenerational policy, i.e., the tax rates (τ^o, τ^y): the party decides the tax rate for the two current groups and the young expect that their tax rate when they become old will be equal in equilibrium to the level of the tax rate for the current old. On the other side, there is "partial" commitment for the intergenerational policy, i.e., the social

security benefit. Following Mulligan and Sala-i-Martin (1999a), the transfer that young people expect to receive in the next period is a percentage ρ $(1 \leq \rho \leq 0)$ of the transfer that current old people are receiving. If $\rho = 0$ there is no commitment and if $\rho = 1$ there is full commitment, i.e., young people know that they will receive the same transfer as the current old.

Since parties act simultaneously and do not cooperate, each party acts taking the choice of the other party as given. Thus, taking q^B as given and specifying for $i = o, y$, party A solves the following problem:

$$\max_{\{q^A=\tau^o,\tau^y,b^o,b^y\}} n^o s^o \left[\begin{pmatrix} w^o(1-\tau^o) - \psi^o + A^o + b^o + T^o + \\ \psi^o \log \psi^o - \psi^o \log w^o - \psi^o \log(1-\tau^o) \end{pmatrix} \right]$$
$$-W^o(q^B)$$
$$+n^y s^y \left[\begin{pmatrix} w^y(1-\tau^y) - \psi^y + b^y + T^y + \psi^y \log \psi^y - \\ \psi^y \log w^y - \psi^y \log(1-\tau^y) + \varphi^y \log \psi^o - \\ \varphi^y \log w^o - \varphi^y \log(1-\tau^o) + \\ R(w^{o'}(1-\tau^{o'}) - \psi^o + b^{o'} + T^{o'} + \\ \log \psi^o - \log w^{o'} - \log(1-\tau^{o'})) \end{pmatrix} \right]$$
$$-W^y(q^B)$$

$s.t.$

$n^o b^o + n^y b^y + \alpha |n^o b^o| |n^y b^y| = 0, \alpha > 0$

$b^o b^y < 0$

$\tau^{o\prime}$ *given*

$b^{o'} = \rho b^o$

Taking into account that the density function s is endogenous, i.e., $s^o = s^o(\frac{1}{w^o(1-l^o)})$ and $s^y = s^y(\frac{1}{w^y(1-l^y)})$, the first order conditions are the following:

$$FOC(\tau^o) : n^o \frac{ds^o}{d\tau^o}(W^{oA} - W^{oB}) + n^o s^o \frac{dW^o}{d\tau^o} + n^y s^y \frac{dW^y}{d\tau^o} = 0 \tag{3.16}$$

$$FOC(\tau^y) : n^y \frac{ds^y}{d\tau^y}(W^{yA} - W^{yB}) + n^y s^y \frac{dW^y}{d\tau^y} = 0 \tag{3.17}$$

$$FOC(b^o) \;:\; CASE1 : b^o > 0 (b^y < 0) : n^o s^o + n^y s^y R\rho = \lambda(n^o + n^o n^y \alpha \left|b^y\right|) \quad (3.18)$$
$$CASE2 \;:\; b^o < 0 (b^y > 0) : n^o s^o + n^y s^y R\rho = \lambda(n^o - n^o n^y \alpha b^y)$$

$$FOC(b^y) \;:\; CASE\,1 : b^y < 0 (b^o > 0) : n^y s^y = \lambda(n^y - n^o n^y \alpha b^o) \quad (3.19)$$
$$CASE2 \;:\; b^y > 0 (b^o < 0) : n^y s^y = \lambda(n^y + n^o n^y \alpha \left|b^o\right|)$$

3.3.1 Tax Rates and Retirement

Since party B solves a symmetric and concave problem, it can be verified that in equilibrium the two parties choose the same platform, $q^A = q^B$ [6]and thus the level of utilities that the individuals can reach are the same, $W^{iA} = W^{iB}$ $(i = o, y)$.

Therefore, the first order condition for τ^o becomes:

$n^o s^o \frac{dW^o}{d\tau^o} + n^y s^y \frac{dW^y}{d\tau^o} = 0$

Substituting for the expressions of the derivatives of the indirect utilities with respect to the old group tax rate, the condition can be written as follows:

$n^o s^o \left(-\frac{\psi^o}{(1-\tau^o)^2} + \frac{\psi^o}{1-\tau^o}\right) + n^y s^y \frac{\varphi^y}{1-\tau^o} = 0$

Rearranging terms, the first order condition is:

$$n^o s^o \left(-\frac{\psi^o \tau^o}{(1-\tau^o)^2}\right) + n^y s^y \frac{\varphi^y}{1-\tau^o} = 0 \quad (3.20)$$

The first order condition for τ^y is instead the following:

$n^y s^y \frac{dW^y}{d\tau^y} = 0$

Substituting for the expression of the derivative, the condition becomes:

$n^y s^y \left(-\frac{\psi^y}{(1-\tau^y)^2} + \frac{\psi^y}{1-\tau^y}\right) = 0$

Rearranging terms, the first order condition is:

[6]This is a general result. See Coughlin (1992) for a review.

$$n^y s^y \left(-\frac{\psi^y \tau^y}{(1-\tau^y)^2} \right) = 0 \tag{3.21}$$

Proposition 1 *The old group sets a positive tax rate. The young group sets a zero tax rate.*

Proof. See Appendix. ■

The result derives from the following elements: for both groups the tax has an economic cost, due to the decrease in consumption which cannot be compensated by the increase in leisure ($-\frac{1}{(1-\tau^i)^2} + \frac{1}{1-\tau^i} < 0$ as long as $\tau^i > 0$). Since lump-sum transfers are available, taxation will always be inefficient. This is the only effect of tax and induces them to set a zero tax rate. However, for the old an additional additional effect arises, through the value of tax in the welfare of the young ($n^y s^y \frac{\varphi^y}{1-\tau^o}$). The "merit good" hypothesis implies that young people care about the leisure of the old. This represents a positive externality, since the old do not take into account that their choice of leisure has a positive value for the young. Thus a positive tax on old wage income is introduced, which induces them to enjoy higher leisure up to the level optimal for the all society.

Proposition 2 *Define retirement:* $R^o_{t+1} \equiv l^o_{t+1} - l^y_t = l^{o\prime} - l^y$ *if* $R^o_{t+1} > 0$. *Retirement exists* ($l^{o\prime} > l^y$).

Proof. See Appendix. ■

Corollary 3 *The old are more ideologically homogeneous ("more single-minded") than the young* ($s^o > s^y$).

Proof. See Appendix. ■

The propositions and the corollary show that retirement derives as the equilibrium outcome of a democratic voting process where the two groups of old and young are characterized by a different level of wages ($w^o < w^y$) and leisure for the old is a "merit good" ($\frac{dW^y}{dl^o} > 0$). Young people preferences induce the politicians to set a positive level of tax rate on labor income of the old, to induce them to increase their level of leisure. This tax corrects the externality: the old do not take fully into account the effects of their choice of leisure on the economic welfare, since they don't consider that their leisure has a positive utility for the young. The tax has

the function to induce the old to choose the optimal level of leisure, in other words to retire. Retirement implies a lower level of wage income for the old which in turn implies their higher ideological homogeneity, under the assumptions on the s function.

The Tax Rate for a Constant Elasticity Density Function

In this section I assume that the density function has constant elasticity equal to 1:

$$s^i = \left(\frac{1}{w^i(1-l^i)}\right)^{\epsilon} = \left(\frac{1}{w^i(1-l^i)}\right)$$

Under this assumption it is easy to find explicitly the optimal level of tax rate for the old:

$$\tau^o = \frac{(w^o - \psi^o)}{\left(w^o + \frac{n^o}{n^y}\frac{w^y-\psi^y}{w^y}\frac{\psi^o}{\varphi^y}\right)}$$

It is immediate to verify that $0 < \tau^o < 1$.[7]

It is also immediate to show that the following results hold:

1. $\frac{\partial \tau^o}{\partial w^o} > 0$ and $\frac{\partial \tau^o}{\partial w^y} < 0$
2. $\frac{\partial \tau^o}{\partial \psi^o} < 0$ and $\frac{\partial \tau^o}{\partial \psi^y} > 0$
3. $\frac{\partial \tau^o}{\partial \varphi^y} > 0$
4. $\frac{\partial \tau^o}{\partial\left(\frac{n^o}{n^y}\right)} < 0$

1. When the old wage rate increases, their density s^o decreases, because they are more ideologically "dispersed" and the negative effect of the tax, which depends on the density, decreases. In other words, less old people are damaged by the tax, and therefore, the optimal tax rate increases. On the other side, when the young wage rate increases, the density of the young s^y decreases and the positive external effect of the tax, which is multiplied by that density, decreases. In this case, less young people are favored by the tax. Thus, the optimal tax rate decreases.

[7] $(w^o - \psi^o) > 0$ since $l^o = \frac{\psi^o}{w^o(1-\tau^o)} < 1$ for all τ^o implies that at $\tau^o = 0$ it should be $l^o = \frac{\psi^o}{w^o} < 1, i.e.\ w^o > \psi^o$.

2. When the old intrinsic preference for leisure increases, the tax rate decreases. There is a direct effect, due to the decrease in consumption, which is larger than the increase in leisure, and an indirect effect through the increase of s^o, because the old are more ideologically homogeneous when they enjoy more leisure. The two effects imply that the optimal tax rate has to decrease. On the other side, when the young intrinsic preference for leisure increases, there is an increase of s^y, which implies that the optimal tax rate has to rise.

3. When the young preference for old leisure increases, the external effect of old age leisure on young increases, which implies a higher correcting tax.

4. When the relative size of the old increases, the negative effect of the tax increases (because old are negatively affected by the tax) and the positive effect of the tax decreases (because less young are enjoying the tax inducing retirement for the old). Thus a lower tax rate is required. This result implies that the aging process will decrease retirement, since there will be relatively less young that enjoy retirement of the old.

3.3.2 Optimal Benefit Rate

In the probabilistic framework developed above, the higher ideological homogeneity of the old implies that the old group have more "swing voters" and therefore more political power which allows them to obtain intergenerational transfers from the young.

Proposition 4 *There exist social security transfers from young to old:* $b^o > 0$ $b^y < 0$

Proof. See Appendix. ■

The previous proposition shows that in equilibrium the old receive a positive transfer from the young. This result replicates the current PAYG social security systems, where current young finance the pensions of current retirees. The model derives this result from the higher homogeneity of the old group: given their lower wage income, the old are more ideologically homogeneous, which gives them more political power to obtain resources from the young group.

Proposition 5 *The equilibrium level of the transfers from young to old are the following:*

$$b^y = \frac{1 - \sqrt{\frac{s^o}{s^y} + \frac{n^y}{n^o} R\rho}}{\alpha n^y}$$

$$b^o = \frac{1 - \sqrt{\frac{1}{\frac{s^o}{s^y} + \frac{n^y}{n^o} R\rho}}}{\alpha n^o}$$

Proof. See Appendix. ■

The equilibrium level of transfers decreases with the level of α, which reflects the amount of resources appropriated by the bureaucracy and therefore not redistributed between the two groups. This is of course true for both groups.

The transfer to a group increases with the density of the group itself and decreases with the density of the opposite group (higher s^y implies larger b^y and smaller b^o, while higher s^o implies larger b^o and smaller b^y). This result derives from the relation between the higher density and the larger number of swing voters. The group which is relatively more ideologically homogeneous (i.e. has the higher density s) contains more swing voters. Therefore shifting resources towards this group from the opposite group represents a net gain of votes for the candidate, and therefore an optimal policy. Note that due to the presence of bureaucracy costs, which increase with the comprehensive size of these transfers, it is not optimal to fully expropriate the group with lower density and redistribute all the resources to the group with higher density.

Finally, the equilibrium level of the transfer for each group depends on the relative size of the two groups[8]. When the relative size of old increases, there are two effects, both reducing the social security level: a direct effect due to the lower weight of future old in the party's problem and an indirect effect through the decreased level of retirement and therefore of relative political power of the old (It was proved that $\frac{\partial \tau^o}{\partial(\frac{n^o}{n^y})} < 0$ which implies that $\frac{\partial s^o}{\partial(\frac{n^o}{n^y})} < 0$).

3.4 Concluding Remarks

The model developed in this chapter represents the first attempt to solve the puzzle of the association between retirement and social security in a politico-economic model with a voting process. The explanation is based on two key assumptions: old age leisure is a "merit good" and the political power of a group relies on the ideological homogeneity, which depends negatively

[8]Notice that the sign of the transfers does not depend on the size of the groups, but rather on the relative density between the two groups.

on the wage income. Under these circumstances, a democratic voting-maximizer policy maker would set a positive tax on wages of the old people, with revenues redistributed lump-sum within the generation. This tax induces the old to retire and to become more ideologically homogeneous. This in turn allows them to receive a positive intergenerational transfer from the young, as a function of the existing bureaucratic costs.

The formulation adopted is quite general, and suggests that the arguments used may be extended in several directions. I individuate two of them. First, while the model assumes the "merit goods" hypothesis to explain the existence of mandatory retirement, the interactions between merit goods motives and politics may explain many redistributive policies involving mandatory programs (public education, public health). This as a new promising area of research.

Second, it would be interesting to estimate empirically the concentration of different groups of voters (the number of swing voters for each group) by age, income and other characteristics. It is well known that highly educated, rich, white, elderly, media exposed males participate more in the voting process (Delli Caprini and Keeter, 1996). However, in this framework what is relevant is not the number of voters in a group (voting turnout), but rather the number of swing voters, i .e., of people who vote mainly according to the proposed policy platforms and are ready to change party as the policy changes (voter choice). This is both a limit and a possible extension of the analysis of this chapter. On one side, the assumption that the within-group concentration depends on the wage income has to be supported with empirical estimates; on the other side, a general measure to estimate the number of swing voters related to a specific redistributive program has to be developed. There are still very few contributions in this direction. Stromberg (2000) studies the impact of mass media on government spending: mass media users have more swing voters and therefore more political power. He analyzes a major New Deal relief program implemented in the middle of the expansion period of the radio and shows that counties with many radio listeners received more relief funds. Stromberg also shows that, when controlled for income and wealth, the funds were not going to rich counties. Though in a different framework, this analysis provides evidence that groups that have more swing voters enjoy more political power and obtain larger transfers.

The debate on social security has recently focused on reforms of social security and on the

impact of demographic changes on the social security organization programs. How do theories predict current systems to adjust to the aging population? As stressed in the survey, one of the main drawback of existing models is that they do not adopt a general framework, where social security systems are analyzed within the context of a more integrated welfare state. The following chapter takes up this challenge and analyzes the associated retirement and social security programs in a dynamic economic and demographic environment.

3.5 Technical Appendix:

3.5.1 Proof of Proposition 1

Proposition 1: The old group sets a positive tax rate. The young group sets a zero tax rate. Therefore, the old group is taxed heavier than the young group.

Proof: The old group sets a positive tax rate: From equation (3.20) it is: $\frac{\tau^o}{1-\tau^o} = \frac{n^y}{n^o}\frac{s^y}{s^o}\frac{\varphi^y}{\psi^o}$. Since the right hand side is positive (all terms are positive), the left hand side has to be positive, which implies $\tau^o > 0$.

The young group sets a zero tax rate: Directly from equation (3.21) which is always negative when $\tau^y > 0$.

Therefore the old group is taxed heavier than the young group: $\tau^o > \tau^y = 0$. Q.E.D.

3.5.2 Proof of Proposition 2

Proposition 2: Define retirement: $R^o_{t+1} \equiv l^o_{t+1} - l^y_t = l^{o\prime} - l^y$ if $R^o_{t+1} > 0$. At the steady state retirement exists ($l^{o\prime} > l^y$).

Proof: Since from the previous proposition, $\tau^o > \tau^y$, in steady state $\tau^{o\prime} = \tau^o > \tau^y$. Since $w^{o\prime} < w^y, \psi^o \geq \psi^y$ by hypothesis, then $l^{o\prime} = \frac{\psi^o}{w^{o\prime}(1-\tau^{o\prime})} > l^y = \frac{\psi^y}{w^y(1-\tau^y)}$. Q.E.D.

3.5.3 Proof of Corollary 3

Corollary 3: The old are more ideologically homogeneous (single-minded) than the young ($s^o > s^y$).

Proof: $\tau^o > \tau^y$ and $w^o < w^y$ imply that $l^o > l^y$. Together with $w^o < w^y$ this implies that $w^o(1-l^o) < w^y(1-l^y)$ i.e. the old have lower labor income than the young. Since $\psi^o \geq \psi^y$, it

is $\frac{\psi^o}{w^o(1-l^o)} > \frac{\psi^y}{w^y(1-l^y)}$. Since s is a positive function of $\frac{\psi}{w(1-l)}$,
$s^o = s^o(\frac{\psi^o}{w^o(1-l^o)}) > s^y = s^y(\frac{\psi^y}{w^y(1-l^y)})$. Q.E.D.

3.5.4 Proof of Proposition 4

Proposition 4: There exist Social Security transfers from young to old: $b^o > 0$ $b^y < 0$

Proof. By contradiction.

I consider the two cases separately:

CASE 1: $b^o > 0$ $b^y < 0$

CASE 2: $b^o < 0$ $b^y > 0$,

I will prove that CASE 2 is impossible.

CASE 1: $b^o > 0$, $b^y < 0$

The first order conditions are:

$b^o)$ $n^o s^o + n^y s^y R = \lambda(n^o + n^o n^y \alpha |b^y|)$

$b^y)$ $n^y s^y = \lambda(n^y - n^o n^y \alpha b^o)$

The two conditions together imply:
$\frac{s^o + \frac{n^y}{n^o} s^y R}{s^y} = \frac{1+n^y \alpha |b^y|}{1-n^o \alpha b^o}$

CASE 2: $b^o < 0$, $b^y > 0$

The first order conditions are:

$b^o)$ $n^o s^o + n^y s^y R = \lambda(n^o - n^o n^y \alpha b^y)$

$b^y)$ $n^y s^y = \lambda(n^y + n^o n^y \alpha |b^o|)$

$\frac{s^o + \frac{n^y}{n^o} s^y R}{s^y} = \frac{1-n^y \alpha b^y}{1+n^o \alpha |b^o|}$

This case is impossible: from the previous corollary it is $s^o > s^y$, which implies that $s^o + \frac{n^y}{n^o} s^y R > s^y$. Therefore it must be $1 - n^y \alpha b^y > 1 + n^o \alpha |b^o|$, *i.e.*, $-n^y \alpha b^y > n^o \alpha |b^o|$. But this is impossible, since the left hand side is always negative and the right hand side is always positive. Therefore, the only possible is CASE 1: $b^o > 0$ $b^y < 0$. Q.E.D.

3.5.5 Proof of Proposition 5

Proposition 5: The equilibrium level of the transfer from young to old are the following:

$$b^y = \frac{1 - \sqrt{\frac{s^o}{s^y} + \frac{n^y}{n^o} R\rho}}{\alpha n^y}$$

$$b^o = \frac{1 - \sqrt{\frac{1}{\frac{s^o}{s^y} + \frac{n^y}{n^o} R\rho}}}{\alpha n^o}$$

Proof.

Since proposition 4 shows that CASE 2 is impossible, I consider only CASE 1.

Given the budget constraint:

$n^o b^o = \frac{-n^y b^y}{1-\alpha n^y b^y}$

and the equilibrium condition for CASE 1:

$\frac{s^o + \frac{n^y}{n^o} s^y R\rho}{s^y} = \frac{1+n^y \alpha |b^y|}{1-n^o \alpha b^o}$

it is:

$\frac{s^o}{s^y} + \frac{n^o}{n^y} R\rho = \frac{1+n^y \alpha |b^y|}{1-n^o \alpha b^o} = \frac{1+n^y \alpha |b^y|}{1+\frac{\alpha n^y b^y}{1-\alpha n^y b^y}} = (1 - \alpha n^y b^y)^2$

Solving the second order equation, the solution is:

$b^y = \frac{1 \pm \sqrt{\frac{s^o}{s^y} + \frac{n^y}{n^o} R\rho}}{\alpha n^y}$

Since $b^y < 0$ it must be:

$$b^y = \frac{1 - \sqrt{\frac{s^o}{s^y} + \frac{n^y}{n^o} R\rho}}{\alpha n^y}$$

Substituting into the budget constraint, the equilibrium level of b^o is the following[9]:

$$b^o = \frac{1 - \sqrt{\frac{1}{\frac{s^o}{s^y} + \frac{n^y}{n^o} R\rho}}}{\alpha n^o}$$

Q.E.D.

[9] It can be checked that $b^o > 0$ and $b^y < 0$, as follows:

$b^y < 0 \Leftrightarrow 1 < \sqrt{\frac{s^o}{s^y} + \frac{n^y}{n^o} R}$ i.e. $1 < \frac{s^o}{s^y} + \frac{n^y}{n^o} R$. Since $1 < \frac{s^o}{s^y} > 1, 1 < \frac{s^o}{s^y} + \frac{n^y}{n^o} R$. *Q.E.D.*

$b^o > 0 \Leftrightarrow 1 > \sqrt{\frac{1}{\frac{s^o}{s^y} + \frac{n^y}{n^o} R}}$ i.e.$1 > \frac{1}{\frac{s^o}{s^y} + \frac{n^y}{n^o} R}$ i.e. $\frac{s^o}{s^y} + \frac{n^y}{n^o} R > 1$. Since $\frac{s^o}{s^y} > 1, \frac{s^o}{s^y} + \frac{n^y}{n^o} R > 1$.*Q.E.D*

Chapter 4

Demography, Retirement and Social Security: An Interest Groups Model

4.1 Introduction

The survey makes clear that the debate on social security has recently focused on reforms and on the impact of demographic changes on the size of the social security programs. In this line of analysis, I then turn to my second question: *What will be the impact of the aging process on the current social security and retirement programs?*

This chapter develops a politico-economic model to explain the association between retirement and social security programs in a dynamic economic and demographic environment. To stress the political aspect, the analysis is based on an interest groups model. The model investigates the political equilibrium level of retirement and social security that will arise as the number of elderly in the population increases.

The political environment draws from Mulligan and Sala-i-Martin (1999a). Social security is derived as the equilibrium of the political competition of the two groups, old and young, both exerting political pressure to obtain a positive transfer from the other group. The political pressure depends on time spent in a time-intensive political activity, which is a constant fraction of time dedicated to leisure. Therefore, like in Mulligan and Sala-i-Martin (1999a) more leisure implies more pressure. The benefits obtained by each individual depend on her group aggregate political pressure, rather than on her own individual effort, and thus every individual has an

incentive to free ride. Each group may decide to introduce a tax on individual wage income, to induce the individuals to choose a higher level of leisure, up to the level which is optimal from the group point of view. Since the old have a lower wage than the young (deriving from growth and the depreciation of human capital), this tax turns out to be higher for the old group, and will induce retirement. Retirement allows the old to exert more pressure than the young and thus to be successful in obtaining a transfer from them. To examine the demographic determinants of the retirement and social security programs, I specify a political environment in which the size of each group may matter both in determining their aggregate political pressure, and directly in the decision of the policy maker. In a nutshell, I allow an increase in the size of the elderly to increase their political power.

In this framework, aging is thus associated with several separate effects: (i) it exacerbates the free-rider problem; (ii) through the rise of the size of the elderly, it increases their political power; (iii) through a per capita effect, it reduces the effectiveness of the aggregate political pressure, and the per capita social security transfer.

This chapter delivers three positive implications. First, the aging of the population rises the tax rate among the young and reduces it among the old. In fact, on one hand it worsen the "free-rider" problem among the old, thus inducing them to increase their tax rate. On the other hand, an increase in their size reduces the effectiveness of their average political pressure, as decreasing returns kick in, and the old decrease their tax rate. Since the second effect dominates, tax rates are reduced among the old and increased among the young. Second, the aging of the population decreases retirement. This represents a direct consequence of the previous process. Lower taxes among the old reduce their leisure and therefore the retirement. Third, the aging of the population has opposite effects on the social security transfer. The size effect increases the political power of the elderly and thus leads to larger transfers. However, the per capita effect moves in the opposite direction, since it reduces both the level of retirement and the per capita transfer. The profitability of the system is reduced, and the transfer decreases. As a result, the overall effect of aging on the size of social security is ambiguous.

The chapter is organized as follows: the next section presents the model, and the political environment; section 3 solves the model on balanced growth; section 4 concludes.

4.2 The Model

I consider a two periods overlapping generations model. Society is composed of two distinct groups of individuals, young and old, denoted by $j = o, y$. The two groups have different size: n^o is the number of individuals in the old group and n^y the number of individuals in the young group ($n^o \neq n^y$). I focus on the aging process, which is identified by an exogenous increase in the number of old people in the population: $n^o_{t+1} > n^o_t$.

Individuals value consumption and leisure in youth and old age according to a quasi-concave utility function. In both periods of their life they are endowed with one unit of time to be devoted to labor and leisure. Borrowing and lending take place at an exogenous rate of interest r. Agents have to pay a group-specific tax on their labor income, which is then rebated lump-sum within each group. Additionally, there exists an intergenerational program which redistributes across groups. This intergenerational redistribution program, i.e., social security, is determined through a process of a time-intensive[1] political competition between the two generations of old and young[2]. They represent two interest groups which compete for receiving a transfer from each other. Each group exerts a time-intensive political pressure (described by a pressure function) and the interaction of the pressure of the two groups determines the existence and size of the social security system. Intergenerational promises are non-enforceable: current old cannot promise the young to tax the next generation, and therefore to pay them an old-age transfer. However, the existence of a social security program today may increase the possibility that social security is in place in future periods. This assumption helps to explain the weak relation between benefits and contributions[3]. Group-specific fiscal policies, represented by a proportional labor income tax and by a lump-sum transfer are meant to deter the free-rider problem. The tax rate is chosen within each group to achieve the optimal level of group pressure.

The economic and political decisions of the agents can be summarized in three stages:

- Stage 1. Each interest group chooses the labor income tax rates to impose on its members,

[1] See chapter 2 for a review of these models. Justifications for the specific hypothesis adopted here are stressed in the following section.

[2] In the Appendix, I provide a democratic foundation to this formulation, and show that this pressure function approach can be derived from a probabilistic voting model.

[3] See Mulligan and Sala-i-Martin (1999a): According to The House Ways and Means Committee (1996) an average earner retiring at age 65 in 1940 recovered in 5 months his lifetime OASI contributions with interest; those retiring in 1960 in 2 years, those in 1980 in 4 years, those in 1996 in 28 years.

taking into account the effects of the tax on their political participation and on their utility, as well as on future decisions. Non members actions are taken as given. The aim is to induce the members to exert the optimal individual political pressure from the group point of view.

- Stage 2. Every individuals chooses current consumption and leisure, taking current and future prices, tax rates and subsidies as given, to maximize her utility function.
- Stage 3. Given the amount of redistribution of the previous period, the political pressure exerted by each interest group determines the pattern of transfers across groups for the current period.

It is convenient to analyze these decisions backward, starting from stage three.

4.2.1 Stage 3: Transfers across Groups

In this stage, the political pressure exerted by each group is combined to determine the political equilibrium policy outcome, i.e., the size of the social security system. I first describe in detail the pressure function, which aggregates individual political actions into the group political pressure. Then I characterize the transfer function, which maps the two group's political pressure, and their relative size, into an intergenerational transfer. In other words, the transfer function represents the outcome function of the pressure game.

The Pressure Function

The pressure measures the aggregate political activity exerted by each group. I consider the following general formulation:

$$p^j = p^j(l^j, n^j) \qquad \text{(Pressure function)}$$

$j = \{o, y\}$, where l^j is the average leisure of the individuals in group j and n^j is the number of individuals in group j.

$$\frac{\partial p^j}{\partial l^j} > 0, \frac{\partial p^j}{\partial n^j} > 0 \qquad \text{(Property1)}$$

The pressure function has the same formal function for both groups. The pressure exerted by each group depends positively on two elements: the average time dedicated to the political activity by each individual and the number of individuals in the group.

The former element corresponds to the hypothesis of *time-intensive* pressure, introduced by Mulligan and Sala-i-Martin (1999a). This hypothesis assumes that the pressure depends on the time dedicated to the political activity by each individual in the group, which represents a constant fraction of the time that the individual allocates to leisure. Thus, the pressure depends on the level of leisure chosen by the individual. There are several interpretations of leisure in the pressure function. The basic idea is that what is crucial to determine the political pressure, and therefore the political success of a group is the amount of time spent in the political activity, rather than the amount of money spent. Active participation is the fundamental of the success.[4] Additionally, the success depends on the cohesion among the members of the group with respect to the issues they care about: if a group has active members who focus their energies on a narrow range of issues, it will be more likely successful. In this sense, leisure in the pressure function may measure the amount of "political single-mindedness" for each group, which facilitates its political success. If every citizen has a fixed amount of political resources, to be allocated among different "issues", the "issue" that acquires the most aggregate political resources will be the most politically successful. Thus, the group whose members turn out to be the more united in their political action ("single-minded"), will also be the more politically successful.[5]. Leisure may also represent the effort, such as political advertising and moral persuasion, by some members of each group to influence members of the same group and of the other group to support their preferred policies. Under this interpretation, the group which is able to obtain more political support from the other will be more successful.

The latter element in the pressure function suggests that the size of a group matters for its political pressure. This hypothesis is meant to capture an element of democracy, the relevance of the large voting groups. It generalizes Mulligan and Sala-i-Martin's formulation (1999a) in

[4] Empirical studies support this view: see Peterson (1994), Day (1990) and the results of the polls cited as example in Mulligan and Sala-i-Martin (1999).

[5] For instance, while workers care about a lot of opposite issues (members of different industries and different occupations tend to focus on issues that subsidize their own industry or occupation), nonworkers do not have such special interests and are united in their political action (they care only about monetary transfers and medical care).

which the assumption of equal size implied that for each group the pressure was equal to the leisure, to account for demographic effects in the political pressure. This element proves to be relevant for the results on retirement and social security. I refer to it as the "pressure size effect".

The political pressure exerted by every group depends on the average leisure of its individual members. It is well-known in this literature (see chapter two for a review) that this formulation gives rise to a free-rider problem, since members of a group does not fully internalize the effect that their leisure decision has on their group's political pressure. Clearly, as the size of the group increases, the free-rider problem becomes more severe, because the relative importance of an individual contribution decreases. Formally, we have that:

$$\begin{aligned} \frac{\partial p^j}{dl^j} &> \frac{\partial p^j}{dl^{j,i}} > 0 \\ \frac{\partial p^j}{dl^j} - \frac{\partial p^j}{dl^{j,i}} &= \xi(n^j), \xi' \geq 0 \end{aligned} \qquad \text{(Property 2)}$$

where $l^{i,j}$ represents the leisure of an individual i in group j.

This property makes explicit two features: the first one is the existence of a free rider problem (as already in Mulligan and Sala-i-Martin 1999a), the second one relates the free ridering to the size of the group. Members of a more numerous group have more incentives to free ride. The reasons behind the free rider effect can be explained as follows. There exists a positive externality, which each member enjoys from the activity of other members of his group. Individuals do not take fully into account the effects of their political activity on the welfare of the other members of the group. Moreover, every individual knows that the transfer he receives will be determined by his group's aggregate pressure, regardless of his own individual contribution. Thus, he will be tempted to choose a lower level of political activity with respect to what the group believes it would be optimal. In a sense, there is a difference between the perception that each individual has on the impact of his own political effort on the aggregate pressure, and the perception that the group has on the impact of each individual. Every individual believes that his own effort has a small (in the limit, zero) effect on the aggregate pressure, and that as the size of the group increases, his own impact decreases.

The Transfer Function

The aggregate pressures determine the intergenerational transfers between the two groups[6], according to the transfer function

$$F_t^o = f(p^o(l^o, n^o), p^y(l^y, n^y), \frac{n^o}{n^y}, x) + \rho F^o{}_{t-1} \qquad \text{(Transfer function)}$$

The current transfer to the old depends on the previous period transfer $F^o{}_{t-1}$, and on the transfer function f. The parameter $\rho \in [0, 1]$ represents the persistence of the government program. The existence of a social security program in the past makes it easier to sustain it today[7]. The transfer function depends on the pressure of both groups ($p^o$and p^y), on their relative size ($\frac{n^o}{n^y}$), and on other characteristics (x). Notice that the relative size of the groups affect the political outcome both through its impact on the pressures and through the number of votes (the direct effect of the relative size). I call the latter effect the "voters size effect". This generalizes Mulligan and Sala-i-Martin's formulation, in which the transfer only depended on the relative pressure, i.e., on the leisure to an environment in which the traditional models based on the median voter theorem can be incorporated (this would correspond to the special case of zero pressure and transfers which depend only on the relative size).

The transfer function satisfies the following properties:

$$F^o = -F^y \qquad \text{(Property 3)}$$

This requests an accounting identity. Resources are either transferred from young to old, or viceversa, or there are no transfers ($F^o = F^y = 0$).

$$\frac{\partial F^o}{\partial p^o} = \frac{\partial F^y}{\partial p^y} \qquad \text{(Property 4)}$$

The transfer function is "symmetric", that is how the pressure exerted by a group influences the transfer is equal across groups. This symmetry means that the "political technology" does not favor either group. The two groups are given the same "fundamental political power". An

[6] See the appendix for a microfoundation of the transfer function derived from a democratic voting mechanism.

[7] There exists a literature which analyzes the persistence of government programs. See Romer (1994) and Wilensky (1975).

analogous property is in Mulligan and Sala-i-Martin's (1999a).

$$\frac{\partial F^o}{\partial p^o} > 0, \frac{\partial F^o}{\partial p^y} < 0, \frac{\partial F^y}{\partial p^y} > 0, \frac{\partial F^y}{\partial p^o} < 0 \qquad \text{(Property 5)}$$

This property is quite intuitive. It guarantees that the transfer obtained by each group depends positively on its own pressure and negatively on the pressure exerted by the opposite group.

The following two properties refer to the specification adopted for the transfer function and to the way in which leisure affects the transfer. Remember that the transfer depends on leisure only through the pressure function.

$$\frac{\partial F^o}{\partial l^o} \geq 0, \frac{\partial^2 F^o}{\partial^2 l^o} \leq 0, \frac{\partial F^y}{\partial l^y} \geq 0 \frac{\partial^2 F^y}{\partial^2 l^y} \leq 0 \qquad \text{(Property 6)}$$

This property guarantees that the transfer function is non decreasing and non convex in leisure. Leisure has a positive (or non-negative) effect on the transfer that each group can obtain from the other. However, the impact of leisure on the transfer displays decreasing marginal returns, because as an individual becomes more involved in political activity, an additional contribution she makes has a smaller (or at least equal) effect.

$$\frac{1}{n^o}\frac{\partial F^o}{\partial l^o} = \zeta(n^o), \zeta' \leq 0, \frac{1}{n^y}\frac{\partial F^o}{\partial l^y} = \xi(n^o), \xi' \geq 0 \qquad \text{(Property 7)}$$

When the number of members increases, the effect of the average individual effort on the aggregate transfer, weighted by the number of members, is not increasing. In other words, the average contribution is not able to increase the value of the per capita transfer, when the size increases. On the other hand, the average contribution increases the average value of the transfer as the size of the other group increases. This property captures the existence of decreasing returns to size in the average contribution. As the number of members increases, there exist two positive effects on the overall transfer (the pressure size effect and the voters size effect). However, the average individual contribution has a lower impact on the per capita transfer. I call this property the "per capita pressure effect".

$$\frac{\partial F^o}{\partial \frac{n^o}{n^y}} > 0, \frac{\partial F^y}{\partial \frac{n^y}{n^o}} > 0 \qquad \text{(Property 8)}$$

This is the direct effect of the proportion of voters. As the relative size of one group increases, the number of "votes" of this group increases and this leads to a larger transfer. However, the increase in the relative size of one group also affects the relative pressure of the two groups, both directly and through the free-riding effect. The overall result is therefore ambiguous.

An example of a pressure and a transfer function which satisfies these properties is the following:

$p^o = l^o (n^o)^\alpha , p^y = l^y (n^y)^\alpha \ (\alpha < 1)$

$f(p^o, p^y, \frac{n^o}{n^y}) = l^o (n^o)^\alpha - l^y (n^y)^\alpha + \log \frac{n^o}{n^y}$

$F_t^o = f(p^o, p^y, \frac{n^o}{n^y}) + \rho F_{t-1}^o$

Since individuals care about the per capita transfer, rather than about the aggregate transfer, it is useful to define the transfer from group y to group o in per capita terms:

$$\frac{F_t^o}{n_t^o} = \frac{f(p^o(l^o, n^o), p^y(l^y, n^y), \frac{n^o}{n^y}, x) + \rho F_{t-1}^o}{n_t^o} \tag{4.1}$$

This expression highlights the existence of an additional effect. Together with the effects described above, an increase in the number of members of a group decreases the per capita transfer, since more people have to share the transfer. This "per capita transfer" effect increases the ambiguity of the impact of an increase in the group size on the transfer it receives. Will the "per capita" effects (pressure and transfer) compensate the increase in the political power due to a larger group size (pressure and voters size effects)? In the remaining of this chapter I will try to characterize the effects and to provide an answer.

4.2.2 Stage 2: Individual's Choice

At this stage, every individual chooses his optimal allocation of time between leisure and work and his optimal consumption,[8] by maximizing his utility function, which depends on consumption and leisure, under his budget constraint. An agent receives income from the assets he owns (A), from the wage earned for each hour worked ($w(1-l^i)$), and from the transfer that the group

[8]This analysis stresses the impact of size on the relation between each individual and his group (free-riding problem) and between the two groups (transfer policy), but does not allow for intragroup heterogeneity. A useful extension of the basic model would be to consider that individuals in the same group differ in their pre-tax income (f.i., $w^j(1+e^{i,j})$ where j identifies the group and i the individual). In this way the analysis would consider the intragenerational as well as intergenerational effects of the social security system.

he belongs to obtains from the opposite group and shares among its members ($\frac{F}{n}$). As argued in the previous section, the presence of an externality due to the free rider effect within each group implies that the optimal level of leisure from the individual point of view differs from the optimal level from the group's point of view. To solve this problem, in the pigouvian tradition, a proportional tax on wage income is introduced, at rate τ^j, with tax revenues rebated lump sum to members of the group ($\tau w(1-l)$). The optimal tax rate, which will be derived in stage 1, is the one that induces each individual to choose the optimal level of leisure from the group's point of view.

The Old

Old individuals choose their optimal level of consumption and leisure, taking as given after-tax wage and the transfer. The program for the old is the following:

$$\max_{\{c^{o,i},l^{o,i}\}} u^o(c^{o,i}, l^{o,i}) \tag{4.2}$$
$$s.t. c^{o,i} = A^{o,i} + w^o(1-l^{o,i})(1-\tau^o) + \tau^o w^o(1-l^o) + \frac{F^o}{n^o}$$

Introducing directly the budget constraint into the utility function, and maximizing with respect to $l^{o,i}$, I obtain the following first order condition:

$$u'(c^{o,i})\left(-w^o(1-\tau^o) + \frac{1}{n^o}\frac{\partial F^o}{\partial p^o}\frac{\partial p^o}{\partial l^{o,i}}\right) + u'(l^{o,i}) = 0 \tag{4.3}$$

which can be conveniently written as:

$$MRS^{o,i} = \frac{u'(l^{o,i})}{u'(c^{o,i})} = w^o(1-\tau^o) - \frac{1}{n^o}\frac{\partial F^o}{\partial p^o}\frac{\partial p^o}{\partial l^{o,i}} \tag{4.4}$$

The solution to equation 4.4 and to the budget constraint are the individual demand functions for consumption and leisure, which determine the indirect utility function.

The Young

Similarly, young individuals choose their optimal level of consumption and leisure, subject to the intertemporal budget constraint and taking as given the young and old-age after tax wages. We assume that the young are taxed on their labor income (τ^y is the tax rate) and that the revenues are rebated to the members of the group in a lump sum fashion. An apostrophe $'$ always indicates next period variables. The optimization problem of the young is thus:

$$\max_{\{c^{y,i}, l^{y,i}, c^{o'}\}} u^y(c^{y,i}, l^{y,i}) + \beta u^{o'}(c^{o,i'}, l^{o,i'}) \tag{4.5}$$

$$\begin{aligned} c^{y,i} + Rc^{o,i'} &= w^y(1-l^{y,i})(1-\tau^y) + \tau^y w^y(1-l^y) - \frac{F^o}{n_t^y} + \\ & R\left(\begin{array}{c} w^{o'}(1-l^{o,i'})(1-\tau^{o'}) + \tau^{o'} w^{o'}(1-l^{o,i'}) \\ + \frac{F^{o'}}{n^{o'}} \end{array} \right) \end{aligned}$$

where β is the discount factor and by property 3, $F^y = -F^o$. Borrowing and lending occurs at an exogenous rate of interest r ($R \equiv (1+r)$).

Taking the Lagrangian, the first order conditions with respect to consumption and leisure in youth, and old age consumption are respectively:

$$FOC(c^y) : \frac{\partial u^y}{\partial c^{y,i}} = \lambda \tag{4.6}$$

$$FOC(l^y) : \frac{\partial u^y}{\partial l^{y,i}} = \lambda \left(\begin{array}{c} w^y(1-\tau^y) + \frac{1}{n^y} \frac{\partial F^o}{\partial p^y} \frac{\partial p^y}{\partial l^{y,i}} - \\ R\rho \frac{1}{n^y} \frac{\partial F^o}{\partial p^y} \frac{\partial p^y}{\partial l^{y,i}} \end{array} \right) \tag{4.7}$$

$$FOC(c^{o'}) : \beta \frac{\partial u^{o,i'}}{\partial c^{o,i'}} = \lambda R \tag{4.8}$$

Notice that in taking the leisure decision, young individuals consider the traditional leisure-consumption trade-off, and the impact that the more leisure (and thus more political activity) has on today and tomorrow transfers. This last effect is driven by the element of policy persistence introduced in the transfer function, through the persistence parameter ρ.

It is convenient to rewrite the first order conditions as:

$$MRS^{y,i} = \frac{u'(l^{y,i})}{u'(c^{y,i})} = w^y(1-\tau^y) + \frac{1}{n^y}\frac{\partial F^o}{\partial p^y}\frac{\partial p^y}{\partial l^{y,i}} - R\rho\frac{1}{n^y}\frac{\partial F^o}{\partial p^y}\frac{\partial p^y}{\partial l^{y,i}} \tag{4.9}$$

where I have used the fact that $n^{o\prime} = n^y$

The solution to equation 4.9 and to the budget constraint gives the individual demand functions for consumption and leisure.

4.2.3 Stage 1: Group's Choice (tax rate)

At the initial stage each group chooses the optimal level of income tax to impose on their own members to overcome the free-riding problem and induce them to exert more political activity, i.e., to choose more leisure. To find the intragroup tax rate which induces the optimal level of group political pressure, I solve the agents optimization problem from the point of view of the group. In other words, the individuals now take fully into account the impact that their leisure decision has on the political pressure of their group, and thus to the policy outcome through the transfer function. They choose their level of leisure as if they were choosing the average leisure in the group. To draw a parallel with the literature on externality, this optimization problem corresponds to the social planner (in each group) decision. I will then determine the tax rate (in each group) which decentralizes the social planner decision (in each group).

The Old

The old group solves the following problem:

$$\max_{\{c^o, l^o\}} u^o(c^o, l^o) \tag{4.10}$$
$$s.t. c^o = A^o + w^o(1-l^o) + \frac{F^o}{n^o}$$

The first order condition is:

$$\frac{\partial u^o}{\partial l^o} + \frac{\partial u^o}{\partial c^o}\left(-w^o + \frac{1}{n^o}\frac{\partial F^o}{\partial p^o}\frac{\partial p^o}{\partial l^o}\right) = 0 \tag{4.11}$$

$$MRS^o = w^o - \frac{1}{n^o}\frac{\partial F^o}{\partial p^o}\frac{\partial p^o}{\partial l^o} \tag{4.12}$$

As expected, the marginal rate of substitution from the individual optimization problem (equation 4.4) differs from the marginal rate of substitution obtained by the group (equation 4.12), since the individuals do not take into account the externality. To decentralize the solution at equation 4.12, the group can impose a labor income tax, τ^o, to distort the leisure decision of the individuals. The optimal tax rate equates the marginal rate of substitution of the individual (equation 4.4) to the marginal rate of substitution of the group (equation 4.12). Therefore, if it is unique[9], the optimal tax τ^o_* can be derived as follows:

$MRS^{o,i}(\tau^o_*) = MRS^o \Leftrightarrow w^o(1-\tau^o_*) - \frac{1}{n^o}\frac{\partial F^o}{\partial p^o}\frac{\partial p^o}{\partial l^{o,i}} = w^o - \frac{1}{n^o}\frac{\partial F^o}{\partial p^o}\frac{\partial p^o}{\partial l^o}$

$$\tau^o_* = \frac{1}{w^o}\frac{1}{n^o}\frac{\partial F^o}{\partial p^o}\left(\frac{\partial p^o}{\partial l^o} - \frac{\partial p^o}{\partial l^{o,i}}\right) \tag{4.13}$$

The solution shows that when the free rider effect is larger, the optimal tax rate will increase, since the group has to set a higher tax to correct the larger effect. Notice that the size of the group has a direct negative impact on the optimal tax rate (per capita effect) and an indirect positive impact, through the free rider effect (which increases with the number of members). The overall effect on the optimal tax rate of an increase of the number of old people is therefore ambiguous. However, given the properties assumed for the transfer function, if in the limit the relative impact of the individual effort is small, I obtain the following result.

Proposition 6 *If* $\frac{\partial p^o}{\partial l^{o,i}} = 0$, *the optimal tax rate for the old is a decreasing function of the number of the old.*

Proof. Directly from property 7: $\frac{1}{n^o}\frac{\partial F^o}{\partial p^o}\frac{\partial p^o}{\partial l^o} = \frac{1}{n^o}\frac{\partial F^o}{\partial l^o} = \zeta(n^o), \zeta' \leq 0$ ■

When the number of old increases, their optimal tax rate decreases. In other words, property 7 guarantees that the per capita pressure effect is larger than the free rider effect, even when

[9]The uniqueness of the optimal tax rate relies on the group's budget constraint to be linear. The transfer function should be linear in pressure, i.e. F^j linear in p^o, p^y, and the pressure functions linear in leisure, i.e. p^j linear in l^j.

this last one is maximum (i.e., when $\frac{\partial p^o}{\partial l^{o,i}} = 0$). In a sense, as the number of elderly increases, the effectiveness of their average political contribution on the aggregate pressure of the group decreases, and the group optimally decides to reduce every individual's contribution.

The Young

The young group solves the following problem:

$$\max_{\{c^y, l^y, c^{o\prime}\}} u^y(c^y, l^y) + \beta u^{o\prime}(c^{o\prime}, l^{o\prime}) \tag{4.14}$$

$$\begin{aligned} s.t.\ c^y + Rc^{o\prime} &= w^y(1 - l^y) - \frac{F^o}{n^y} + \\ &\quad R\left(w^{o\prime}(1 - l^{o\prime}) + \frac{F^{o\prime}}{n^{o\prime}}\right) \end{aligned} \tag{4.15}$$

The first order conditions are:

$$FOC(c^y) : \frac{\partial u^y}{\partial c^y} = \lambda \tag{4.16}$$

$$FOC(l^y) : \frac{\partial u^y}{\partial l^y} = \lambda \left(\begin{array}{c} w^y + \frac{1}{n^y}\frac{\partial F^o}{\partial p^y}\frac{\partial p^y}{\partial l^y} - \\ R\frac{\rho}{n^y}\frac{\partial F^o}{\partial p^y}\frac{\partial p^y}{\partial l^y} \end{array} \right) \tag{4.17}$$

$$FOC(c^{o\prime}) : \beta\frac{\partial u^{o\prime}}{\partial c^{o\prime}} = \lambda R \tag{4.18}$$

It is convenient to rewrite the first order conditions as:

$$MRS^y = \frac{u'(l^y)}{u'(c^y)} = w^y + \frac{1}{n^y}\frac{\partial F^o}{\partial p^y}\frac{\partial p^y}{\partial l^y} - R\frac{\rho}{n^y}\frac{\partial F^o}{\partial p^y}\frac{\partial p^y}{\partial l^y} \tag{4.19}$$

Again, the optimal tax rate on labor income is the one that equalizes the individual's and the group's marginal rate of substitution. From equations 4.9 and 4.19 it is:

$$MRS^{y,i} = MRS^y \Leftrightarrow \tag{4.20}$$

$$
\begin{aligned}
& w^y(1-\tau^y) + \frac{1}{n^y}\frac{\partial F^o}{\partial p^y}\frac{\partial p^y}{\partial l^{y,i}} - R\rho\frac{1}{n^y}\frac{\partial F^o}{\partial p^y}\frac{\partial p^y}{\partial l^{y,i}} \\
= \; & w^y + \frac{1}{n^y}\frac{\partial F^o}{\partial p^y}\frac{\partial p^y}{\partial l^y} - R\frac{\rho}{n^y}\frac{\partial F^o}{\partial p^y}\frac{\partial p^y}{\partial l^y}
\end{aligned}
$$

and therefore:

$$
\tau^y = \frac{1}{w^y}\frac{1}{n^y}\frac{\partial F^o}{\partial p^y}\left(\frac{\partial p^y}{\partial l^{y,i}} - \frac{\partial p^y}{\partial l^y}\right)(1-R\rho) \tag{4.21}
$$

The per capita pressure effect implies a reduction in the optimal tax rate as the number of members in the group increases, whereas the free rider effect induces an increase. If we concentrate on an exogenous increase in the number of old people, it is plausible to assume that the free rider effect for the young group, $\left(\frac{\partial p^y}{\partial l^{y,i}} - \frac{\partial p^y}{\partial l^y}\right)$, is independent from the number of old members, n^o. Therefore, by property 7, the only relevant effect will be the per capita pressure effect, which increases the effectiveness of the average political contribution in a group, as the size of the other group rises. This implies that the optimal tax rate for the young increases with the number of old people. I can now state the following proposition.

Proposition 7 *If* $\left(\frac{\partial p^y}{\partial l^{y,i}} - \frac{\partial p^y}{\partial l^y}\right)$ *is independent from* n^o*, the optimal tax rate for the young is an increasing function of the number of old.*

Proof. By property 7: $\frac{1}{n^y}\frac{\partial F^o}{\partial l^y} = \xi(n^o), \xi' \geq 0$ and by property 3: $F^o = -F^y$, which implies that $-\frac{1}{n^y}\frac{\partial F^o}{\partial l^y}$ is an increasing function of n^o. Given the wage rate, when the number of old people increases, the optimal tax rate of the young will increase. ■

4.2.4 Equilibrium Definition

Definition 8 *For given vector of values* $(\beta, \rho, A, F^o_{t-1})$ *a sequence of wages, interest rates and group sizes* (w^o, w^y, R, n^o, n^y)*, a pressure function* $p^j(l^j, n^j)$ *and a transfer function* $F^{o\prime} = f(p^y, p^o, \frac{n^o}{n^y}) + F^o$*, a balanced growth political equilibrium is a sequence of allocations* (c^o, l^o, c^y, l^y) *and policy variables* (τ^y, τ^o, F^o) *such that:*

- $c^o$and l^o solve the old optimization problem at equation 4.2
- c^y, l^y solve the young optimization problem at equation 4.5

- τ^y, τ^o are the optimal intergroup tax rates for the young and old, as obtained respectively at equation 4.13 and 4.21
- F^o is the policy outcome associated to the transfer function at time t and $F^o = -F^y$
- $F^o = \frac{f}{1-\rho}$

4.3 Solving the Model on Balanced Growth for Quasi-linear Preferences

To obtain an analytical result of the pressure game, I embody the political model described in the previous section into a simpler environment, characterized by the following assumptions:

- Assumption 1. Quasi-linear preferences: $u = c + \gamma \log l$. This assumption, which is widely used in this type of models[10], guarantees that all income effects are channelled toward consumption, whereas leisure is only affected by the net wage and thus by the distortionary tax.
- Assumption 2: $\frac{\partial p^j}{\partial l^{j,t}} = 0$ for both old and young. I assume the maximum free rider effect.
- Assumption 3: Balanced growth path. Individuals have the same wage in youth and in old age: $w^y = w^{o\prime}$. However, wages increase across generations. Thus a young born at time t has a wage which is weakly higher than the wage of a young born at $t-1$: $w^{y\prime} \geq w^y$ which also implies $w^{o\prime} \geq w^o$, with $w^{o\prime}/w^o = w^{y\prime}/w^y = 1 + g$, where $g \geq 0$ is the constant growth rate.

The following proposition formalizes the results obtained under this specification of the model.

Proposition 9 *Define retirement as the difference between leisure in old age and in youth:* $R^o \equiv l^{o\prime} - l^y$.

[10] See Persson and Tabellini (2000).

1. If the steady-state growth rate is nonnegative and ρ is positive, the optimal tax rate chosen by the group of the old is a negative function of the number of members. At steady state, the old choose a lower tax rate and enjoy less leisure when their number is higher.

2. If the steady-state growth rate is nonnegative and ρ is positive, the optimal tax rate chosen by the group of the young is a positive function of the number of members in the group of the old. At steady-state, the young choose a lower tax rate and enjoy a higher level of leisure when the number of old is higher.

3. At steady state, retirement decreases as the number of old people increases.

Proof. See Appendix. ■

The proposition suggests that the aging process induces a decrease in the optimal level of leisure chosen by the old and an increase in the optimal level of leisure chosen by the young. Since I interpret retirement as the difference in leisure at old and young age, this leads to less retirement. The intuition is straightforward. Aging decreases the effectiveness of the average individual contribution to the aggregate pressure in the group of the old, and increases it in the group of the young. This "per capita pressure" effect dominates the free rider effect. Thus, young individuals are pushed to exert more pressure, through higher taxes, whereas the old to reduce it, because of lower taxes. The overall effect is a decrease in the use of the retirement provision by the old.

How does aging affect social security? This model has described several mainly political channels through which aging dynamics may affect the size of the per capita social security transfer. Unsurprisingly, as the next corollary shows, the overall result is ambiguous.

Corollary 10 *The aging of population has an ambiguous impact on the size of the social security transfers.*

Proof. See Appendix. ■

It is however useful to summarize the different effects that this model has analyzed. An increase in the proportion of elderly in the population has a direct, positive size effect in their political power. This size effect rises the aggregate political pressure of the group of the old, as well as their political relevance in the transfer function. I referred to the former as the "pressure size" effect and to the latter effect as the "voters size" effect. The latter effect is

meant to capture the relevance of the democratic element in the policy making process. Both size effects clearly increase the equilibrium social security transfer. Proposition 6 suggested that aging also influences the individual political activities. In fact, an increase in the proportion of elderly in the population exacerbates the free-riding problem, which is common to the pressure groups, and decreases the effectiveness of the average individual contribution to the aggregate political pressure (the "per capita pressure" effect). Under the properties of the transfer function specified in section 4.2.1, this leads to a lower intragroup tax among the old, which decreases their use of retirement. The reduction in time dedicated to individual political activities (which depends on leisure) reduces their political power and therefore the social security transfer. Finally, there exists a last effect depending on the decrease in the per-capita transfer associated to an increase in the elderly. This "per capita transfer" effect is induced by the dependency ratio. As the elderly increase, the aggregate transfer have to be shared among more group members, and therefore their individual effort will be reduced since the individual profitability of the transfer decreases.

To summarize, the size and the per capita effects represent the two faces of the same coin. An increase in the number of the elderly increases their political power, but decreases their size of the transfer, as well as their individual incentives to participate to the political activities. Which of the two effects will prevail is ultimately an empirical question, that I address in chapter five.

4.4 Concluding Remarks

This chapter analyzes the effect of the demographic dynamics on retirement and social security. Starting from the new approach introduced by Mulligan and Sala-i-Martin (1999a), I develop a simple overlapping generations model of time-intensive political competition to address the impact of demography on social security. My model can still account for all the "facts" explained by the Mulligan and Sala-i-Martin's model (page 44). Moreover, it can answer these additional questions:

- Why there exists retirement in aging populations?
- Why do the old want to reduce retirement as aging of the population increases?

- Why is social security associated with retirement even in aging populations?

The main contributions of this model are the following:

1. The focus of the analysis is on the impact of demography on social security, through retirement decisions. The model characterizes the relation among aging, retirement and social security transfers. This allows a comprehensive analysis of the social security system along three dimensions: demographics (changes in the population structure are crucial to assess the future developments of the system); politics (the political game among groups of different age is the key determinant for the existence and size of the system); labor (retirement choices depend crucially on the disincentive to work existent in the labor market).

2. Demographic changes, in particular aging of the population, have a direct impact on the retirement choice. This impact is due to the "per capita pressure" effect, which induces people in the old group to set a lower tax on their wage income and, as a consequence, to reduce retirement when population ages. This relation is crucial for the future of social security. Previous analysis have argued that the old group will have an increasing political power, which, together with the aging process, will lead to serious distress for the social security system. Proposals to avoid the collapse are numerous, from privatization to higher taxation, to changes in the retirement ages. Here I have not analyzed different proposals, but rather adopted a new starting point. Given that the old have a large political power, the future of social security will depend on the behavior of this group. Aging will lead this group to reduce their use of the retirement provision.

3. The aging of the population has an ambiguous effect on the size of social security. In spite of the increase in their political power, which lead to a larger social security size, the per capita effect induces the old to retire less and work longer, and thus to reduce the individual political effort they exert to obtain transfers from the young. As a consequence, social security size could in principle even decrease. Successful policy reforms should consider this trend, and provide larger incentives for the old to work longer and reduce their leisure.

Due to the general framework I developed, the analysis can be extended in several directions. The only relevant demographic change I considered is the increase in the dependency ratio, that is the aging of the population and/or the increase in life expectancy. However, there are several other channels through which an exogenous demographic change affects the social security

system, as an exogenous increase of the worker population (young), due for instance to an increased participation of women in the labor market and to immigration. These trends would lead to a less dramatic impact of demography on the social security size. However, this model suggests that the solution to the sustainability of the social security problem is to induce the old to reduce their retirement level, which leads to a reduction of their leisure-political activity with respect to that one of the young.

4.5 Appendix: Microeconomic Foundation for the Transfer Function Based on Pressures

This section shows how to derive the transfer function based on pressure from a probabilistic voting model. I extend the formulation in Mulligan and Sala-i-Martin (1999a) for the specification used in my model.

Consider a majoritarian election between two candidates, A and B. Candidates offer a policy and voters vote on these policies. The candidate with most votes wins the election and implements the announced policy.

Voters differ by age, indexed by i, by occupation, by electoral preferences δ_i . We assume that in each group of age there are workers and non workers. Workers have different occupations indexed by $j = 1...J$.

I assume that each candidate k $(k = A, B)$ offers a transfer T_i^k to each individual of age i. Individuals of age i vote for candidate A if

$W(T_i^A) \geq W(T_i^B) + \delta_i$

where $W(T_i^k)$, $k = A, B$ is the indirect utility function of individual i when he receives the transfer T_i^k and δ_i is the willingness to vote for B. δ_i is normally distributed with H distribution function and h density function. Workers and non workers have a different distribution of δ_i: workers have δ_i normally distributed with mean equal to $\overline{\delta}$ and variance equal to σ^2 and non workers have δ_i normally distributed with mean equal to 0 and variance equal to σ^2. Let α_i be the size of the $i-th$ group, $\overline{l}_i$ the number of non-workers for the $i-th$ group, $(1-\overline{l}_i)$ the number of workers for the $i-th$ group, μ_j the proportion of workers in occupation j.

Each party chooses the transfer to be offered to each group, T_i^k. He wants to maximize the

expected number of votes. He also knows that total transfers have to sum up to zero.

Therefore, the problem solved by party A is the following:

$\max_{T_i^k} \sum \alpha_i \left[\bar{l}_i H\left(\frac{W(T_i^A)-W(T_i^B)}{\sigma_w}\right) + (1-\bar{l}_i)\sum_{j=1}^{J}\mu_j H\left(\frac{W(T_i^A)-W(T_i^B)-\overline{\delta_j}}{\sigma_w}\right)\right]$

s.t. $\sum \alpha_i T_i^A = 0$

If we consider only two groups, old (o) and young (y), with different size ($\alpha_o \neq \alpha_y$), the budget constraint becomes:

$\alpha_o T_o^A + \alpha_y T_y^A = 0$

The first order conditions are:

$\alpha_i \left[\bar{l}_i h\left(\frac{W(T_i^A)-W(T_i^B)}{\sigma_w}\right)\frac{W'(T_i^A)}{\sigma_w} + (1-\bar{l}_i)\sum_{j=1}^{J}\mu_j h\left(\frac{W(T_i^A)-W(T_i^B)-\overline{\delta_j}}{\sigma_w}\right)\frac{W'(T_i^A)}{\sigma_w}\right] = \lambda\alpha_i \quad (i = y, o)$

where λ is the Lagrange-multiplier associated with the budget constraint.

Given that in equilibrium the two parties choose the same policy, it is $T_i^A = T_i^B$, which implies $W(T_i^A) = W(T_i^B)$. Therefore, the condition can be rewritten as follows:

$\bar{l}_i h(0)\frac{W'(T_i)}{\sigma_w} + (1-\bar{l}_i)\sum_{j=1}^{J}\mu_j h\left(-\frac{\overline{\delta_j}}{\sigma_w}\right)\frac{W'(T_i)}{\sigma_w} = \lambda$

Define $\overline{h} = \sum_{j=1}^{J}\mu_j \frac{h\left(-\frac{\overline{\delta_j}}{\sigma_w}\right)}{h(0)}$, which is a term independent on i, it is:

$W'(T_i)(\bar{l}_i + (1-\bar{l}_i)\overline{h}) = \frac{\lambda\sigma_w}{h(0)} \quad (i = y, o)$

The left hand side is independent on i and it is therefore equal for the two groups. This implies that it must be:

$W'(T_o)(\bar{l}_o + (1-\bar{l}_o)\overline{h}) - W'(T_y)(\bar{l}_y + (1-\bar{l}_y)\overline{h}) = 0$

Introducing the budget equation

$T_y = -\frac{\alpha_o T_o}{\alpha_y}$

it is:

$W'(T_o)(\bar{l}_o + (1-\bar{l}_o)\overline{h} - W'(-\frac{\alpha_o T_o}{\alpha_y})(\bar{l}_y + (1-\bar{l}_y)\overline{h} = 0$

This is an implicit function $F(T_o, \bar{l}_o, \bar{l}_y, \alpha_o/\alpha_y)$, from which it can be implicitly defined $T_o = f(\bar{l}_o, \bar{l}_y, \alpha_o/\alpha_y)$.[11]

If we think at $\bar{l}_o$ and $\bar{l}_y$ as the aggregate leisure for each group, since political activity is assumed to be a constant fraction of time dedicated to leisure (the time-intensive hypothesis),

[11] If we assume that total size is 1 ($\alpha_o + \alpha_y = 1$), it is $T_y = -\frac{\alpha_o T_o}{1-\alpha_o}$, and therefore
$V'(T_o)(\bar{l}_o + (1-\bar{l}_o)\overline{h} - V'(-\frac{\alpha_o T_o}{1-\alpha_o})(\bar{l}_y + (1-\bar{l}_y)\overline{h} = 0$,
from which it can be implicitely defined $T_o = f(\bar{l}_o, \bar{l}_y, \alpha_o)$.

$\bar{l}_o$ and $\bar{l}_y$ can be seen as the aggregate pressure for each group. Therefore, using a probabilistic approach, we have derived from a democratic voting process a function where the transfer to the old depends on the pressure of the two groups and the relative size, as used in the model developed in this chapter.

4.6 Technical Appendix

4.6.1 Proof of Proposition 9

Under the assumptions made, the F.O.C. becomes:

$MRS^{o,i} = \gamma/l^o = w^o(1-\tau^o)$

$MRS^{y,i} = \gamma/l^y = w^y(1-\tau^y)$

From them:

$l^o = \frac{\gamma}{w^o(1-\tau^o)}$

$l^y = \frac{\gamma}{w^y(1-\tau^y)}$

$l^{o\prime} = \frac{\gamma}{w^{o\prime}(1-\tau^{o\prime})}$

Consider two steady-state economies characterized by a different steady state size of the old group: $\underline{n}$ and $\overline{n}$, where $\underline{n} < \overline{n}$.

1. *At steady state, the old choose a lower tax rate and enjoy less leisure when their number is higher.*

If $\overline{n} > \underline{n}$, by proposition 6 it is $\tau^o(\overline{n}) < \tau^o(\underline{n})$ and therefore $(1-\tau^o(\underline{n})) < (1-\tau^o(\overline{n}))$. Therefore, $l^o(\overline{n}) < l^o(\underline{n})$. Similarly, it is $\tau^{o\prime}(\overline{n}) < \tau^{o\prime}(\underline{n})$ and therefore $(1-\tau^{o\prime}(\underline{n})) < (1-\tau^{o\prime}(\overline{n}))$. Therefore, $l^{o\prime}(\overline{n}) < l^{o\prime}(\underline{n})$.

2. *At steady-state, if the growth rate is small enough, the young choose a lower tax rate and enjoy a higher level of leisure when the number of old is higher.*

When $\overline{n} > \underline{n}$, by proposition 7 it is $\tau^y(\overline{n}) > \tau^y(\underline{n})$, which implies that $(1-\tau^y(\overline{n})) < (1-\tau^y(\underline{n}))$. Therefore, $l^y(\overline{n}) > l^y(\underline{n})$.

3. *At steady state, retirement decreases as the number of old people increases.*

When $\overline{n} > \underline{n}$, since from the previous steps it is $l^{o\prime}(\overline{n}) < l^{o\prime}(\underline{n})$ and $l^y(\overline{n}) > l^y(\underline{n})$, it is $R^o(\overline{n}) \equiv l^{o\prime}(\overline{n}) - l^y(\overline{n}) < R^o(\underline{n}) \equiv l^{o\prime}(\underline{n}) - l^y(\underline{n})$ Q.E.D.

4.6.2 Proof of Corollary 10

Given the definition of the balanced growth political equilibrium, it is:

$F^o = \frac{f(p^o(l^o,n^o),p^y(l^y,n^y),\frac{n^o}{n^y},x)}{1-\rho}$.

Therefore, the impact of aging on the social security transfer depends on the impact of n^oon $f(p^o(l^o,n^o),p^y(l^y,n^y),\frac{n^o}{n^y},x)$, which is given by:

$\frac{d\left(f(p^o(l^o,n^o),p^y(l^y,n^y),\frac{n^o}{n^y},x)\right)}{dn^o} = \frac{\partial f}{\partial p^o}\left(\frac{\partial p^o}{\partial l^o}\frac{\partial l^o}{\partial n^o}+\frac{\partial p^o}{\partial n^o}\right)+$

$\frac{\partial f}{\partial p^y}\left(\frac{\partial p^y}{\partial l^y}\frac{\partial l^y}{\partial n^o}+\frac{\partial p^y}{\partial n^o}\right)+\frac{\partial f}{\partial n^o}\frac{1}{n^y}$

Consider the simple case where p^y does not depend on n^o:

$\left(\frac{\partial p^y}{\partial l^y}\frac{\partial l^y}{\partial n^o}+\frac{\partial p^y}{\partial n^o}\right)=0.$

Since the last term, $\frac{\partial f^o}{\partial n^o}\frac{1}{n^y}$, is positive by property 7, $\frac{\partial p^o}{\partial l^o}\frac{\partial l^o}{\partial n^o}<0$ by property 1 and proposition 9, and $\frac{\partial p^o}{\partial n^o}>0$ by property 1, the following is true:

1) If $\frac{\partial p^o}{\partial l^o}\frac{\partial l^o}{\partial n^o}+\frac{\partial p^o}{\partial n^o}>0$, i.e. $\left|\frac{\partial p^o}{\partial n^o}\right|<\left|\frac{\partial p^o}{\partial l^o}\frac{\partial l^o}{\partial n^o}\right|$ then $\frac{df}{dn^o}>0$.

If the reduction of leisure induced by the aging process is not sufficient to compensate the increased political power of the old induced by their larger size, the impact of aging on social security transfers is positive.

2) If $\frac{\partial p^o}{\partial l^o}\frac{\partial l^o}{\partial n^o}+\frac{\partial p^o}{\partial n^o}<0$, i.e. $\left|\frac{\partial p^o}{\partial n^o}\right|<\left|\frac{\partial p^o}{\partial l^o}\frac{\partial l^o}{\partial n^o}\right|$ the overall impact of n^o on f is ambiguous.

In this case the impact of aging on social security transfers is ambiguous, due to the presence of two opposite effects: the size effect, i.e., when the old are more numerous they will exert more pressure and obtain more transfers, and the per capita effect, i.e., when the old are more numerous they are induced to retire less (proposition 6) and to exert less pressure and receive less transfers. Q.E.D.[12]

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[12] Consider the simple case represented by the following specification:
$p^o = l^o\,(n^o)^\alpha, p^y = l^y\,(n^y)^\alpha$, $(\alpha<1)$
$F^o = p^o - p^y + \log\frac{n^o}{n^y} = l^o\,(n^o)^\alpha - l^y\,(n^y)^\alpha$
$F^o_t = f^o + \rho f_{t-1}$
At steady state it is: $F_t = \frac{f^o}{1-\rho}$
In this case it can be proved that: $\tau^o = \frac{1}{w^o}\,(n^o)^{\alpha-1}, \tau^y = \frac{1}{w^y}\,(n^y)^{\alpha-1}$,
$l^o = \frac{\gamma}{w^o(1-\frac{1}{w^o}(n^o)^{\alpha-1})}, l^y = \frac{\gamma}{w^y(1-\frac{1}{w^y}(n^y)^{\alpha-1})}$
$p^o = \frac{\gamma(n^o)^{\alpha-1}}{w^o(1-\frac{1}{w^o}(n^o)^{\alpha-1})}, p^y = \frac{\gamma(n^y)^{\alpha-1}}{w^y(1-\frac{1}{w^y}(n^y)^{\alpha-1})}$
$F^o = \frac{\gamma(n^o)^{\alpha-1}}{w^o(1-\frac{1}{w^o}(n^o)^{\alpha-1})} - \frac{\gamma(n^y)^{\alpha-1}}{w^y(1-\frac{1}{w^y}(n^y)^{\alpha-1})}$
$\frac{dF^o}{dn^o} = \frac{\gamma n^{\alpha-1}\left(\alpha w^o - n^{\alpha-1}\right)}{\left(w^o(1-\frac{1}{w^o}(n^o)^{\alpha-1})\right)^2}$
The overall result depends on the size of the demographic change: If $n^o < (\alpha w^o)^{\frac{1}{\alpha-1}}$ then $\frac{dF^o}{dn^o}>0$, if $n^o > (\alpha w^o)^{\frac{1}{\alpha-1}}$ then $\frac{dF^o}{dn^o}<0$.

Chapter 5

Demography, Retirement and Social Security: A Short Empirical Analysis

5.1 Introduction

This chapter tests the predictions of the theory developed in the previous chapter. The theoretical model delivers two testable implications. First, it predicts that a large increase of the old population will lead to a reduction in the retirement level. Aging of the population has opposite effects on the retirement level. On one side, the free-riding effect induces the old to set a higher tax on their labor income and thus to work less, and retire early; on the other side, the lower per capita transfer associated to a more numerous group induces the old to reduce the tax rate and thus to retire later. The model suggests that the second effect dominates, and thus that the retirement level will be reduced. Second, it shows that aging of the population has opposite effects on the size of social security. A larger proportion of elderly in the population increases their political power, and leads to more pension transfers. However, to the extent that aging reduces the level of retirement, it induces a reduction in the social security level as well. Although the overall effect is ambiguous, the model suggests that when the proportion of elderly in the population becomes very large, the combined effect of a lower per capita bene-

fit and higher retirement age may compensate the political power of the elderly and induce a reduction in the social security level.

In the last few years there have been several contributions in the empirical literature on social security. However, previous studies focus either on the relation between demography and pensions[1], or on the relation between retirement and pensions[2]. None of these contributions has provided a comprehensive analysis of the impact of demography on both retirement and social security. In this chapter, I organize the data for such a comprehensive analysis and perform a short econometric analysis.

This chapter has two main contributions. First, it builds a new large data set, which includes informations on demography, retirement and social security for many countries around the world. This represents the first attempt to gather together all these informations. Second, the data seem to support the predictions of the theory[3]. This analysis suggests that there exists a hump-shaped relation both between the number of elderly in the population (people above retirement age) and the length of retirement (years spent in retirement) and between the number of elderly in the population and the per capita size of social security (as percentage of GDP).

The chapter is organized as follows: in the next section I describe the construction of the data set; in the following two sections, I separately address the two testable predictions. A summary of the results concludes. Tables and graphs are reported in the appendix.

5.2 The Data

I construct a large data set on social security, retirement, and demographic variables, using cross-country data. The sample includes all the countries in which a retirement program exists and data on at least one of the other two fields of interest, demography and social security, are available. The year to which data refer to may differ across countries to reflect unavailability of more recent data.

The data are collected from different sources.

[1] European Commission (1997), OECD (1998), Rosevare and oth., 1996.

[2] Brugiavini (1997), Gruber and Wise (1997), Latulippe (1997), Samwick (1998).

[3] The focus is on a positive explanation of the demographic effects on retirement and social security, rather than on giving policy recommendations. To this extent a cross-country analysis seems appropriate.

1. United Nations: Demographic Yearbook (several years)

2. Social Security Throughout the World (last available reports: 1995)

3. International Monetary Fund: Government Finance Statistics Yearbook (several years)

From the first source, I collect data on the demographic issues: the age structure of the total population, and the life expectancy at birth disaggregated by sex. In particular, I select the elderly (people aged more than 65 years) and I aggregate all the individuals belonging to the groups with above retirement age to obtain the total number of retired people in each country by sex. Since different countries may report data from different years, I restrict the period from 1990 to 1998.

From the second source, I derive the following informations on the old age social security program for each country, according to their current law: type of program, retirement age, relation between retirement and benefits. This source represents the main reference for retirement issues. All data come from a 1995 report.

From the third source, I obtain data on social security expenditure, welfare expenditure, and GDP. The unavailability of disaggregate data on social security and welfare limits the analysis to a smaller sample of countries. Again, data are restricted to the 1990-1998 period. The IMF's definition of social security includes old age payments, however, it differs from an ideal measure of "governments transfers to the elderly," because it excludes medical and other subsidies for the elderly.

Table 5.1, 5.2 and 5.3 summarize the data on demography, retirement and social security.

These data are then transformed to closely match the variables of the theory in chapter four. Specifically,

- The *demographic factors*, which represent the aging process, are captured by the proportion of elderly (individuals aged more 65 years) in the population, by the proportion of people in retirement age (people above the official retirement age) in the population, by the dependency ratio (ratio of people aged 65 years or more over people aged less than 65), and by the life expectancy at birth.

- To describe the *Retirement* policy in different demographic environment, I use the official

retirement age, the expected length of retirement, defined as the difference between the life expectancy and the legal retirement age, and the working life, i.e., the ratio between the legal retirement age and the life expectancy. These last two measures are meant to capture the different relevance that the legal retirement age has in different demographic scenarios.

- The level of *Social Security* is measured as the overall and per capita level of social security expenditure as percentage of GDP.

- Finally, I occasionally include other variables which may represent significant determinants of retirement or social security, but which were not explicitly considered in the theoretical model, like the human capital.

5.3 Demographic Dynamics and Retirement

This section tests the impact of demographic dynamics on the retirement system. The model in chapter four predicts a negative relation: as aging increases, political pressure entails larger inefficiency, and the use of the retirement provision decreases. In a cross-country study, we should thus observe higher legal retirement ages, or a shorter expected length of retirement in countries with a larger proportion of elderly in the population.

5.3.1 The Data

I first examine the data in a set of scattered plots, which display the simple correlation between some crucial characteristics of the retirement system and few measures of the aging of the population. In particular, the aging process is summarized by the proportion of people above 65 years old in the total population, by the dependency ratio, i.e., the ratio of elderly to working age population, and by the life expectancy at birth, for both male and female individuals.

- The first two plots in figure 1 display a strong correlation between the retirement age and the age structure of the population. Older populations, measured with the proportion of elderly in the population or the dependency ratio, are associated with higher legal retirement ages. The results are robust to split the sample by sex.

- The other plots in figure 1 examine the relation between the use of the retirement provision and the age structure of the population. In particular, I consider two variables: the expected length of the retirement period, i.e., the difference between the life expectancy and the legal retirement age, and the working life, i.e., the ratio between the legal retirement age and the life expectancy. In these plots, there is still a link between retirement and aging, which is, however, not linear. Young populations, i.e., countries with low shares of elderly in the population, are more scattered in their expected length of retirement, whereas older populations enjoy longer expected retirement spans. The same results hold true for the expected working life. This non-linearity may emerge from the effect of the life expectancy on the retirement age.

- In fact, the plots in figure 2 show that countries in which the population has a higher life expectancy have higher legal retirement age. However, higher life expectancy is also associated with longer expected length of retirement, and with shorter working life.

- Figure 3 analyzes life expectancy as a possible determinant of the age structure of population. Unsurprisingly, countries with higher life expectancy have a higher proportion of elderly in the population, suggesting that aging is at least partially due to people living longer. This correlation between life expectancy and the age structure of population is a crucial element, which we analyze in the next section.

5.3.2 Econometric Specifications

This first exam of the data is encouraging, in the light of the theory presented in chapter 4. As expected, aging populations are indeed associated to a higher legal retirement age, but also to a larger use of the retirement provision, as measured by the expected length of retirement and by the working life. Since this may be due to the contemporaneous increase in life expectancy, in the econometric analysis I try to disentangle these opposite effects.

Linear Specifications

In the linear specification, I try to quantify the different effects, by running several regressions, with different specifications. The results[4] obtained for the overall sample are reported in table 5.4. The main messages are the following:

- As suggested by the scattered plots in figures 1 and 2, all demographic variables display a strong, positive correlation with the legal retirement age (see regressions 1a and 1b). More aged populations drive a higher legal retirement age, both because of a larger share of elderly in the population (or because of a larger dependency ratio) and because of a higher life expectancy.

- Regressions 2a and 2b suggest that also when taken together, the relative size of the elderly and the life expectancy contribute to explain higher retirement ages, as they both retain their statistical significance, and the explained variability increases.

- Although not supported by the theory, I introduce in the regression other explanatory variables (see regression 3). Adding the per capita social security expenditure as a fraction of GDP does not improve the fit, and the variable turns out not to be significant. On the other hand, when I include a measure of human capital (namely the number of years of schooling), although the variable is not significant, the fit is greatly improved, and the R^2 rises from 37% to 51%. Since human capital is a good proxy for the stage of development, or analogously, for the income level, I interpret this result as a warning that the legal retirement age may be closely related to the country's income level.

Non-linear Specifications

The non-linearity in the scattered plots between the expected length of the retirement period, or the working life, and the share of elderly in the population displayed in figure 1, and the result on the human capital in regression 3 suggest me to try a non-linear specification. Therefore, I include a quadratic term for the demographic variable (the share of elderly in the population)

[4]The results obtained by splitting the sample according to sex are virtually unchanged, and I choose not to report them.

in the regressions in which the explanatory variable is either the expected length of retirement or the working life. The results are the following:

- The non linear specification turns out to be significant, both when the dependent variable is the expected length of retirement and when it is the working life (regressions 4a and 4b). In fact, the proportion of elderly people (O) and the squared of this variable (O^2) alone are jointly significant and display an R-squared of 34% in the case of working life and 29% in the case of the length of retirement. In the regression to explain the variability in the working life, the first variable (O) has a negative coefficient, while the second one (O^2) is positive, indicating that the relation is U-shaped. The same result is obtained in the regression explaining the variability in the length of retirement. In this case I find a hump-shaped relation. Notice that the shape is opposite, since lower retirement can be seen as larger working life or lower length of retirement. Interestingly, in the linear specification, the proportion of the elderly and the life expectancy have no explanatory power on the working life.

- These results are presented in figures 4 and 5 respectively for the working life and the expected length of retirement. The graphs capture the existence of two effects. There is an initial effect, which induces younger countries to reduce the working age (or increase the length of retirement) as the population becomes older. Then, after a maximum has been reached, countries with older populations have higher working age.

To summarize, the empirical tests of this section support the results of the theory in chapter 4. An aging population induces an increase in the retirement age, through an increase in the share of elderly in the population (as predicted by the theory), and a rise in the life expectancy. However, if retirement is considered in relation to the demographic environment, and the working life is taken to be the correct measure of the retirement policy, the empirical analysis suggests the existence of a non-linear relation. In younger countries, which in my sample correspond to developing countries, the aging process leads to longer expected retirements spans, because of the dominant effect of the rise in life expectancy. I interpret this result as evidence in favor of an income effect. As these countries age, they also become richer, people live longer, and therefore they decide to enjoy more old-age leisure, i.e. to reduce their working life. In

other, more developed countries, aging is associated to shorter expected retirement periods, because, as predicted by the theory, people retire later.

5.4 Demographic Dynamics and Social Security

In this section I examine the effect of demographic dynamics on the overall and per capital expenditure in social security. The model in chapter 4 suggests aging has two opposite impacts on social security. A rise in the share of elderly in the population increases their political power, which in turn allows them to obtain larger per capita pension transfers. However, as argued in the previous section, aging induces longer working lives and reduces retirement. This translates into lower pressure by the elderly, and therefore reduces the per capita transfer. Which one of these two political effects dominates? The theory does not say, and the final effect is ambiguous. Therefore, I turn to the empirical analysis to try to assess the quantitative relevance of each of the two opposite effects on both the overall and the per capita level of social security.

5.4.1 The Data

I first present the data on the overall of per capita size of social security and on the different demographic and retirement variables, in a series of scattered plots. As before, the aging process is measured by the proportion of people above 65 years old in the total population, by the dependency ratio, and by the life expectancy at birth. Retirement policies are summarized by the retirement age, by the expected length of retirement and by the working age.

- Figure 6 considers the demographic variables. Unsurprisingly, countries with a larger proportion of elderly in the population, or a higher dependency ratio, display higher overall levels of social security. A slight positive correlation seems to exist also when social security is measured in per capita terms. Life expectancy, on the other hand, is strongly and positively related to the social security size, both in absolute and in per capita terms.

- In figure 7, social security expenditures are related to the retirement age, to the expected length of retirement and to the working life. As predicted by the theory, the length of retirement has a positive impact on the social security level. In fact, the expected length

of retirement is positively correlated to both social security expenditures, whereas the working life shows a negative correlation. Finally, per capita transfers seem to increase in the legal retirement age.

5.4.2 Econometric Specifications

A look at these scattered plots suggests that, as predicted by the theory, there exist positive effects of aging and of the length of retirement on the social security size. The aim of this section is to find the correct specification to disentangle the direct (more political power) and the indirect (through retirement) effect of aging on social security, in a cross country sample.

Linear Specification

I first consider a linear specification for the impact of demographic and other variables on the social security size. The main results are reported in tables 5.2 and can be summarized as follows:

- All demographic variables display a positive, albeit weak, correlation with the per capita size of social security (see regressions 1a and 1b). This is not surprising, since the theory in chapter 4 suggests that there exist opposite effects of aging on social security. Clearly, the correlation becomes much higher if I consider the overall social security expenditure (see regression 4).

- As suggested by the scattered plots in figure 7, retirement variables are related to the social security transfer. In particular, as shown in regression 2, an increase in the working period slightly decreases the per capita transfer. This is consistent with the theory in chapter 4, which argues that aging reduces the per capita average contribution, decreases retirement, which in turn induces less social security transfers. The former effect was analyzed in the previous section, while regression 2 provide supporting evidence for the latter.

- When I lump together retirement and demographic variables, the latter ones become less significant, but the overall fit improves (see regressions 3a, 3b and 5), to confirm that,

despite collinearity problems between retirement and demographic variables, both effects predicted by the theory can be found in the data.

Test non Linear Specifications

To account for the non-linear effect of the demographic variables on the retirement, I adopt a non-linear specification, which includes a quadratic term for the demographic variable. Additionally, since the aim is to explain the size of per capita social security expenditure, I decide to use as the demographic explanatory variable the proportion of people in retirement age in the population, rather than the proportion of elderly in the population, to account for the different retirement policies.

The quadratic specification gives rise to a hump-shaped relation. More aged populations have a larger per capita social security size, but an opposite effect inducing a reduction of social security shows up at a larger level of aging. This threshold coincides with a proportion of elderly in the population of about 18%. The predicted relation is represented in graph 8.

5.5 Summary of the Results

This preliminary econometric analysis seems to support the two main predictions of the theory in chapter 4. In particular, the theory suggests that aging involves a political inefficiency, and thus induces a reduction in the retirement level. The data in my cross country sample show that there exists a U-shaped relation between demography and retirement. In countries with a younger population, typically developing countries, aging rises the expected length of retirement. This may be due to an income effect, driven by the large increase in life expectancy which is associate to the early stage of the aging process. As individuals live longer, they choose to enjoy more leisure, and thus to reduce their working life. In older more developed countries, as predicted by the theory, the aging process leads to shorter expected retirement spans, and people retire later.

The theory in chapter 4 suggests that aging has opposite political effects on social security. As previously argued, it induce less retirement, and thus lowers the per capita transfer. However, it also increases the share of elderly in the population and therefore their political power, which

in turn leads to larger per capita transfers. The empirical analysis confirms the existence of these two opposite effects. In fact, simple regressions show that measures of aging and of the length of retirement have a weak (respectively positive and negative) correlation with social security per capita expenditure. Using a non-linear specification, I also find evidence of a hump-shaped relation between the share of individuals in retirement age in the population and the per-capita level of social security. As populations age, they are characterized by larger social security expenditures, since the elderly can exert more pressure and obtain larger transfers from the other group. However, after a certain threshold is reached, the relation turns negative: an increasing proportion of elderly has to share the transfer from the young group, and the per capita transfer decreases.

This represents a preliminary empirical analysis. Further studies are needed to examine other characteristics of the social security programs around the world and the composition of the population, including for instance not only the disaggregation by sex, as in this chapter, but also the proportion of immigrants in total population, as also suggested in the theoretical extensions of the model.

5.6 Appendix: Tables and Graphs

Table 5.1: Percentage of "Old" People on Total Population Around the World, 1995

COUNTRY	Percentage of people over 65			Percentage of people above official retirement age		
	MAN	WOMAN	TOTAL	MAN	WOMAN	TOTAL
AFGHANISTAN	4,230799	3,157451	3,708361	6,4037	7,087461	6,736511
ALGERIA	3,864332	4,041353	3,951864	3,864332	5,920675	4,88113
ARGENTINA	7,575942	10,02789	8,829294	9,459295	16,35487	12,98408
ARMENIA	5,21058	7,596151	6,440254	9,374519	16,67857	13,13949
AUSTRALIA	10,27812	13,35033	11,82019	10,27812	17,29255	13,79896
AUSTRIA	11,13151	19,01302	15,21891	11,13151	24,1622	17,88932
BAHAMAS, THE	3,981728	5,446035	4,731333	3,981728	5,446035	4,731333
BAHRAIN	2,076517	2,476324	2,244681	3,491359	6,149484	4,609404
BARBADOS	9,840556	12,8006	11,38205	9,840556	12,8006	11,38205
BELARUS	7,359319	14,67563	11,2409	12,6679	21,04628	17,11295
BELGIUM	12,05375	17,66348	14,92238	17,50917	23,43573	20,53981
BELIZE	4,076923	4,423762	4,247805	6,017308	6,209901	6,112195
BENIN	0,9539	1,117118	1,037726	1,890315	2,153341	2,0254
BERMUDA	7,908847	11,058	9,523032	7,908847	11,058	9,523032
BOLIVIA	3,386762	4,076557	3,734525	8,003065	12,36656	10,20294
BRAZIL	4,038748	4,734875	4,390724	4,038748	7,238064	5,656385
BULGARIA	12,52334	15,49083	14,03168	18,45346	28,32619	23,47166
BURUNDI	3,825298	4,048381	3,939886	7,138345	7,895561	8,849978
CAMEROON	3,443349	3,971818	3,708126	5,271672	5,942728	7,527292
CANADA	10,00648	13,54823	11,79383	10,00648	13,54823	5,607889
CAPE VERDE	5,169232	6,393995	5,814795	5,169232	9,088485	11,79383
CENTRAL AFRICAN REP.	3,034115	2,787014	2,908451	7,474156	10,70268	7,235037
CHILE	5,44934	7,570642	6,521515	5,44934	10,72249	9,116038
CHINA,P.R.: MAINLAND	4,926111	6,257133	5,572118	7,930809	12,8845	7,231879
COLOMBIA	3,971121	4,744341	4,361005	5,91345	9,559916	8,114565
COSTA RICA	4,815127	3,784075	4,301144	4,815127	8,375668	10,33507
CROATIA	8,592988	14,47092	11,62227	14,04653	20,65596	7,752122
CYPRUS	8,867403	11,10193	9,986207	8,867403	11,10193	6,590069
CZECH REPUBLIC	10,04335	15,6776	12,94139	14,77744	25,81574	17,4528
DENMARK	10,85377	15,59509	13,25673	10,85377	15,59509	9,986207
DOMINICAN REPUBLIC	3,684426	4,023322	3,851076	5,69886	6,140601	20,45511
ECUADOR	4,016314	4,716418	4,36465	8,6075	9,563527	13,25673
EGYPT	3,377795	4,008526	3,68757	5,434999	6,353135	5,916084
EL SALVADOR	3,112643	3,74183	3,431617	4,959015	8,291224	9,083171
EQUATORIAL GUINEA	3,665542	4,28938	3,986787	6,010541	6,710174	5,885928
ESTONIA	8,397912	16,24912	12,58195	13,47867	28,55225	6,648316
ETHIOPIA	2,956396	3,003955	2,980081	6,866467	6,919439	6,370817
FIJI	3,012221	3,127874	3,069342	7,228061	7,274888	21,51164
FINLAND	10,3129	17,15967	13,83019	10,3129	17,15967	6,892848

	Percentage of people over 65			Percentage of people above official retirement age		
COUNTRY	MAN	WOMAN	TOTAL	MAN	WOMAN	TOTAL
FRANCE	11,85184	17,07906	14,5332	11,85184	17,07906	7,251189
GEORGIA	6,170981	11,26715	8,84964	11,25357	22,90259	13,83019
GERMANY	10,45356	19,15585	14,95888	12,5505	20,66731	14,5332
GREECE	13,31891	16,32475	14,84097	13,31891	22,60336	17,37655
GUATEMALA	3,043713	3,311831	3,176371	4,90879	5,252839	16,7527
GUINEA	0,456731	0,487029	0,472357	0,698011	0,679671	18,02027
HAITI	3,800515	4,356467	4,083858	8,326314	9,323922	5,079017
HONDURAS	3,462054	3,555574	3,509126	3,462054	5,223562	0,688553
HONG KONG	8,23537	10,5095	9,350975	8,23537	10,5095	8,834748
HUNGARY	10,92873	16,4551	13,80659	15,97521	27,92487	4,348683
ICELAND	8,096911	10,33581	9,213967	8,096911	10,33581	9,350975
INDIA	4,110359	4,359946	4,230295	9,886379	10,03713	22,19801
INDONESIA	3,586204	4,087332	3,837617	8,824125	9,618362	9,213967
IRAN, I.R. OF	3,70459	3,04573	3,385188	6,218865	7,58868	9,958819
IRELAND	7,917614	10,77471	9,355591	7,917614	10,77471	9,22259
ISRAEL	8,2701	10,55807	9,423347	8,2701	14,07617	6,882923
ITALY	12,27189	17,22855	14,81894	14,49665	25,41186	9,355591
JAMAICA	7,060276	7,927733	7,49583	7,060276	10,3297	11,19664
JAPAN	11,25629	15,74698	13,54317	11,25629	15,74698	20,10558
JORDAN	2,897196	2,490802	2,700294	4,696262	6,184747	8,701868
KAZAKHSTAN	3,673327	8,144092	5,974136	6,976478	15,91748	13,54317
KENYA	3,389128	3,451075	3,420371	6,489444	6,678522	5,41745
KOREA	4,078645	6,93193	5,500132	7,373069	11,20393	11,57782
KUWAIT	1,228	1,429003	1,305671	7,813954	6,217903	6,584807
KYRGYZ REPUBLIC	3,51673	6,667343	5,12235	6,394272	13,47604	9,281577
LATVIA	8,508482	16,75832	12,92684	13,70205	29,23364	7,197211
LIBYA	2,192657	2,381411	2,285188	2,192657	2,381411	10,00329
LITHUANIA	16,0784	7,347634	11,47834	16,0784	13,14916	22,02029
LUXEMBOURG	9,933712	16,09984	13,07685	9,933712	16,09984	2,285188
MALAYSIA	3,567648	4,224325	3,89328	8,254742	9,298958	14,53504
MALI	3,897401	3,710911	3,802037	8,807989	8,240775	13,07685
MALTA	11,92365	18,85222	15,42069	15,17042	22,77547	8,772546
MARSHALL ISLANDS	2,661027	3,049427	2,850902	5,577584	5,979087	8,517936
MAURITANIA	3,300391	3,700947	3,502084	4,65142	7,633336	19,00889
MAURITIUS	4,888594	6,663562	5,774238	7,275869	9,359744	5,773864
MEXICO	3,957047	4,347742	4,155909	3,957047	4,347742	6,152917
MOROCCO	4,620075	4,66973	4,645364	6,683865	6,997063	8,315646
NETHERLANDS	10,55273	15,51062	13,05911	10,55273	15,51062	4,155909
NEW ZEALAND	9,903444	12,98222	11,46318	11,57692	14,55883	6,843377
NICARAGUA	1,00219	0,823024	0,912783	1,626539	1,358919	13,05911
NIGER	3,170969	2,748474	2,957741	5,0233	4,371205	13,08758
NORWAY	11,45196	16,33608	13,92058	11,45196	16,33608	1,492992
PAKISTAN	3,737579	3,777912	3,757087	6,009967	5,948778	4,694196
PANAMA	5,074184	5,437908	5,254022	6,225863	9,141166	13,92058
PAPUA NEW GUINEA	2,441757	2,451185	2,446308	7,033795	7,176246	5,980371

COUNTRY	Percentage of people over 65			Percentage of people above official retirement age		
	MAN	WOMAN	TOTAL	MAN	WOMAN	TOTAL
PARAGUAY	2,507356	3,456368	2,978198	3,978975	5,263183	7,667294
PERU	3,486327	4,223474	3,852486	3,486327	6,499513	7,102556
PHILIPPINES	3,175791	3,793194	3,483007	5,031149	5,826642	5,426981
POLAND	7,983019	12,70323	10,40421	7,983019	17,91524	13,07767
PORTUGAL	12,19405	16,09851	14,21797	12,19405	16,09851	14,21797
ROMANIA	9,663594	13,08386	11,40397	14,90188	24,90162	19,99018
RUSSIA	6,942294	15,12813	11,28634	11,79996	27,11509	19,92737
RWANDA	3,020135	3,306602	3,167061	6,367051	7,229553	6,809419
SENEGAL	3,432914	3,283746	3,358439	7,316132	6,962446	7,139548
SEYCHELLES	5,083417	8,427591	6,752877	6,606819	10,22269	8,411916
SINGAPORE	5,933753	7,338882	6,630947	12,61939	14,26508	13,43594
SLOVAKIA	8,371286	12,13573	10,29855	8,371286	21,89089	15,29285
SLOVENIA	8,302329	14,6336	11,56382	11,31588	23,77507	17,7341
SOLOMON ISLANDS	3,809505	2,644967	3,249222	18,0595	15,83919	16,99126
SOUTH AFRICA	3,560205	5,028563	4,295044	3,560205	7,409454	5,48656
SPAIN	11,98616	16,40931	14,23779	11,98616	16,40931	14,23779
SRI LANKA	4,46909	4,144782	4,310104	9,827605	12,55995	11,16709
ST. LUCIA	5,810194	7,187277	6,519489	7,978962	9,631097	8,829928
ST.CHRISTOPHER AND NEVIS	7,563764	11,41405	9,44119	8,729112	13,00832	10,81568
SUDAN	2,90758	2,366769	2,638226	4,7368	6,391885	5,561124
SWAZILAND	2,954173	3,792979	3,396916	8,702372	9,050573	8,886161
SWEDEN	15,0694	20,00325	17,56544	15,0694	20,00325	17,56544
SWITZERLAND	12,29574	17,64513	15,0323	12,29574	20,64665	16,56777
SYRIAN ARAB REPUBLIC	4,313393	4,444116	4,377348	6,265026	8,401004	7,310026
TANZANIA	3,102378	3,298486	3,202503	6,844035	7,047585	6,947959
TRINIDAD AND TOBAGO	5,219394	5,752605	5,468767	8,044659	8,114059	8,077116
TUNISIA	5,563043	5,246767	5,406582	8,428518	8,099203	8,265607
TURKEY	3,814242	4,759282	4,280562	6,500807	11,19675	8,817969
TURKMENISTAN	2,642091	4,804709	3,739472	4,769479	10,28991	7,570719
UGANDA	3,45448	3,222842	3,336575	6,781226	6,50603	6,64115
UKRAINE	8,185621	16,42866	12,60897	13,8048	28,49558	21,68811
UNITED KINGDOM	13,08659	18,62405	15,91451	13,08659	23,55573	18,43307
UNITED STATES	10,60391	14,76983	12,73638	10,60391	14,76983	12,73638
URUGUAY	9,969001	13,14684	11,59765	14,66714	23,50428	19,19618
UZBEKISTAN	2,896213	5,191483	4,057854	5,100399	10,81415	7,99214
VANUATU	2,528786	2,695403	2,608481	4,217621	4,384206	4,297302
VENEZUELA	3,455197	4,188593	3,818804	5,439516	8,859541	7,135115
VIETNAM	4,348134	5,694267	5,046004	6,814972	11,38226	9,182769
WESTERN SAMOA	3,28019	3,621978	3,446433	7,713441	7,802198	7,756612
YEMEN, REPUBLIC OF	2,915688	3,147314	3,032368	4,442812	6,809391	5,634959
YUGOSLAVIA, SFR	8,259966	10,4303	9,354143	13,91593	16,56208	15,24999
ZAMBIA	2,900012	2,309904	2,599992	9,100016	8,706586	8,89999
ZIMBABWE	3,088964	3,230479	3,161397	4,778027	4,654175	4,714634

Source: United Nations Demographic Yearbook, several years

Table 5.2 Retirement Age and Type of Social Security Programme Around the World

COUNTRY	RAM	RAW	CURRENT LAW	TYPE OF PROGRAMME
AFGHANISTAN	60	55	1987	Social Insurance System
ALBANIA	60	55	1993	Social Insurance System
ALGERIA	60	55	1984	Social Insurance System
ANTIGUA	60	60	1972	Social Insurance System
ARGENTINA	62	57	1954	Dual Soc.Insurance Syst.&Prov.Fund
ARMENIA	60	55	1992	Social Insurance System
AUSTRALIA	65	60	1991	Dual Soc. Ins. Syst.&Soc.Assist.Syst
AUSTRIA	65	60	1979	Social Insurance System
BAHAMAS, THE	65	65	1972	Social Insurance System
BAHRAIN	60	55	1976	Social Insurance System
BARBADOS	65	65	1966	Social Insurance System
BELARUS	60	60	1993	Social Insurance System
BELGIUM	60	60	1990	Social Insurance System
BELIZE	60	60	1979	Social Insurance System
BENIN	55	55	1970	Social Insurance System
BERMUDA	65	65	1970	Social Insurance System
BOLIVIA	55	55	1993	Social Insurance System
BRAZIL	65	60	1991	Social Insurance System
BULGARIA	60	55	1957	Social Insurance System
BURKINA FASO	55	55	1972	Social Insurance System
BURUNDI	55	55	1991	Social Insurance System
CAMEROON	60	60	1990	Social Insurance System
CANADA	65	65	1966	Dual Provident System&Social Ins.Sys
CAPE VERDE	65	60	1983	Social Insurance System
CENTRAL AFRICAN REP.	55	50	1981	Social Insurance System
CHAD	55	55	1977	Social Insurance System
CHILE	65	60	1981	Provident Insurance System
CHINA,P.R.: MAINLAND	60	55	1986	Separate Mandatory Prov.System
COLOMBIA	60	55	1994	Social Ins.Sys&Prov. Ins. System
CONGO, DEM. REP.(ZAIRE)	63	55	1961	Social Insurance System
CONGO, REPUBLIC OF	55	55	1986	Social Insurance System
COSTA RICA	61,9	59,9	1971	Social Insurance System
CROATIA	60	60		Social Insurance System
CYPRUS	65	65	1980	Social Insurance System
CZECH REPUBLIC	60	53	1994	Social Insurance System
DENMARK	67	67	1984	Social Insurance System
DOMINICAN REPUBLIC	60	60	1948	Social Insurance System
ECUADOR	55	55	1988	Social Insurance System
EGYPT	60	60	1984	Social Insurance System
EL SALVADOR	60	55	1969	Social Insurance System
EQUATORIAL GUINEA	60	60	1984	Social Insurance System
ESTONIA	60	55	1994	Social Insurance System
ETHIOPIA	55	55	1975	Social Insurance System
FIJI	55	55	1985	Provident Insurance System
FINLAND	65	65	1986	Universal and
FRANCE	65	65	1980	Social Insurance Sys&Mandatory

COUNTRY	RAM	RAW	CURRENT LAW	TYPE OF PROGRAMME
GABON	55	55	1965	Social Insurance System
GAMBIA, THE	55	55	1987	Pension
GEORGIA	60	55	1992	Social Insurance System
GERMANY	63	63	1973	Social Insurance System
GREECE	65	60	1992	Social Insurance System
GUATEMALA	60	60	1969	Social Insurance System
GUINEA	55	55	1994	Social Insurance System
GUYANA	60	60	1992	Social Insurance System
HAITI	55	55	1967	Social Insurance System
HONDURAS	65	60	1959	Social Insurance System
HONG KONG	65	65		Dual Ins. Syst.&Soc.Assist.sys
HUNGARY	60	56	1994	Social Insurance System and Private
ICELAND	67	67	1993	Dual System and Soc.ins.Sys.
INDIA	55	55	1976	
INDONESIA	55	55	1977	Provident Insurance System
IRAN, I.R. OF	60	55	1975	Social Insurance System and Private
IRELAND	66	66	1993	Dual System and Soc.ins.Sys
ISRAEL	65	60	1982	Social Insurance System
ITALY	61	56	1992	Social Insurance System
JAMAICA	65	60	1990	Social Insurance System
JAPAN	65	65	1985	Social Insurance System
JORDAN	60	55	1978	Social Insurance System
KAZAKHSTAN	60	55	1991	Social Insurance System
KENYA	55	55	1965	Provident Insurance System
KOREA	60	60	1994	Social Insurance System
KUWAIT	50	50	1976	Social Insurance System
KYRGYZ REPUBLIC	60	55	1994	Social Insurance System
LATVIA	60	55	1990	Social Insurance System
LEBANON	64	64	1963	Social Insurance System
LIBYA	65	65	1980	Social Insurance System
LITHUANIA	62	60	1990	Social Insurance System
LUXEMBOURG	60	60	1987	Social Insurance System
MADAGASCAR	60	55	1969	Social Insurance System
MALAYSIA	55	55	1969	Dual Provident System
MALI	55	55	1986	Social Insurance System
MALTA	61	60	1987	Social Insurance System
MARSHALL ISLANDS	55	55	1990	Social Insurance System
MAURITANIA	60	55	1967	Social Insurance System
MAURITIUS	60	60	1976	Social Insurance System
MEXICO	65	65	1992	Social Insurance System
MOROCCO	60	60	1981	Social Insurance System
NETHERLANDS	65	65	1975	Social Insurance System
NEW ZEALAND	62	62	1990	Social Insurance System
NICARAGUA	60	60	1982	Social Insurance System
NIGER	60	60	1967	Social Insurance System
NORWAY	67	67	1966	Dual System and Soc.ins.Sys.
OMAN	60	55	1991	Social Insurance System
PAKISTAN	60	55	1976	Social Insurance System
PANAMA	62	57	1991	Social Insurance System

COUNTRY	RAM	RAW	CURRENT LAW	TYPE OF PROGRAMME
PAPUA NEW GUINEA	55	55	1980	Provident Insurance System
PARAGUAY	60	60	1973	Social Insurance System
PERU	65	60	1991	Individual Funded System
PHILIPPINES	60	60	1992	Social Insurance System
POLAND	65	60	1991	Social Insurance System
PORTUGAL	65	65	1989	Social Insurance System
ROMANIA	60	55	1992	Social Insurance System
RUSSIA	60	55	1993	Social Insurance System
RWANDA	55	55	1974	Social Insurance System
SAUDIARABIA	60	60	1969	Social Insurance System
SENEGAL	55	55	1975	Social Insurance System
SEYCHELLES	63	63	1990	Social Insurance System
SINGAPORE	55	55	1991	Provident Insurance System
SLOVAKIA	65	53	1994	Social Insurance System
SLOVENIA	63	58	1992	Social Insurance System
SOLOMON ISLANDS	40	40	1973	Social Assistance System
SOUTH AFRICA	65	60	1973	Social Assistance System
SPAIN	65	65	1985	Social Insurance System
SRI LANKA	55	50	1985	Provident Insurance System
ST. LUCIA	60	60	1978	Social Insurance System
SUDAN	60	55	1990	Social Insurance System
SWAZILAND	50	50	1974	Provident Insurance System
SWEDEN	65	65	1976	Dual System and Soc.ins.System
SWITZERLAND	65	62	1982	Soc.Ins.Syst.&Mandat. occup. plans
SYRIAN ARAB REPUBLIC	60	55	1976	Social Insurance System
TANZANIA	55	55	1964	Provident Insurance System
TOGO	55	55	1973	Social Insurance System
TRINIDAD AND TOBAGO	60	60	1971	Dual System and Social ins.System
TUNISIA	60	60	1974	Social Insurance System
TURKEY	60	55	1983	Social Insurance System
TURKMENISTAN	60	55	1991	Social Insurance System
UGANDA	55	55	1965	Provident Insurance System
UKRAINE	60	55	1992	Social Insurance System
UNITED KINGDOM	65	60	1992	Dual System and Social ins.System
UNITED STATES	65	65	1935	Social Insurance System
URUGUAY	60	55	1987	Social Insurance System
UZBEKISTAN	60	55	1994	Social Insurance System
VANUATU	55	55	1987	Provident Insurance System
VENEZUELA	60	55	1989	Social Insurance System
VIETNAM	60	55	1992	Social Insurance System
WESTERN SAMOA	55	55	1972	Provident Insurance System
YEMEN, REPUBLIC OF	60	55	1995	Provident Insurance System
YUGOSLAVIA, SFR	60	55	1983	Social Insurance System
ZAMBIA	50	50	1973	Provident Insurance System
ZIMBABWE	60	60	1993	Social Insurance System

Source: Social Security Throughout the World, 1995

Table 5.3 Percentage of Social Security Expenditures Around the World, 1995

COUNTRY	%SOC.SEC./GDP	%WELF./GDP	%SOC.SEC.&WELF./GDP
ARGENTINA	6,732229102	0	7,242229102
AUSTRALIA	8,46360463	0,557226185	9,333066368
AUSTRIA	0	0	17,23114005
BAHRAIN	0	0	1,064386669
BARBADOS	6,576989291	0,592337545	7,169326836
BELARUS	0,00401794	0,543670659	11,70594112
BELGIUM	20,66613938	0,140609895	20,80674927
BELIZE	1,20647164	0,150126987	1,356598627
BENIN	0	0	2,816998999
BOLIVIA	5,414237936	0,662446249	6,076684185
BRAZIL	0,940405441	0,086634	1,027039441
BULGARIA	7,262255478	1,203343212	9,076002461
BURKINA FASO	1,113515036	0	1,113515036
BURUNDI	1,377650551	0,085599179	1,463249729
CAMEROON	0,122668106	0,08757723	1,398236459
CANADA	7,810534486	1,876589139	9,687123625
CENTRAL AFRICAN REP.	0	0	1,171480972
CHILE	6,288186774	0,023823225	6,923926563
CHINA,P.R.: MAINLAND	0,000637349	0,003505417	0,004142766
COLOMBIA	1,056558128	0,067656533	1,12421466
CONGO, DEM. REP. (ZAIRE)	0	0	0,137347047
CONGO, REPUBLIC OF	1,703777833	0	1,703777833
COSTA RICA	3,532575433	0	3,532575433
CROATIA	0,012600676	0,002118087	0,015142351
CYPRUS	7,426762061	1,246495214	8,673257275
CZECH REPUBLIC	12,64340709	0,201758109	13,14628675
DENMARK	17,1997948	0,401424569	17,89777436
DOMINICAN REPUBLIC	0,07096947	0,581592573	0,652562042
EGYPT	4,439512195	0	4,44097561
EL SALVADOR	0,882299103	0,154324899	1,054224926
EQUATORIAL GUINEA	0	0	0
ESTONIA	9,719729564	0,329440688	10,11293792
ETHIOPIA	0,976337053	0,051943055	1,230761831
FIJI	1,07007874	0,149212598	1,219291339
FINLAND	0	0	15,53411251
FRANCE	16,53219539	0,317926834	18,30693363
GABON	0	0	0
GAMBIA, THE	0,674879033	0,014790711	0,689669745
GERMANY	0	0	13,66063919
GREECE	5,609862043	0,420908016	6,03077006
GUATEMALA	0	0,072156287	0,607396336
GUYANA	2,795315682	1,588594705	4,383910387
HAITI	0,314478252	0,007147233	0,36348785
HONDURAS	0,885875706	0	0,885875706

COUNTRY	%SOC.SEC./GDP	%WELF./GDP	%SOC.SEC.&WELF./GDP
HUNGARY	10,82624828	3,099891898	13,92614018
ICELAND	6,435260268	0,892846852	7,32810712
INDIA	0	0	0
INDONESIA	0,997806853	0,061776149	1,059583002
IRAN, I.R. OF	3,080524658	0,180243464	3,334860297
IRELAND	10,59137734	0,353554623	10,94493196
ISRAEL	6,972517	0	11,98028189
ITALY	13,20724425	4,396329252	17,6035735
JAMAICA	1,148532243	0,037158396	1,185690639
JAPAN	7,414473864	0,881187931	8,720584121
JORDAN	3,179933883	1,629322559	4,966678911
KENYA	0,019783836	0	0,019783836
KOREA	1,664897016	0,360581206	2,025478221
KUWAIT	4,580981329	2,029960921	6,610942249
KYRGYZ REPUBLIC	0	0	0
LATVIA	12,92885997	0,435352897	13,49438276
LITHUANIA	8,204682801	0,339590457	8,794401713
LUXEMBOURG	20,94406415	0,641502054	21,65284569
MADAGASCAR	0	0	0,160251472
MALAYSIA	0,994567198	0,524187249	1,518754448
MALI	0,904128284	0,034118048	0,938246332
MALTA	12,34806147	0,385085575	12,73314705
MAURITANIA	1,322399767	0,048617638	1,371017405
MAURITIUS	0	0	4,583896056
MEXICO	2,624527191	0,35731558	2,981842771
MOROCCO	0	0	2,319488818
NETHERLANDS	16,52712795	1,261037634	0
NEW ZEALAND	14,01313442	0,147993499	14,75310192
NICARAGUA	2,415070256	0	3,057313845
NIGER	0	0	0,306975009
NORWAY	13,74127372	0,059408794	13,88116869
OMAN	0	0	0
PAKISTAN	0,017746418	0,114289054	0,132035472
PANAMA	5,672853971	0,046619475	5,719473445
PAPUA NEW GUINEA	0,194636939	0,044390881	0,23902782
PARAGUAY	2,083262625	0,028094387	2,112632893
PERU	0	0	0
POLAND	20,03624516	0,938057196	20,97834959
PORTUGAL	0	0	9,050990302
ROMANIA	8,992924925	0,621633634	9,898002002
RUSSIA	7,616196259	0,181055071	8,006529206
RWANDA	0	0	0,412037037
SENEGAL	0	0	1,635509347
SEYCHELLES	0	0	7,603934209
SINGAPORE	0,200679654	0,09649405	0,297173703
SOLOMON ISLANDS	0,238496072	0,056116723	0,294612795
SOUTH AFRICA	1,545571203	0,173805695	1,719376898
SPAIN	13,98693897	0,246345305	14,36598686

COUNTRY	%SOC.SEC/GDP	%WELF/GDP	%SOC.SEC&WELF./GDP
SRI LANKA	0	0	3,593771933
ST. LUCIA	0	0	1,276086668
SWEDEN	20,40025303	0,617631836	21,02363563
SWITZERLAND	13,4185759	0,276892119	13,69546802
SYRIAN ARAB REPUBLIC	0,517413936	0	0,579503608
TOGO	2,032760473	0,182867884	2,216165414
TRINIDAD AND TOBAGO	2,387190684	1,639453199	4,026643883
TUNISIA	5,035088271	0,397562178	5,432650449
TURKEY	0,497071829	0,117718742	0,614790571
UNITED KINGDOM	0	0	12,93221956
UNITED STATES	4,511583178	1,517587444	6,029170622
URUGUAY	11,24604155	1,120044919	12,36608647
VANUATU	0,343479475	0	0,343479475
VENEZUELA	1,477861541	0	1,477861541
VIETNAM	0	0	0
YEMEN, REPUBLIC OF	0	0	0
YUGOSLAVIA, SFR	0,928550172	0	0,928550172
ZAMBIA	0,400226795	0,113687756	0,700693726
ZIMBABWE	0,7065321	0,270943217	0,977475318

Source: Government Finance Statistics Yearbook, International Monetary Fund, several years

Table 5.4: The Variables

M = total man
W = total women
POP = M + W = total population
TOM = total old (man)
TOW = total old (woman)
OLD = TOM + TOW = total old (total population)
O = OLD / POP = proportion of old
TY = POP - OLD = total young
DR = OLD/TY = dependency ratio (total population)
RAM = retirement age (man)
RAW = retirement age (women)
RA = official retirement age (total population) = (RAM*M+RAW*W) / POP
EM = expectancy of life at birth (man)
EW = expectancy of life at birth (woman)
E = expectancy of life (total population) = (EM*M+EW*W) / POP
R = lenght of retirement (total population) = E - RA
PRM = working life (man) = RAM / EM
PRW = working life (women) = RAW / EW
PR = working life (total population) = (PRM*M+PRW*W) / POP
SSGDP = social security expenditure / GDP
H = years of schooling
F = SSGDP / O = per capita social security

Table 5.5 Retirement

Dependent Variable RA - Estimation by Least Squares
(1a) independent variables: constant, O
(1b) independent variables: constant, DR
(2a) independent variables: constant, O, E
(2b) independent variables: constant, DR, E
(3) independent variables: constant, O, E, H

Dependent Variable PR – Estimation by Least Squares
(4a) independent variables: constant, O O**2

Dependent Variable R – Estimation by Least Squares
(4b) independent variables: constant, O O**2

Variable	1a	1b	2a	2b	3	4a	4b
Constant	55.62	55.91	45.56	45.52	45.667	1.09	-4.29
Std er	0.59	0.56	2.55	(2.56)	3.12	0.0368	2.19
T-Stat	(93.77)	(98.96)	(17.8)	(17.78)	(14.62)	(29.62)	(-1.95)
Signif	0.000	0.000	0.000	0.000	0.000	0.000	0.052
O	50.03		23.72		32.73	-4.31	261.13
Std er	7.068		9.33		11.18	1.109	66.19
T-Stat	(7.078)		(2.54)		(2.92)	(-3.88)	(3.944)
Signif	0.000		0.012		0.004	0.000	0.000
DR		41.3		19.23			
Std Er		5.92		7.7			
T-Stat		(6.97)		(2.49)			
Signif		0.000		0.013			
E			0.179	0.18	0.172		
Std er			0.044	0.04	0.058		
T-Stat			(4.028)	(4.14)	(2.963)		
Signif			0.000	0.000	0.003		
H					0.0025		
Std er					0.208		
T-Stat					(0.012)		
Signif					0.99		
O**2						17.33	-970.48
Std er						6.43	384
T-Stat						(2.69)	(-2.52)
Signif						0.008	0.0127
F	0.000	0.000	0.000	0.000	0.000	0.000	0.000
N	127	127	127	127	86	127	127
R**2	0.28	0.28	0.368	0.367	0.51	0.286	0.34

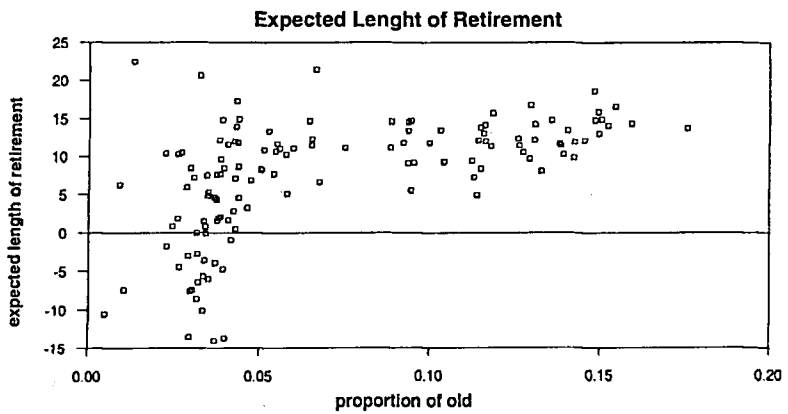
Table 5.6 Social Security

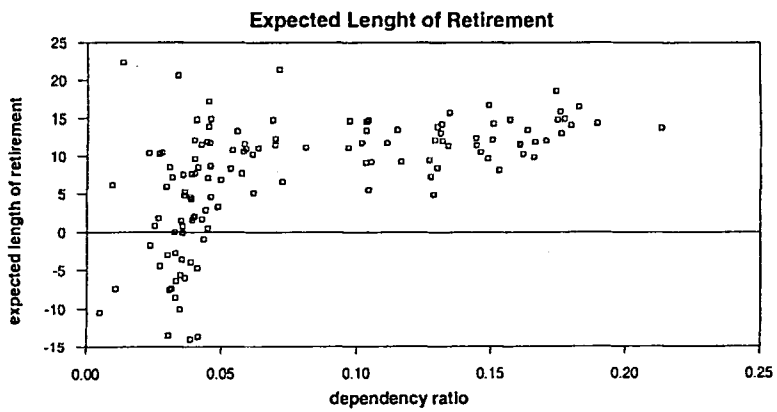
Dependent Variable F - Estimation by Least Squares
(1a) independent variables: constant, O
(1b) independent variables: constant, DR
(2) independent variables: constant, PR
(3a) independent variables: constant, O, PR
(3b) independent variables: constant, DR, PR

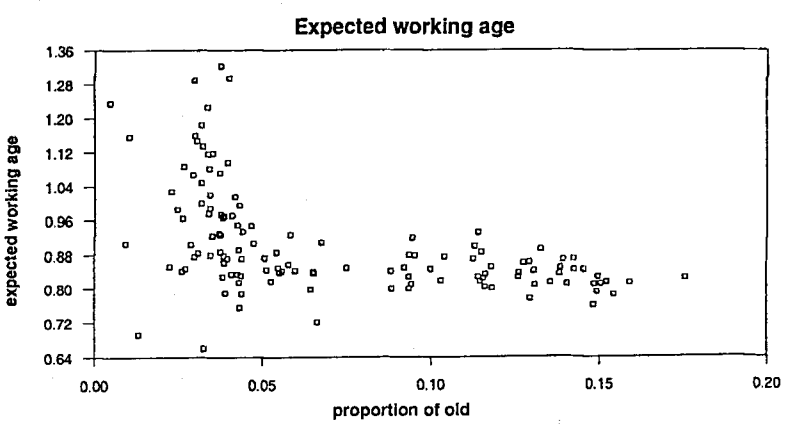
Dependent Variable SSGDP- Estimation by Least Squares
(4) independent variables: constant, O
(5) independent variables: constant, O, PR

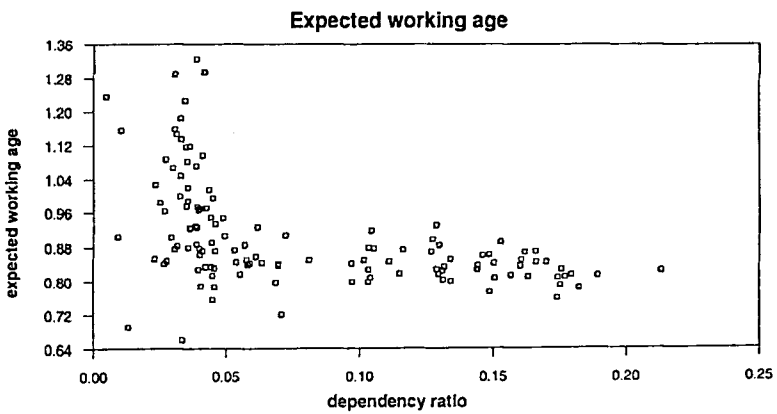
Variable	1a	1b	2	3a	3b	4	5
Constant	0.42	0.434	2.435	2.04	2.01	-0.024	-0.016
Std er	0.129	0.122	(0.628)	0.76	0.756	0.007	0.047
T-Stat	(3.29)	(3.539)	3.877	(2.68)	(2.661)	(-3.05)	(-0.33)
Signif	0.001	0.000	0.000	0.0089	0.009	0.003	0.738
O	2.91			1.4		1.04	1.033
Std er	1.438			1.569		0.087	0.098
T-Stat	(2.024)			(0.89)		11.92	(10.53)
Signif	0.046			0.37		0.000	0.000
DR		2.52			1.29		
Std Er		1.194			1.3		
T-Stat		(2.1)			(0.99)		
Signif		0.038			0.32		
PR			-2.03	-1.71	-1.68		-0.008
Std er			0.712	0.797	0.79		0.049
T-Stat			(-2.85)	(-2.15)	(-2.11)		(-0.17)
Signif			0.005	0.034	0.037		0.86
F	0.046	0.038	0.00	0.01	0.01	0.000	0.000
N	137	137	80	80	80	80	80
R**2	0.05	0.05	0.1	0.1	0.1	0.64	0.64

Graph 1. Retirement and aging

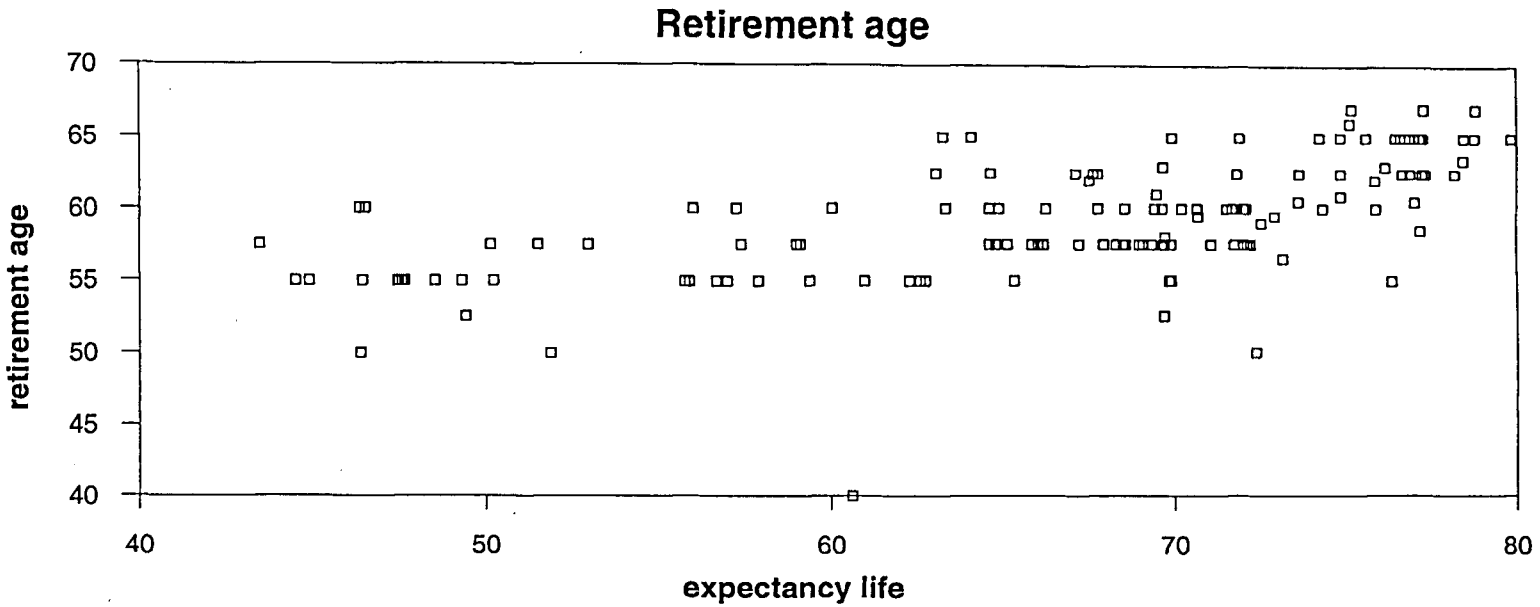


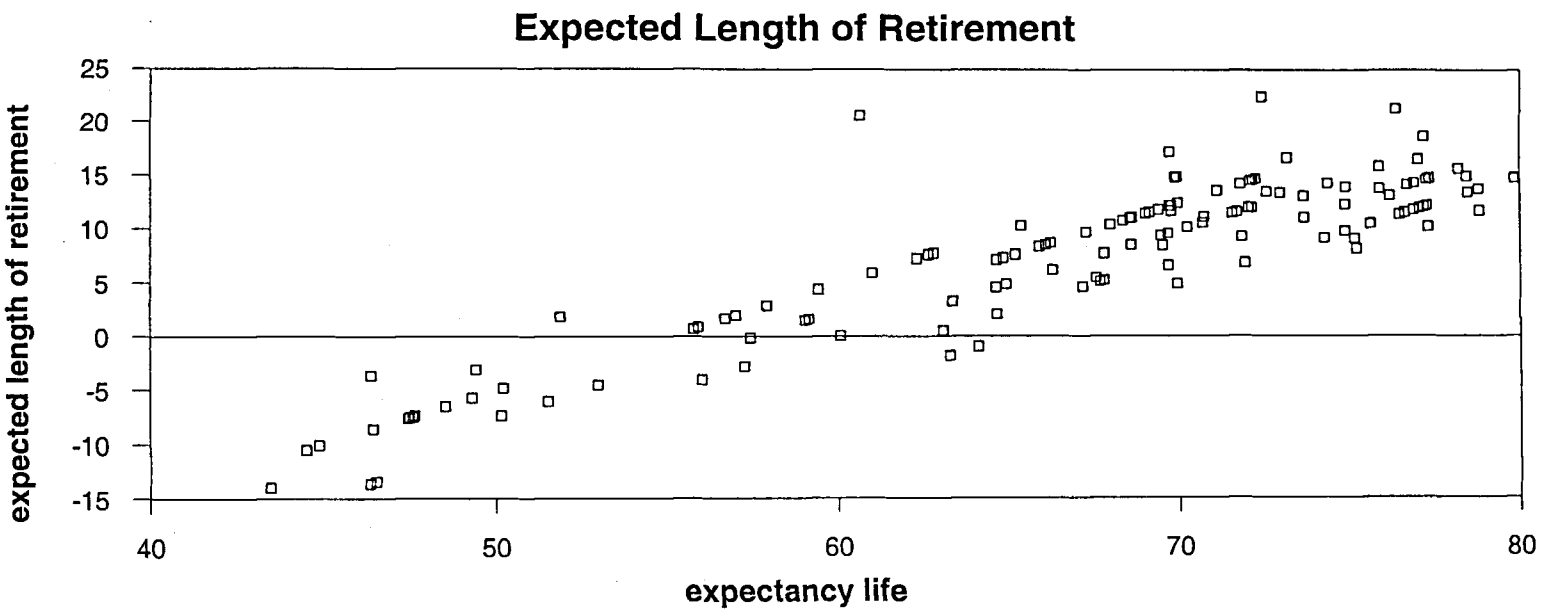




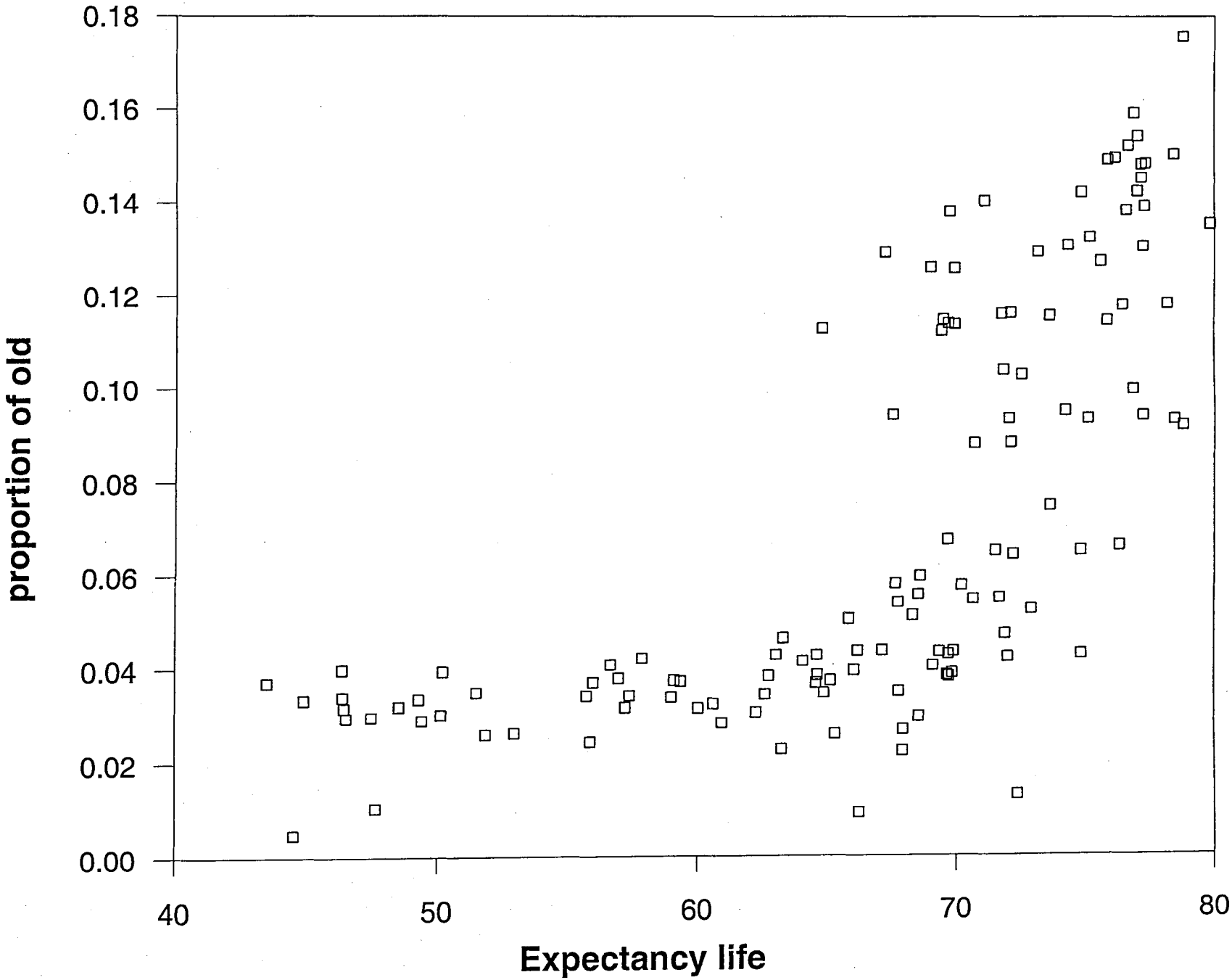


Graph 2. Retirement and expectancy life

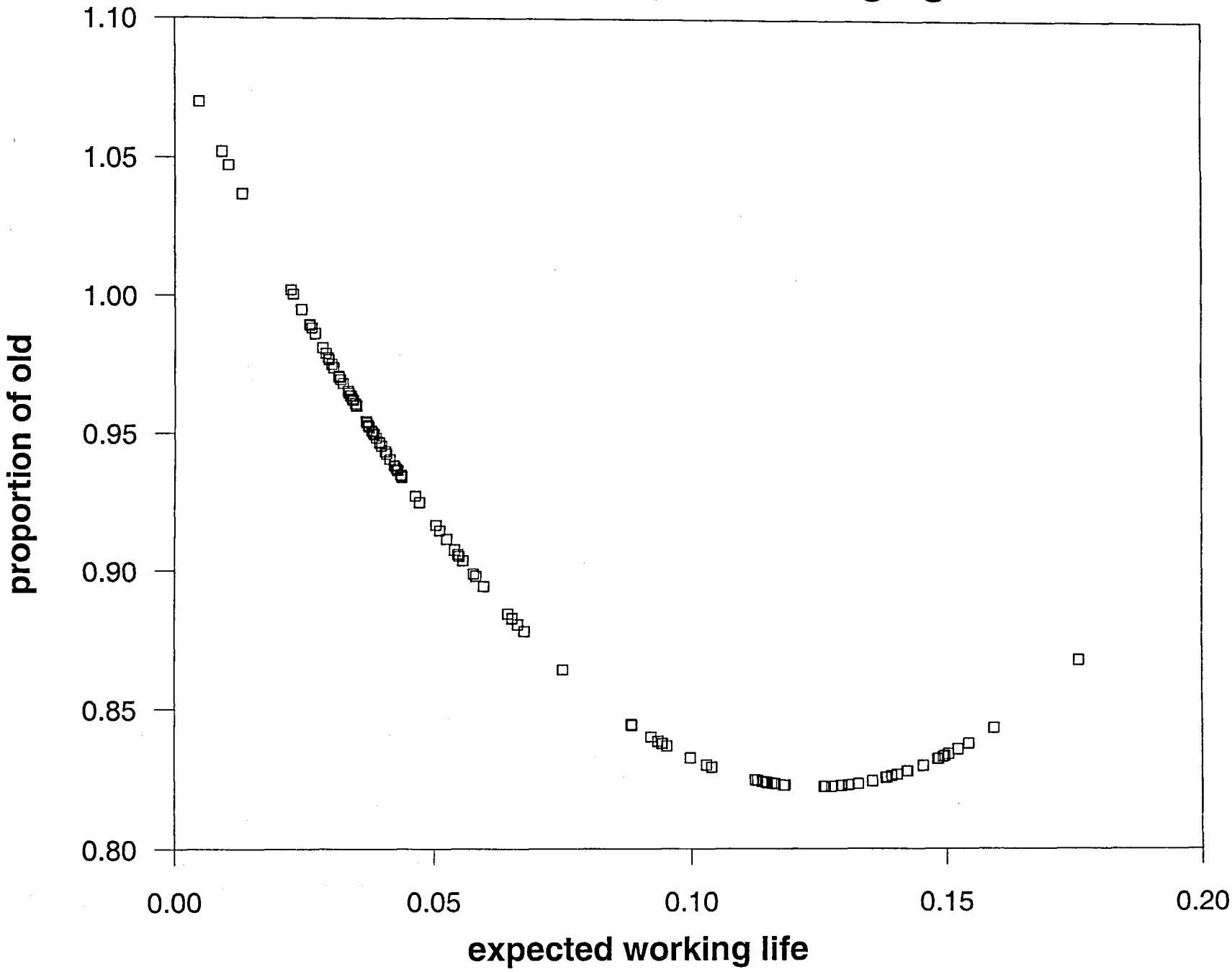




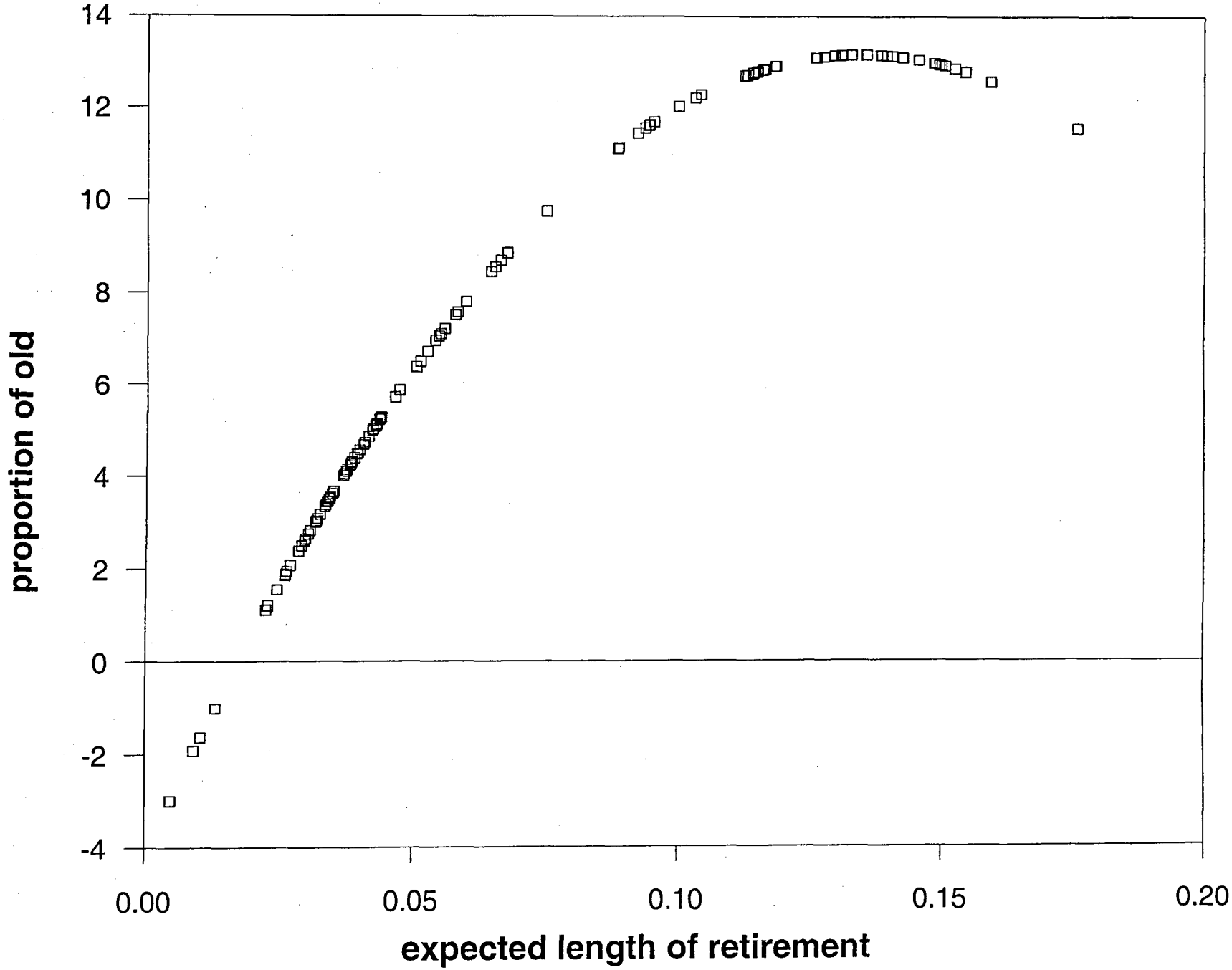
Graph 3. Determinants of aging: Higher life expectancy?



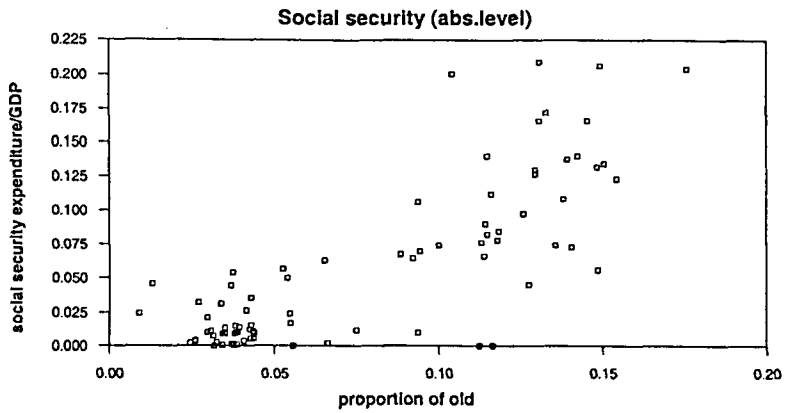
Graph 4. Working life and aging

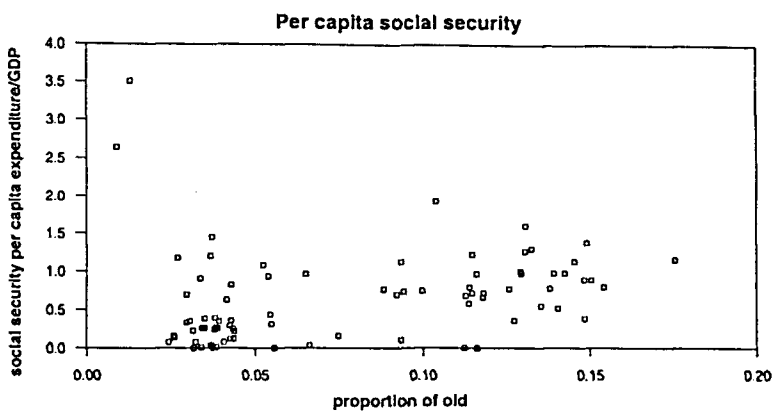


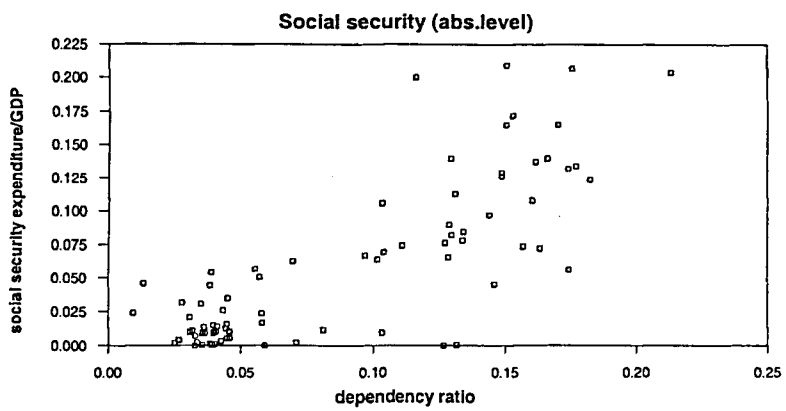
Graph 5. Length of retirement and aging

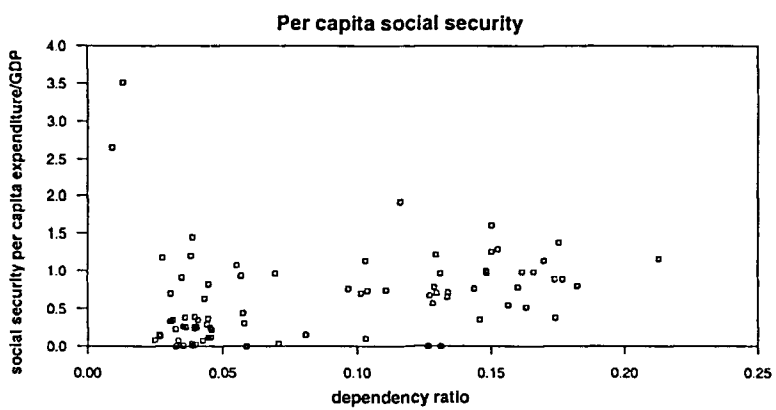


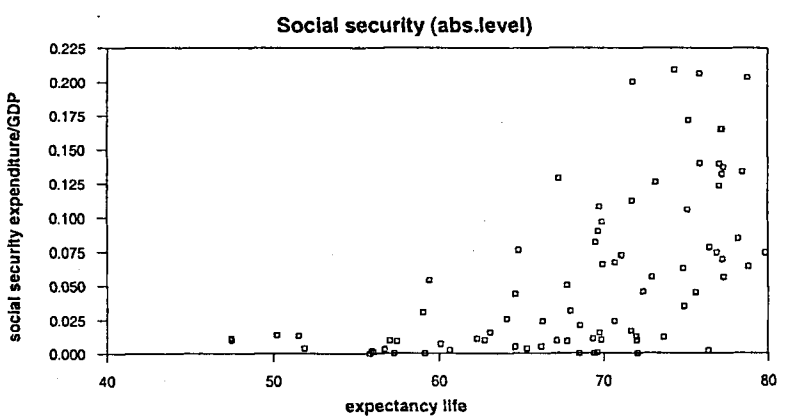
Graph 6: Social security and Demographics

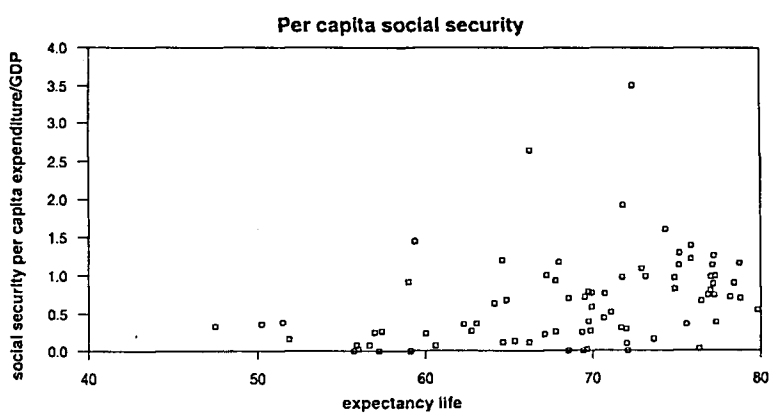




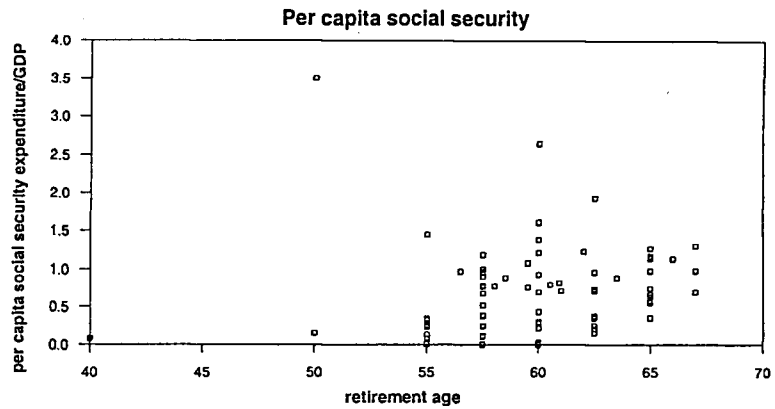


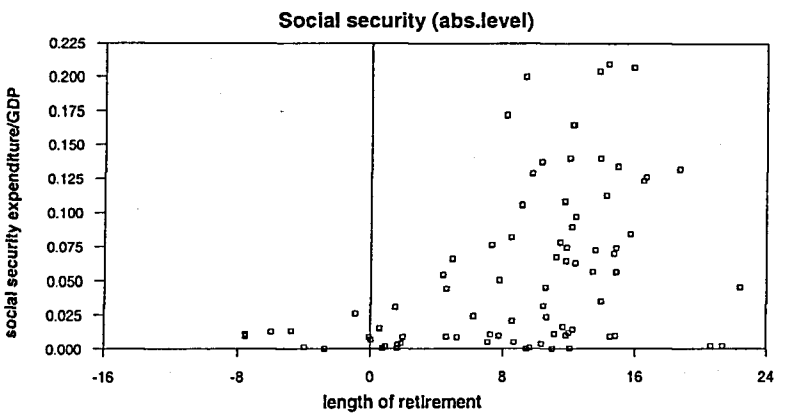


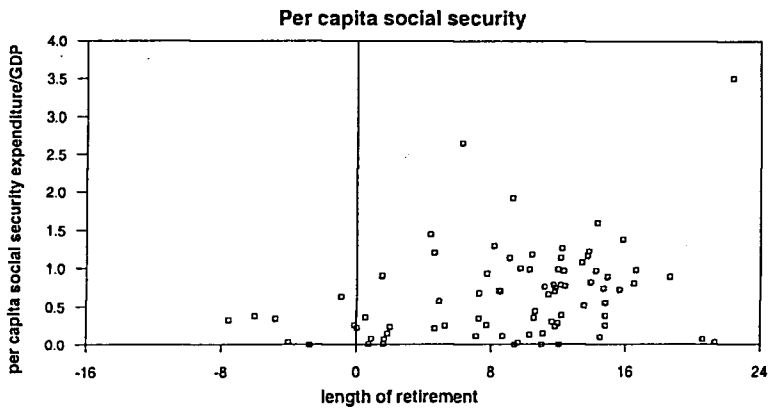


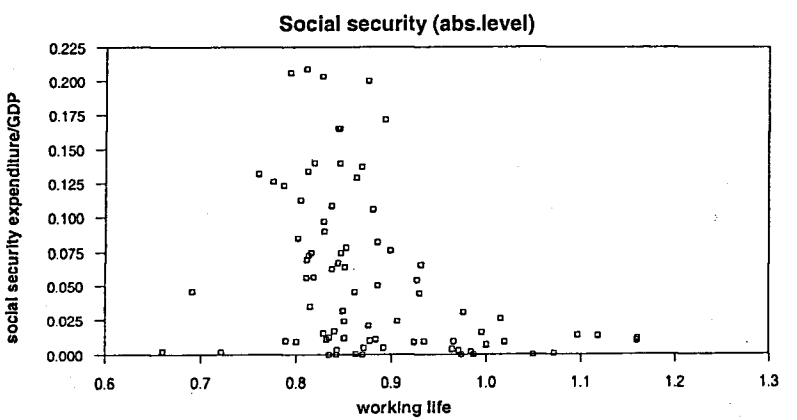


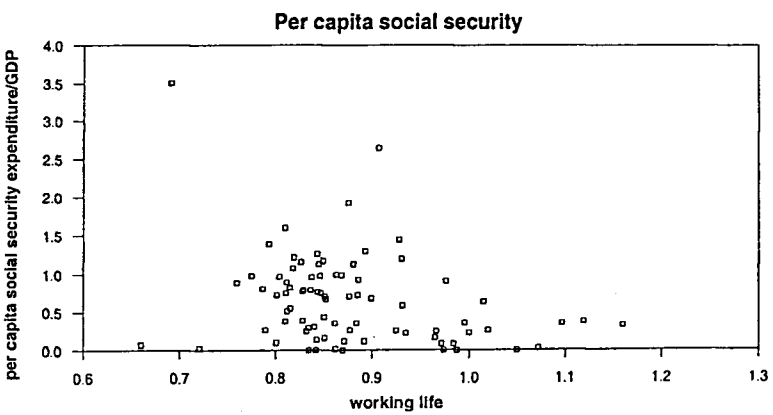
Graph 7: Social security and Retirement



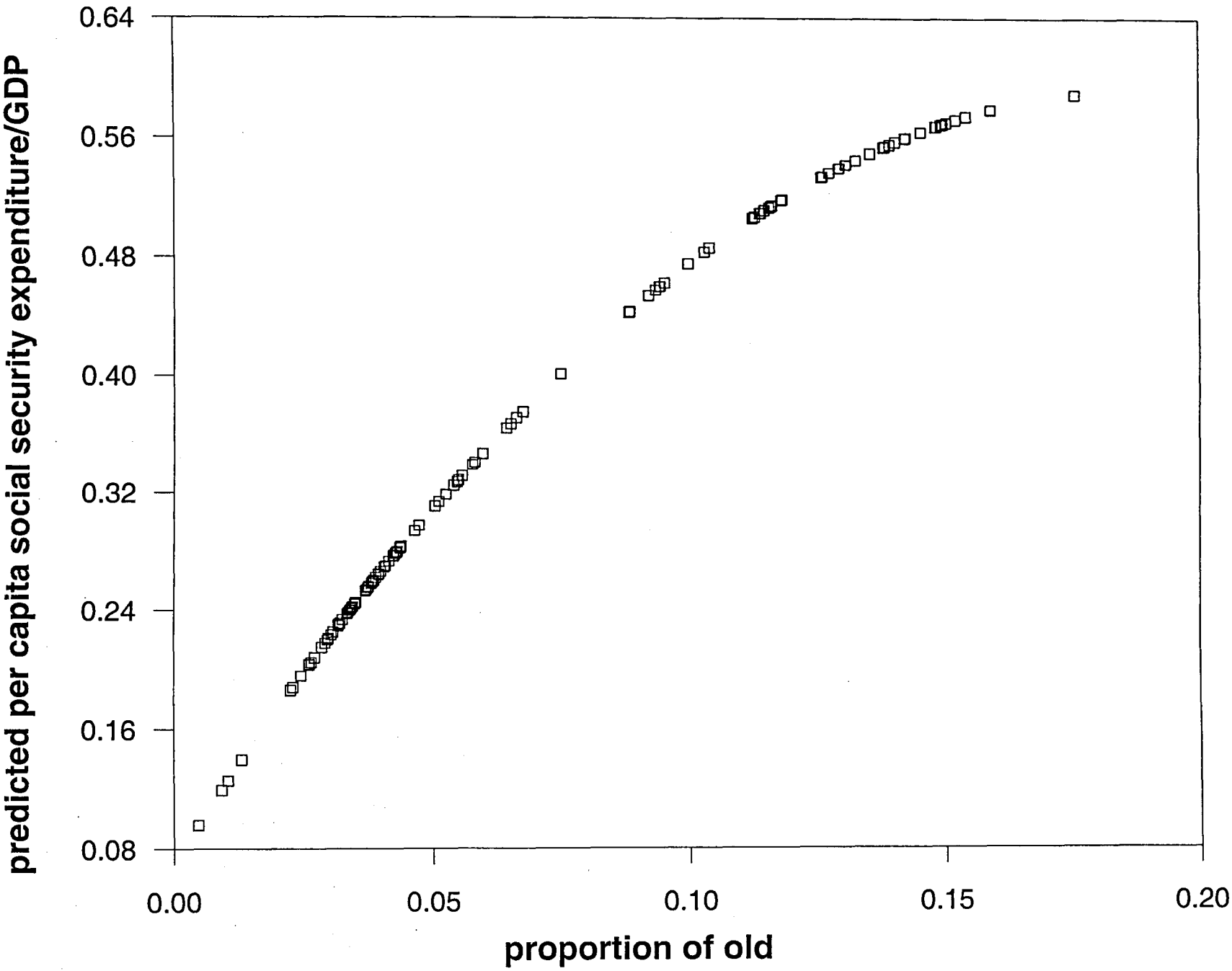








Graph 8: Per capita social security



Chapter 6

Conclusions

Social security represents a topical issue in policy debates all around the world. In the 1990s many OECD and developing countries have undergone important changes in their mandatory old-age security systems to deal with the complex challenges driven by the aging process. However, the reform process is not over yet, nor is the debate on the determinants of the current structure of old age security systems.

A crucial open issue in this debate on the determinants of current social security systems is the following: *Why is social security always associated with retirement?* This question is also relevant for the debate on the future of social security and the reform process: *What will be the impact of the aging process on the current social security and retirement programs?*

The tight link between retirement and social security is the most common feature of all social security systems since their introduction, and not only in democratic countries. Surprisingly, this has largely been an unsolved puzzle for the positive theories of social security. I argue that this association relies mainly on a political element. The old have to retire, or are induced to retire, in order to win the political process that allows them to receive a positive transfer from the young. Although politico-economic voting models can account for the introduction of social security, they are not able to explain why the old retire from the labor market. The only model that provides an explanation for the contemporaneous existence of retirement and social security is Mulligan and Sala-i-Martin (1999a). However, this represents an interest groups model, based on pressure functions, which does not derive the policy outcome from a democratic voting process, as it occurs in current western countries. Additionally, this model does not take

into account the demographic aspects. Since the two groups of young and old are assumed to be of equal size, this framework cannot assess the channels through which demography is related to social security, nor predict the effects of expected demographic changes on social security, nor address policy reforms issues.

These considerations motivated this thesis. The thesis provides a positive explanation of the puzzle of the tight link between retirement and social security, within a majoritarian voting model. Then, it analyzes, theoretically and empirically, the effects of the changes of the population's age structure on the retirement and social security programs.

6.1 What have we learned?

The main contributions of the thesis are four, corresponding to the answers to each of the following questions.

(i) *Why there exist social security programs which transfer resources from young and middle-aged workers to the elderly?*

Chapter two reviews the main contributions in the literature of politico-economic models of social security. The survey highlights that existing models may differ in how they explain the existence of social security programs, but they generally neglect some important issues, concerning the interactions between social security and other redistributive programs. This represents an unexplored territory both in terms of the positive theories of social security, and to analyze social security reforms. In this context, the most important issue seems to be the association between retirement and social security. This result motivates the analysis developed by the thesis to study the determinants of this feature and the impact that the aging process has on them.

(ii) *Why are the current social security programs always associated with retirement? And what are the economic and political interactions between social security and retirement programs?*

Chapter three provides a positive explanation of the contemporaneous existence of retirement and social security. To my knowledge, this is the first model in the literature to derive the existence of retirement and social security from a voting process. To deal with multi-dimensional

policy issues, I adopt a probabilistic voting approach. A crucial hypothesis is that leisure when old is a "merit good," i.e., all agents in the economy, young and old, value the leisure of the old. Since they care about the leisure of the old, the young force the politicians to set a positive tax on the labor income of the old, to induce them to retire. Retirement increases the level of ideological homogeneity of the old group. In fact, retirement reduces their wage income, which make the old more united than the young in their political interests, which in turn increases their political power and thus allows them to receive a positive transfer from the young (social security).

(iii) *What is the impact of the aging process on retirement and social security?*

Chapter four analyzes the equilibrium level of retirement and social security in a dynamic economic and demographic environment. I introduce an interest groups model in an overlapping generations economy. As explained in the survey (chapter 2), this is an alternative approach, as opposed to the voting mechanisms, to model the political institution that aggregates individual preferences over social security into a policy outcome. It has the advantage of being able to account for the existence of retirement and social security also in non-democratic countries, as shown by the evidence (Russia). Social security is derived from the political interaction between two groups of agents, young and old, which differ in size, wage and persistence. The model investigates the political solution which is likely to emerge as the fraction of elderly in the population (agents above retirement age) increases. The more elderly in the economy, the more political power they will enjoy. However, the dependency ratio decreases, and more retirees have to share a given amount of resources. My analysis suggests that the aging of the population induces elderly people to set a lower tax rate on their wage income, which decreases the disincentives to work and reduces retirement. The effect on social security is ambiguous. In fact, while more political power induces a larger transfer, the decrease in retirement leads to lower transfers.

(iv) *What does the empirical evidence suggest about demography as a determinant of retirement and social security around the world?*

Chapter five constructs a new data-base, which collect data from different sources for many countries. The construction of a new extended data base collecting informations on demography, retirement and social security has not been an easy task, and it represents a relevant contribution

in the large empirical literature of social security. Based on these data, the chapter provides new evidence on the determinants of the retirement level and the size of the social security programs around the world. This cross-country analysis suggests that there exist a relevant effect of demography on retirement and social security. The results provides empirical support for the implications of the theory: both retirement level and social security expenditures decrease after a large increase of the proportion of old in the population. The data support the possibility that the relation is hump-shaped, due to the existence of opposite size and per capita effects.

6.2 Where do we go from here?

The thesis provides a positive answer to a big puzzle: the contemporaneous existence of retirement and social security. It also suggests a new theoretical explanation of the impact of the aging process on both retirement and social security, as well as some empirical evidence on this effect. These results contribute to the understanding of some central, open issues in the debate on the determinants of the current social security programs and may have important implications for the design of the reform process.

In the meantime, the thesis opens new questions which represent promising areas of research. I would like to remember the following:

(i) *Retirement, Social Security and The Welfare State*

The interactions between social security and other redistributive programs are important elements of the social security systems. Their study may lead to a more natural environment in which to analyze comprehensive reforms of the welfare state, which may include politically feasible social security reforms. The thesis addresses the first and more general association, the one between retirement and social security. As a common feature of all past and current programs around the world, this association needs to be explained in any positive theory of social security and to be considered in any analysis of reforms. However, the few existing analysis in this direction (see chapter 2 for a review) share a common failure of majoritarian voting politico-economic models: they only focus on the interactions between social security and other specific redistributive programs, but cannot explain retirement. Further analysis are needed to study the interactions of both retirement and social security with many other

redistributive programs (public education, public health) in a more general framework.

(ii) *Merit goods and Politics*

The model in chapter three assumes the "merit goods" hypothesis to explain the existence of mandatory retirement. The leisure of the old is a merit good, since the young give a positive value to it. The government program redistributing from young to old is seen as a mechanism (a "merit-good contract") through which the young can "help" the old to obtain retirement, as they feel it is meritorious. However, the interactions between merit goods motives and politics may explain many redistributive policies. Many welfare programs which target the poor, including government health insurance, compulsory schooling, safety regulations, environmental protection, public housing, contain merit goods motives. The rich seem to value consumption of these goods by the poor, and they are willing to redistribute part of their income in favor of the poor, although only for these specific purposes. Merit goods motives inducing redistributive politics have never been analyzed in politico-economic models.

(iv) *Retirement, Social Security, and demographic changes (other than aging)*

The model in chapter four analyzes the impact of the aging process on retirement and social security. The same framework can be used to address a largely discussed issue in the social security debate: the impact of migration flows on retirement and social security. Again, any analysis that aims at explaining the impact of immigration on social security has to take into account the impact of this phenomenon on retirement. A general perception about a less dramatic impact of the aging process on the social security size has to be revisited in a more appropriate framework, to consider both retirement and social security. Besides, several political elements are involved in this issue, which make the politico-economic environment the more appropriate to this purpose. Similarly, the same framework can be used to analyze the impact of the increased participation of women to the labor market on the political equilibrium of retirement and social security.

(iii) *The empirical evidence on the relation between political power and wage income/leisure*

The model in chapter three introduces the hypothesis that groups with lower wage income are more ideologically homogeneous, i.e. they are more united in their political interests. This hypothesis resembles the "single-mindedness" assumption. Workers of different occupations care about several issues, related to their different occupations and industries, while non-workers

(e.g. retirees) are more united in their political action. In this model the degree of within-group ideological concentration is captured by the number of swing voters, i .e., people who vote mainly according to the proposed policy platforms and are willing to change party when the opposite party proposes a policy platform more favorable to them. Therefore, once induced to retire, the old turn out to win the political process because they have more swing voters. The estimate of the number of swing voters in different age and income groups based on empirical evidence is a new, interesting task. I suspect that it may reinforce the evidence on the "single-mindedness" hypothesis.

Bibliography

[1] Alesina, A. and Rodrik, D. (1994), "Distributive Politics and Economic Growth", *Quarterly Journal of Economics*, 109: 465-90.

[2] Atkinson, A. B. (1987), "Income Maintenance and Social Insurance", in A.A. Auerbach and M.S. Feldstein (eds), Handbook of Public Economics, Vol. 2, New York North Holland.

[3] Auerbach, A.J., Gokhale J., Kotlikoff L.J. (1994), "Generational Accounting: A Meaningful Way to Evaluate Fiscal Policy", *Journal of Economic Perspectives*, 8: 73-94.

[4] Auerbach, A.J. and L.J. Kotlikoff (1987), "Dynamic Fiscal Policy", Cambridge University Press.

[5] Austen-Smith (1981), "Voluntary Pressure Groups", *Economica* 48: 143-153.

[6] Austen and Smith (1987), "Interest Groups, Campaign Contributions and Probabilistic Voting", *Public Choice*, 39: 427-433.

[7] Azariadis, C. and V. Galasso (1997), "Fiscal Constitutions and the Determinacy of Intergenerational Transfers", mimeo.

[8] Baron, D.P, and J.A. Ferejohn (1989), "Bargaining in Legislature", *American Political Science Review, 83 (4).*

[9] Baugmartner and Leech (1998), "Basic Interests. The importance of Groups in Politics and in Political Science", Princeton University Press.

[10] Becker, G.S. (1983), "A Theory of Competition Among Pressure Groups for Political Influence", *The Quarterly Journal of Economics*, 3: 371-400.

[11] Becker, G.S., (1985), "Public Policies, Pressure Groups and Deadweight Costs", *Journal of Public Economics,* 28: 329-347.

[12] Becker, G. S. and Mulligan, C. (1998), "Deadweight Costs and the Size of Government", NBER W.P. No. 6789.

[13] Becker, G.S, and Murphy (1988). "The Family and the State," *Journal of Law and Economics,* 31 (1): 1-18.

[14] Boadway, R.W. and D.E. Wildasin (1989), "A Median Voter Model of Social Security", *International Economic Review, 30.*

[15] Boadway, R. and Wildasin, D. (1989), "Voting Models of Social Security Determination", In Gustafsson and Kleirmarken (eds), "The Political Economy of Social Security", North Holland, Amsterdam, New York, Oxford, Tokyo.

[16] Bohn, H. (1999) "Will Social Security and Medicare Remain Viable as the U.S. Population is Aging?", *Carnagie Rochester Conference Series on Public Policy, 50 (99).*

[17] Boldrin M. and A. Montes (1998), "Intergenerational Transfer Institutions: Public Education and Public Pensions", mimeo, Universidad Carlos III.

[18] Boldrin M. and A. Rustichini (2000), "Equilibria with Social Security", *Review of Economic Dynamics 3(1):* 41-78.

[19] Boskin, M. (1977), "Social Security and Retirement Decisions", *Economic Inquiry* XV:1-25.

[20] Boskin, M.J., L.J. Kotlikoff, D.J. Puffert and J.B. Shoven (1987), "Social Security: A Financial Appraisal across and within Generations", *National Tax Journal,* 40.

[21] Bradford, D.F. (ed), "Distributional Analysis of Tax Policy", AEI Press.

[22] Breyer, F. (1994a), "The Political Economy of Intergenerational Redistribution", *European Journal of Political Economy,* 10.

[23] Breyer, F., (1994b), "Voting on Social Security when Labor Supply is Endogenous", *Economics and Politics,* 10.

[24] Breyer, F. and K. Stolte (1999), "Demographic Changes, Endogenous Labor Supply and the The Political Feasibility of Pension Reforms", forthcoming in *Journal of Population Economics.*

[25] Browning, E. (1975), "Why the Social Insurance Budget is Too Large in a Democracy", *Economic Inquiry,* XIII.

[26] Brugiavini, A. (1997), "Social Security and Retirement in Italy", NBER W.P. No.6155.

[27] Cohen, W.J. (1972), "Social Security: Universal or Selective?", Companion to Milton Friedman lecture, Washington, D.C: American Entreprise Institute.

[28] Conde-Ruiz, J.I. and V. Galasso (1999a), "Positive Arithmetic of the Welfare State", CEPR *Discussion Paper Series* No. 2202.

[29] Conde-Ruiz, J.I. and V. Galasso (1999b), "Early Retirement", mimeo, Universidad Carlos III de Madrid.

[30] Conesa J.C. and D. Kruger (1999), "Social Security Reform with Heterogeneous Agents", *Review of Economic Dynamics,* 2(4).

[31] Cooley T.F. and J. Soares (1996), "Will Social Security Survive the Baby Boom?", *Carnagie Rochester Conference Series on Public Policy, 45(0).*

[32] Cooley T.F. and J. Soares (1998), "A Positive Theory of Social Security Based on Reputation", *Journal of Political Economy, 107(1):* 135-160.

[33] Cooley T.F. and J. Soares (1999), "Privatizing Social Security", *Review of Economic Dynamics,* 2(3).

[34] Coughlin, P. (1982), "Pareto Optimality of Policy Proposals with Probabilistic Voting", *Public Choice* 39: 427-433.

[35] Coughlin, P. (1984), "Expectations About Voter Choices", *Public Choice* 44: 49-59.

[36] Coughlin, P. (1992), "Probabilistic Voting Theory", Cambridge, *Cambridge University Press.*

[37] Coughlin, P. and Nitzan (1981), "Directional and Local Electoral Equilibria with Probabilistic Voting", *Journal of Economic Theory* 34: 1-12.

[38] Cuckierman, A. and Meltzer (1989), "A Positive Theory of Government Debt and Deficits in a Neo-Ricardian framework", American Economic Review, *79.*

[39] Davis and Hinich (1984), "Conditions and Median Outcomes in Probabilistic Voting Models", *Journal of Economic Theory* 34: 1-12.

[40] Day, C.L. (1990), "What Older Americans Think. Interest Groups and Aging Policy", *Princeton University Press.*

[41] Delli Caprini, M.X. and Scott, K. (1996), "What Americans Know about Politics and why it Matters", Yale University Press, 1996.

[42] Diamond, P. (1977), "A Framework for Social Security Analysis", *Journal of Public Economics,* 8(3): 275-98.

[43] Diamond, P. (1993), "Privatization of Social Security: Lessons from Chile", NBER W.P. No. 4510.

[44] Diamond, P. (1996), "Proposals to Restructure Social Security", *Journal of Economic Perspectives* (10), No. 3: 67-88.

[45] Diamond, P. and Gruber, J. (1997), "Social Security and Retirement in the U.S", NBER W.P. No 6097.

[46] Diamond, P.A. Mirrlees, J.A. (1986), "Payroll-tax Financed Social Insurance with Variable Retirement", *Scandinavian Journal of Economics,* 88: 25-50.

[47] Disney, R. (1996), "Can we Afford to Grow Older?", The MIT Press.

[48] Dixit, A. and Londregan, J. (1996). "The Determinants of Success of Special Interests in Redistributive Politics", *The Journal of Politics,* 58: 1132-55.

[49] Dougan, W.R. and Snyder, J.M. (1996), "Interest Group Politics Under Majority Rule", *Journal of Public Economics*, 61: 49-71.

[50] European Commission (1997), "The Welfare State in Europe, Challanges and Reforms", *European Economy* 4.

[51] Feldstein M.S. (1974), "Social Security, Induced Retirement and Aggregate Capital Accumulation", *Journal of Political Economy*, 82(5): 905-26.

[52] Feldstein, M. and Samwick A. (1997), "The Economics of Prefunding Social Security and Medicare Benefits", NBER W.P. No.6055.

[53] Friedman, M. (1963), "Capitalism and Freedom", University of Chicago Press.

[54] Galasso, V. (1999), "The US Social Security System: What Does Political Sustainability Imply?", *Review of Economic Dynamics*, 2(3): 698-730

[55] Galasso, V. (2000), "The US Social Security: A Financial Appraisal for the Median Voter", mimeo, Universidad Carlos III.

[56] Gerber, J. Wolff, J. Klores, W. Bown, G. (1989), "Lifetrends: The Future of Babyboomers and Other Aging Americans", Macmillan New York.

[57] Gramlich, E.M. (1996), "Different Approaches for Dealing with Social Security", *Journal of Economic Perspectives* (10), 3: 55-66.

[58] Grossman, G. and Helpman, E. (1996), "Electoral Competition and Special Interest Politics", *Review of Economic Studies* 63: 265-286.

[59] Grossman, G.M., and E. Helpman (1998), "Intergenerational Redistribution with Short-Lived Governments", *The Economic Journal,* 108: 1299-1329

[60] Gruber, J. and Wise, D. (1997), "Social Security Programs and Retirement Around the World", NBER W.P. No. 6134.

[61] Gustafsson and Kleirmarken (eds) (1989), "The Political Economy of Social Security", North Holland Amsterdam New York Oxford Tokyo.

[62] Hamermesh, D.S. (1987), "Social Security as Longevity Insurance", Conference on Economic Development and Social Welfare in Taiwan.

[63] Hammond P. (1975) "Charity: Altruism or Cooperative Egoism" in "Altruism, Morality and Economic Theory" (E.S. Phelps, Ed.), Russell Sage Foundation, New York.

[64] Hansson, I. and C. Stuart (1989), "Social Security as Trade among Living Generations", *American Economic Review*, 79.

[65] Hinich, M.J., Ledyard, J.O., Ordershook, P.C., (1972), "Nonvoting and the Existence of the Equilibrium under Majority Vote", *Journal of Economic Theory,* 44: 144-153.

[66] Hu, S.C. (1982) "Social Security, Majority-Voting Equilibrium and Dynamic Efficiency", *International Economic Review,* 23: 269-287.

[67] A. Imrohoroglu, S. Imrohoroglu, and D.H. Joines (1995), "A Life Cycle Analysis of Social Security", *Economic Theory,* 6(1): 83-114.

[68] Joines, D.H. (1999) "Will Social Security and Medicare Remain Viable as the U.S. Population is Aging? A Comment", *Carnagie Rochester Conference Series on Public Policy, 50 (99).*

[69] Kotlikoff, L. (1979), "Testing the Theory of Social Security and Life-cycle Accumulation", *American Economic Review*: 396-410.

[70] Kotlikoff, L.J. (1993), "Generational Accounting. Knowing who Pays and when for what we Spend", The Free Press.

[71] Kotlikoff, L.J. and Gokhale, J. "Estimating a Firm's Age-Productivity Profile Using the Present Value of Workers' Earnings", *Quarterly Journal of Economics,* 107 (4): 1215-42.

[72] Lam, D. (1986), "The Dynamics of Population Growth, Differential Fertility and Inequality", *American Economic Review,* 76: 1103-1116.

[73] Lambertini, L., and C. Azariadis (1998), "The Fiscal Politics of Big Governments: Do Coalitions Matter?", mimeo, UCLA.

[74] Latulippe, D. (1997), "Effective Retirement Age and Duration of Retirement in the Industrialised Countries Between 1950 and 1990", ILO Discussion Paper 2.

[75] Lazear, E.P., "Why is There Mandatory Retirement?", *Journal of Political Economy,* 87 (6): 1261-74.

[76] Lilien, D.M. (1979), "The Labor Force Participation of Older Workers", Report submitted to ASPER.

[77] Lindbeck, A. and Weibull, J.W. (1987), "Balanced-Budget Redistribution as the Outcome of Political Competition", *Public Choice,* 52: 273-297.

[78] Lindert, P.H. (1996), "What Limits Social Spending?", *Explorations in Economic History* 33, 1-34.

[79] Meijdam, L., and H.A.A Verbon (1996), "Aging and Political Decision Making on Public Pensions", *Journal of Population Economics,* 9(2).

[80] Meltzer, A. H. and Richard, S.F. (1994), "A Rational Theory of the Size of Government", In: Persson,T. and Tabellini, G. , "Monetary and Fiscal policy", Cambridge, MIT Press.

[81] Mueller, D. (1989), "Public Choice II", Cambridge, Cambridge University Press.

[82] Mulligan, C.B. (1998), "Substitution Over Time: Another Look at Life Cycle Labor Supply", *NBER Macroeconomics Annual,* Cambridge, MA: MIT Press.

[83] Mulligan, C.B. and Philipson T.J. (1999), "Policy design and Incidence in a Merit Good Economy", Mimeo, University of Chicago and NBER.

[84] Mulligan, C.B., and X. Sala-i-Martin (1999a), "Gerontocracy, Retirement and Social Security", NBER W.P. No. 7117.

[85] Mulligan, C.B., and X. Sala-i-Martin (1999b), "Social Security in Theory and Practice (I): Facts and Political Theories", NBER W.P. No.7118.

[86] Mulligan, C.B., and X. Sala-i-Martin (1999c), "Social Security in Theory and Practice (II): Efficiency Theories, Narrative Theories, and Implications for Reform", NBER W.P.No. 7119.

[87] Mulligan C.B. and Sala-i-Martin, X. (1999d), "Retirement-Inducing Policy Wears many Disguises", Mimeo University of Chicago, Columbia University and Universitat Pompeu Fabra and NBER.

[88] Musgrave, R. (1986), "On Merit Goods", in "Public Finance in a Democratic Society. Collected papers of Richard Musgrave", New York University Press.

[89] Musgrave, R. (1988), "Merit Goods", The New Palgrave: A Dictionary of Economics, Stocktone Press.

[90] Myles, G.B.(1995), "Public Economics", Cambridge UP.

[91] Olson, M. (1971), "The Logic of Collective Action", Cambridge, MA. Harvard University Press.

[92] Organisation For Economic Co-operation and Development (OECD), (1998), "Maintaining Prosperity in an Aging Society".

[93] Perotti, R. (1992), "Income Distribution, Politics and Growth", AEA Papers and Proceedings, 82 (2): 311-316.

[94] Perotti, R., (1996), "Growth, Income Distribution, and Democracy: What the Data Say", *Journal of Economic Growth*, 1(2), 149-188.

[95] Persson, T. (1998), "Economic Policy and Special Interest Politics", *The Economic Journal*, 108: 310-327.

[96] Persson, T. Roland, G. Tabellini, G. (1998a), "Towards micropolitical foundations of public finance", *European Economic Review* 42: 685-694.

[97] Persson, T. Roland, G. Tabellini, G. (1998b), "Comparative Politics and Public Finance", W.P. 114, IGIER.

[98] Persson, T and Tabellini, G. (1984), "Growth, Distribution and Politics", In: Persson, T. and Tabellini, G. "Monetary and Fiscal Policy", Cambridge, MIT Press.

[99] Persson, T. Tabellini, G. (1999a), "Political Economics and Public Finance", Handbook of Public Economics.

[100] Persson, T. Tabellini, G. (1999b), "The Size and Scope of Government: Comparative Politics with Rational Politicians", *European Economic Review,* 43: 699-735.

[101] Persson, T., and G. Tabellini, (2000), "Political Economics. Explaining Economic Policy", MIT Press.

[102] Peterson, P.G. (1996). "Will America Grow up Before it Grows Old?", *Random House, NY.*

[103] Peterson, S.A. and Somit, A.(1994), "The Political Behavior of Older Americans", Garland Publishing, NY- London.

[104] Pogue, T.F. and Sgontz, L.G. (1977), "Social Security and Investment in Human Capital", *National Tax Journal,* 30(2): 157-69.

[105] Rappaport, A.M.and Schieber, S.J. (eds) (1993), "Demography and Retirement: The twenty-first century", PRAEGER.

[106] Rein, M. Jacobs, K.(1993), "Aging and Employment Trends: A Comparative Analysis for OECD countries", In: P.Johnson and K.F.Zimmermann, eds. "Labour Markets in an aging Europe", Cambridge University Press: 53-76.

[107] Roberts, K.W.S. (1977), "Voting Over Income Tax Schedules", *Journal of Public Economics,* 8.

[108] Romer, P. (1994), "Preferences, Promises and the Politics of Entitlement", UC Berkeley.

[109] Rosevare, D. and Leibfritz, W. and Fore, D. and Wurzel, E. (1996), "Aging Populations, Pension Systems and Government Budgets: Simulations for 20 OECD countries", OECD W.P. No 168.

[110] Sala-i-Martin, X. (1996), "A Positive Theory of Social Security", *Journal of Economic Growth,* 277-304.

[111] Samuelson, P.A. (1975a), "Optimum Social Security in a LifeCcycle Growth Model", *International Economic Review,* 16: 539-44.

[112] Samuelson (1958), P.A. "An Exact Consumption-Loan Model of Interest with or without the Social Contrivance of Money". *Journal of Public Economics* 66 (6): 467-482.

[113] Samwick, A.A. (1998), "New Evidence on Pensions, Social Security and the Timing of Retirement", NBER W.P. No W6534.

[114] Schieber, S.J.and Shoven, J.B. (1997), "Public Policy Toward Pensions", MIT Press.

[115] Schulz, J.H. (1995), "The Economics of Aging", Auburn House.

[116] Shepsle, K.A. (1979), "Institutional Arrangements and Equilibrium in Multidimensional Voting Models", *American Journal of Political Science*, 23 (1).

[117] Sjoblom, K. (1985), "Voting for Social Security", *Public Choice* 45, 225-240.

[118] Smith, A. (1982), "Intergenerational Transfers as Social Insurance", *Journal of Public Economics*, 19: 97-106.

[119] Stromberg, D., (2000) "Radio's Impact on Public Spending", mimeo, Stockolm University

[120] Tabellini, G. (1990), "A Positive Theory of Social Security", NBER Working Paper No 3272.

[121] Tabellini, G. (1994), "The Politics of Intergenerational Redistribution", In: Persson, T. and Tabellini, G. "Monetary and Fiscal Policy", Cambridge, MIT Press.

[122] Turner, J.A.(1984). "Population Age Structure and the Size of Social Security" *Southern Economic Journal*, 50(4): 1131-46.

[123] Usher, D. (1994), "The Significance of the Probabilistic Voting Theorem", *Canadian Journal of Economics* XXVII, N.2.

[124] Veall, M.R. (1986), "Public Pensions as Optimal Social Contracts", *Journal of Public Economics*, 31.

[125] Verbon, H.A.A., and M.J.M. Verhoeven (1992), "Decision Making on Pension Schemes Under Rational Expectations", *Journal of Economics*, 56 (1).

[126] Verhoeven, M.J.M., and H.A.A. Verbon (1991), "Expectations on Pension Schemes under Non-Stationary Conditions", *Economic Letters*, 36.

[127] Wilensky, H.L. (1975) "The Welfare State and Equality: Structural and Ideological Roots of Public Expenditures", University of California Press.