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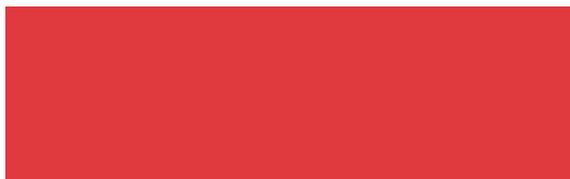
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**Macroeconomic
and
Distributional
Effects
of Social Security**

Luisa Fuster



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Macroeconomic and Distributional Effects of Social Security

Luisa Fuster¹

1. Introduction

Social security is at the forefront of the political debate. Free market positions emphasize the negative impact of social security on savings while other positions advocate for preserving social security as a social protection for low earners and the elderly. The public attention on social security is perhaps motivated by the quantitative importance of social security expenditures. Indeed, the ratio of social security expenditure to GDP is quite large in most countries, though significant differences remain: it varies from 4% in the USA to 20% in Sweden.

The effects of social security in the economy have been widely discussed among economists. Some of the questions that researchers have posed are: What are the effects of social security on savings, employment and production in an economy? How does social security affect the welfare of individuals across the income distribution? Will social security be sustainable in economies where the population is aging? This *Opuscle* reviews the findings of recent research addressing these questions.

Our discussion is organized around the main effects of social security in the economy. In particular we will focus on its impact on savings and labor supply. Social security discourages savings because public pensions decrease the need of savings for retirement. Pensions also discourage labor supply because they induce individuals to retire at an early age. Moreover, the taxation of labor income used to finance pensions reduces after tax wages and may thus negatively affect labor supply. The decrease of savings and labor supply induced by social security translates into a decrease of the economy's output.

On the positive side, we will argue that social security provides insurance against lifetime uncertainty and income risk which markets may fail to supply. As a result, social security may improve individuals' well-being. Moreover, we will see that social security has important distributional effects. Indeed, whether individuals benefit or not from social security depend on their income level, wealth, age, and mortality rate.

In summary, this *Opuscle* will discuss the macroeconomic and distributive impact of the public pension system. We start by describing the main characteristics of different pension systems. Then, we evaluate the impact of social security on capital accumulation and labor supply. The next two sections focus on the role of social security as an insurance device and its distributive effects. This *Opuscle* ends with a discussion of recent reforms of social security systems and with some concluding comments.

2. Social security systems

Pension systems can be classified according to the way pensions are determined and financed.

Regarding the determination of pensions, we can distinguish between defined benefit systems and defined contribution systems. In a *defined benefit system*, pension benefits are determined as a function of the earnings and the labor market history of individuals. Indeed, pensions are typically computed as a function of the average wage over a specified amount of years and this relationship may depend on the years of employment of the individual but not on the actual taxes paid. In a *defined contribution system*, however, workers accumulate contributions in an individual account and the balance accumulated by the time of retirement is converted into an annuity.

Regarding the financing of pensions, we can distinguish between pay-as-you-go systems and fully-funded systems. In a pay-as-you-go system, the contributions of workers are used to finance the pension benefits paid to individuals that are currently retired. As a result, this system imposes intergenerational transfers of income. In a fully-funded system, contributions are invested in the capital market and returns are accumulated. Since pensions are financed with own accumulated savings, there are no intergenerational transfers taking place.

Fully-funded systems vary across countries with respect to the degree of freedom that individuals have in choosing their investment portfolio. While in Chile individuals control their accounts, in Singapore the government decides how pension funds are invested. After a recent reform, Sweden has a social security system that combines features of both systems. There is a payroll tax of 18.5%, of which 2.5% points are deposited in individual accounts while the rest is used to finance a pay-as-you-go system. The pay-as-you-go system pays benefits determined by the

contributions made by individuals which are accumulated according to a legislated rate of return (the rate of growth in the economy instead of the rate of return in the capital markets).

In most countries retirement pensions are primarily financed by a special tax instead of being financed from general revenue. In particular, social security contributions are collected from a payroll tax. In most countries, there is a maximum level of taxable earnings, which makes the tax regressive. For example, maximum taxable earnings are 145% of the median annual earnings in Canada, 246% of average earnings in the USA and 180% of average monthly gross wage in Germany. Table 1 compares data on contributions to social security across countries.

We can see that social security tax rates are very diverse across countries reflecting the different generosity of social security systems. For example, Canada and the U.S. are the countries with lowest level of expenditure in social security over GDP and also the countries with lowest social security taxation.

In a pay-as-you-go system, current pensions are financed by contributions of workers and, thus, the demographic structure of the economy affects the magnitude of social security taxation. In particular, the larger the population of retirees is relative to the number of contributors to the system, the higher will be the social security tax rate for a given level of benefits. We can measure the burden of social security on the working population using the dependency ratio, which is the ratio of population older than 65 to the population of working age (16-64) of an economy (see Table 1). Since population is aging in developed economies, the tax burden of pay-as-

Table 1
Social security taxation across countries²

	Payroll tax (%)	Social security expenditure/GDP	Dependency ratio in 1995
Germany	20.3	10.3	21
Italy	27.2	17	25
Spain	28.3	11.4	24
Sweden	31.4	20	28
Canada	5.4	5.3	19
USA	10.6	4	21

you-go social security systems is expected to increase in the near future.

In this *Opuscle* we concentrate our analysis on social security systems of the defined benefit type and financed as pay-as-you-go with payroll taxation, which is the most prevalent social security system in the world (see Mulligan and Sala i Martin, 1999). This system is used in countries such as Spain, Germany, France, and the USA.

3. Social security and capital accumulation

Economists consider the accumulation of capital as a crucial determinant of the long-run performance of an economy. There is strong empirical evidence that countries with high capital per worker achieve high output per worker and ultimately high levels of individual and social welfare. The capital accumulation process requires funding and the ability to fund investments, in turn, depend crucially on how much the economy saves. Since a pay-as-you-go social security system discourage savings, economists are concerned that it can have significant negative effects on capital

accumulation. In the discussion that follows, we present some recent contributions that quantify how big is the impact of social security on capital accumulation.

Proponents of privatizing or funding social security emphasize the negative impact of a pay-as-you-go social security on an economy's aggregate savings. Because pensions provide income during retirement years, social security induces individuals to save less for their retirement. Advocates of a fully-funded system claim that if social security contributions were invested in the financial markets, rather than transferred to the current old people as in a pay-as-you-go system, the reduction in private savings would be compensated by an increase in savings through the social security system. Thus, a fully-funded or a private social security system would not have a negative impact on capital accumulation. On the other hand, as we will see in Section 5 of this *Opuscle*, a pay-as-you-go system can play an important role as a social insurance device, a role that a fully-funded or a privatized system cannot so easily fulfill. Therefore, it is important to discuss whether the negative effects of a pay-as-you-go system on capital accumulation are quantitatively important or not. If the answer is no, then the gains from converting the current system into a fully-funded one are likely to be small, while the costs could be high.

Methodology of research

Many economists have investigated how important the negative impact of a pay-as-you-go system is on savings. Their research is motivated by the following question: How much bigger would the capital stock of an economy be if the pay-as-you-go system were eliminated? Ideally, we would answer the question by comparing two

economies that are identical in all respects but differ in that one of them has a pay-as-you-go social security system while the other has not. Unfortunately, there are no two economies in the world satisfying these requirements. Economists run into this type of problems quite frequently and the way they deal with them is by constructing model economies. The idea is to build a model that can be used as a laboratory in which policy experiments can be run. The model can be thought of as an artificial economy that is meant to reproduce the behavior of actual economies in dimensions that the researcher considers relevant for the question at hand. In this way, models of social security typically incorporate individuals taking labor supply and savings decisions, firms deciding how much capital and labor services to hire, a government collecting taxes to finance its expenditures, and a social security system taxing labor earnings and using the proceeds to finance pension benefits paid to retired individuals. Once the researcher is confident that the model economy mimics reasonably well key aspects of actual economies, the artificial economy can be used to perform experiments such as changing aspects of the social security system (or, for instance, just eliminating it!) and to study how individuals and firms in the model economy change their decisions in response to the change in policy or social security system.

Early quantitative studies find big effects

Auerbach and Kotlikoff (1987) used the methodology we just described to quantify the impact of the U.S. social security on capital accumulation and found the striking result that the capital stock would be 24% higher if social security were eliminated. In their model individuals start taking saving and labor supply decisions at age 20

and live for 55 years more. As individuals age, their labor productivity changes and it is assumed to be zero at age 65. Thus, individuals retire from the labor market at age 65 because they are no longer productive and, as a consequence, do not receive any labor earnings even if they work. The absence of earnings during their last 10 years of life and the assumption that individuals like to consume during their whole lifetime induce young people to save. These savings are then used to finance consumption during retirement. In this model economy, the introduction of a social security system crowds out private savings because as people receive pension benefits during retirement they do not need to save as much as in the economy without social security. As a consequence, the introduction of social security decreases the capital stock by 24%. This is a pretty large effect!

The huge negative effect of social security on capital accumulation has been confirmed in more recent studies such as Imrohorglu *et al.* (1995) for the U.S. economy and Conesa and Garriga (2000) for the Spanish economy.³ However, all of these studies are likely to exaggerate the true impact of social security since, following Auerbach and Kotlikoff (1987), they assume that individuals' savings are only motivated to finance consumption during their retirement. This assumption is not supported by empirical analysis on the determinants of the capital stock.⁴ In the U.S. economy, for instance, 33% of aggregate wealth is held by the 1% richest people. It follows that the aggregate capital accumulation is mostly determined by the saving motives of the richest individuals in the economy and it does not seem plausible that these fortunes have been accumulated mostly as savings for retirement. On the contrary, the evidence shows that rich individuals save to provide an estate or to transfer

income to their children.⁵ If the impact of social security on savings due to bequests and transfers is smaller than the one on savings for retirement, then the results in the literature just discussed would be biased.

Modeling savings for bequests

Economic theory supports the idea that the finding of Auerbach and Kotlikoff is biased (exaggerated) by the assumption that savings are only motivated by retirement. Indeed, in a famous paper, Barro (1974) shows that if savings are also motivated by the desire to leave a bequest, social security does not affect the capital accumulation of the economy. In order to understand this finding, consider a family where parents save for their retirement and for leaving an estate to their children. If parents are altruistic towards their children, the transfer is made so that the allocation of the family's resources between parents and children is optimal. Now, how would this decision change in the presence of a social security system? Under a pay-as-you-go system, the government forces a transfer from children to their parents. This is because children (workers) pay social security taxes in order to finance the pension received by their parents (retirees). However, the optimal allocation of resources within the family is not necessarily affected by social security transfers: the parents can undo this "government-sponsored transfer" by increasing the estate to their children by an amount equal to the taxes paid by them. This is in fact what the parents would do if they were happy with the allocation of resources under a situation without social security. In this case, social security does not affect savings: the decrease in savings motivated for financing retirement is exactly offset by an increase in savings motivated by bequests.

Recent quantitative studies find smaller effects

Although both economic theory and empirical studies pointed out the importance of modeling savings for bequests for a social security analysis, most studies have abstracted from bequests. In my recent work, I consider a model where individuals not only save for retirement and for precautionary reasons, but also to transfer income to their descendents.⁶ The desire to transfer income to children is motivated by altruism as in Barro (1974), that is, the happier their descendents are, the happier are the parents. Of course, parents do not wish to transfer all their income to their children because they also like to consume. This trade-off implies that the transfer to children increases with the income of the father while it decreases with the income of the children, which this is exactly what we observe in reality: transfers are higher the higher is the income of the father and the lower is the income of the children. Since in our model individuals are heterogeneous regarding their earnings, there are different levels of transfers depending on the particular combination of earnings of the parents and children. In fact, the model generates a distribution of bequests that, consistent with actual data, is concentrated in the upper tail of the distribution (that is, among the richest individuals).

Differently from Auerbach and Kotlikoff (1987), in my 1999 paper, I find that the capital stock of the USA would be only 8% higher if the social security system were eliminated. Although pensions induce a lower savings for retirement, they also induce more savings for bequests since altruistic parents compensate their children for the social security taxation. However, these two effects do not compensate each other as it

happens in Barro (1974) and the capital stock decreases significantly, though not as much as in previous analysis based on savings for retirement. In my model, savings decrease due to the effect of social security taxation on labor supply. Taxation of labor income reduces the wage per hour inducing workers to work less hours. As a consequence, the reduction in hours worked and the taxation of labor income decrease disposable income and individuals reduce their savings. In the next section we discuss the effects of social security on labor supply and the retirement decision of individuals in more detail.

4. Social Security and Labor Supply

The rules regulating the benefits and contributions of the social security system affect two dimensions of individuals' labor supply decisions: whether to participate in the labor market or not and, if employed, how many hours to work. In most countries, individuals receive social security benefits only if they do not work. This rule encourages old workers to retire from the labor market. Moreover, the taxes financing social security affect the decision about how many hours to work. In most countries, social security is financed with a payroll tax, which reduces the after-tax wage, inducing two opposite effects on the amount of time that individuals want to work. A substitution effect induces individuals to work less and increase their leisure time which is now cheaper (the opportunity cost of leisure decreases as the after-tax wage rate goes down). An income effect induces individuals to work more because they are poorer due to the reduction of the after-tax wage. Therefore, the total effect of a change in the wage rate on labor supply is an empirical question. Since the marginal tax that workers pay depends on their

age and earnings, the impact of social security on labor supply varies across workers with different age and earnings.

Social security also affects labor supply because of its effects on the prices of capital and labor services. The reduction of the capital stock due to social security, as discussed in the previous section in this *Opuscle*, leads to a reduction of the wage rate and an increase of the interest rate in the economy. The reduction of the wage rate induces an ambiguous effect on labor supply, while the increase of the interest rate induces individuals to raise the hours worked when young and to decrease them when old.

Retirement decision

All public pension systems have established rules about who is entitled to receive a retirement pension. In general terms, these rules say that in order to receive a retirement pension an individual must be older than some age, his labor income must be zero, and he must have contributed to social security for a minimum number of years. For example, in Spain people have the right to receive pension benefits if they have worked at least for 15 years and retired at age 60 or later. In Spain as well as in many other countries there is a penalty for individuals retiring earlier than age 65 to discourage early retirement. In most countries, the normal retirement age (age at which individuals receive full benefits) is 65 and the early retirement age (age at which individuals can start receiving some benefit) is 60.

Social security encourages retirement because individuals can receive a pension only if they do not earn labor income. In fact, economists have suggested the possibility that the development of social security could explain the decrease of labor

participation of older workers in industrialized countries. In some countries the labor force participation rates of 60 to 64 year old men have fallen from 80% to below 20% over the past three decades according to Gruber and Wise (1999). In a cross-country study about the effects of social security on the timing of retirement, these authors conclude that there is a strong relation between the age at which old workers withdraw from the labor force and the age at which they can start receiving social security benefits. The incentives of social security to retire early are strong in many countries because the penalty for retiring early is small (the reduction of social security benefits is not important). For instance, in 1972 a change in the German legislation reduced the penalty for early retirement that many individuals faced. As a consequence, the mean retirement age of white-collar workers decreased by 5.5 years in Germany.

Hours worked

As in the case of any labor income tax, the payroll tax used to finance social security may discourage work because it reduces the wage received by workers. A well-designed social security system should minimize its negative effect on labor supply. This can be achieved by linking the pension that an individual receives to his labor history so that individuals perceive that their pension will be higher the more they work. A defined benefit system, provides 'good' work incentives if the benefit formula relates the pension benefit with the complete earnings history of workers. This is the case in the USA where the pension depends on the average earnings of the best 35 years of a career. In contrast, defined benefit systems have a poor design in some countries. For instance, in Spain average earnings are computed using only the

last 15 years of an individual career and in Italy before the 1995 reform, the system used only the last 5 years of a career to compute average earnings.

When pensions are a function of the average earnings that individuals get during their working life, the effective tax that individuals pay is lower than the payroll tax. The effective marginal tax is defined as the payroll tax net of the (present value of) pension benefits that individuals will receive on the last euro of earnings. The magnitude of the effective marginal tax, which is a key determinant of labor supply decisions, depends on the relation between the pension and earnings. In many countries, the pension received per euro of contribution is higher for individuals with low earnings than for those with high earnings. This implies that the effective marginal tax rate increases with the level of earnings of individuals, that is, social security taxation is progressive, which strongly discourages labor supply.⁷

The magnitude of the effective marginal tax rate does not only depend on the earnings, but also on the age of individuals. In particular, other things being equal, the burden of social security taxation is larger for younger individuals. The reason being that young people are far from their retirement age and, thus, they do not value pension benefits as much as old workers. As a consequence, social security discourages relatively more labor supply at young ages than at old age. For instance, in my own work, I find that the U.S. social security taxation and pension benefits imply a reduction of the labor supply of young and old individuals of 8% and 4%, respectively.⁸

In a quantitative analysis applied to the U.S. economy, Conesa and Krueger (1999) find that

social security induces young individuals to increase their labor supply.⁹ This effect is due to the fact that social security leads to an important increase in the interest rate in their model economy. The interest rate increases quite significantly because social security reduces the capital-labor ratio by 22%. While this result illustrates how interest rate changes labor supply along the life of individuals, it does not seem plausible because it is based in a model economy that exaggerates the impact of social security on the economy's capital stock and interest rates. The reason is that these authors model individuals that do not save for bequests. As explained in Section 2 of this *Opuscle*, this assumption substantially biases the results.

5. Social security as an insurance device

A pay-as-you-go social security system can play an important role in society as an insurance device. In order to understand this observation, it is convenient to consider a young individual that is just entering the labor market and is making decisions about how much to save and consume. Let us assume that this individual expects to retire when he is about 65 years old and that he is not covered by the social security system. The individual thus needs to accumulate some savings during his working lifetime in order to finance his consumption when retired. When deciding how much to save, unfortunately, the individual faces many risks. First, the individual is uncertain about how long he will live. On the one hand, the individual may die before retiring so that he would have been better off by not saving. On the other hand, if he lives longer than expected he may have wished to have saved more during his working lifetime. Second, in planning his

retirement savings the individual is also uncertain about his future labor income. In effect, the individual may become unemployed and, if employed, his labor earnings may vary substantially according to events that are outside of his control or just depend on his luck. The particular realization of the employment and wage risks will not only determine the individuals' ability to save but also how much he would like to save for his retirement. Third, the individual is also uncertain about the rate of return on savings that he will face. In fact, the high volatility of the rate of return in modern capital markets is likely to affect the savings accumulated by the individual in a significant way.

Lifetime uncertainty

A social security system can play an important role in providing insurance against lifetime risk, a role that insurance markets may fail to fulfill. To illustrate this idea, let us consider a person that is concerned about the possibility of living longer than expected and running out of financial resources when old. In this case, he may be better off by purchasing annuity insurance. When purchasing an annuity, an individual pays an insurance premium for the right to receive some funds when he is old, as long as he is alive. Naturally, the premium charged by the insurance company will depend on the probability that the individual will survive to old age and by the amount that he wants to receive when he is old. A social security system can be interpreted, to some extent, as the mandatory purchase of an annuity. In effect, when young individuals make contributions to the social security system it is as if they were paying insurance premiums. Similarly, if alive when old, they receive payments that can be interpreted as the payments contracted in an annuity. Thus social security works similarly to an

annuity contract and this could improve individuals' welfare. This will happen, when individuals would like to purchase annuity insurance which the insurance markets fail to provide (or provide less than the optimal amount).

Imperfect insurance market

Can it be possible that modern insurance markets underprovide annuity insurance? Surprisingly, economic theory suggests that the answer to this question could well be yes. According to the seminal work of Akerlof (1970), for which he received a Nobel Prize, when markets are characterized by one of the parties (either seller or buyers) having information about the value of goods or services that the other party does not have, the markets may fail to provide the optimal amount of goods and services and can actually fail to operate at all. In the case of annuity insurance, consider a situation in which individuals differ in their survival probabilities or in other words, some individuals are more likely than others to live long lives. In this case, insurance companies would like to charge higher premiums to individuals with high probability of surviving than to individuals with low probability of surviving. But if survival probabilities are known by individuals but not by insurance companies, all individuals interested in purchasing annuities, regardless of their type, will claim to have low probability of surviving in order to pay a low insurance premium. Rothschild and Stiglitz (1976) show that in such situations it could happen that the markets fails to exist altogether, that is, no annuities will be offered. If this is the case, then a social security system may be a way of correcting for this "market failure". Intuitively, while a social security system can provide annuity insurance based on the average mortality rate of the population, private insurance

companies may not be able to do this. The reason is that an insurance contract based on average mortality rates is effectively making a transfer from individuals with low probability of surviving to those with high probability of surviving (the second group of individuals are expected to collect more benefits). The social security system can impose this redistribution across individuals because participation is *mandatory*. On the contrary, private insurance companies can not impose this redistribution scheme because *only* individuals with high probability of surviving, those who expect to collect high amount of benefits, will be willing to purchase the contract. As a result, private insurance companies expect to make negative profits and thus do not offer the contract.

An interesting question thus arises: are modern social security systems correcting a market failure? The evidence points that actual annuity markets are quite “thin”, that is, the volume of annuities transacted is quite low.¹⁰ However, this should not be taken as evidence of a market failure, for it could well be the case that individuals purchase few annuities because social security is already providing them with annuity insurance and not because capital markets do not function well.

Labor income risk

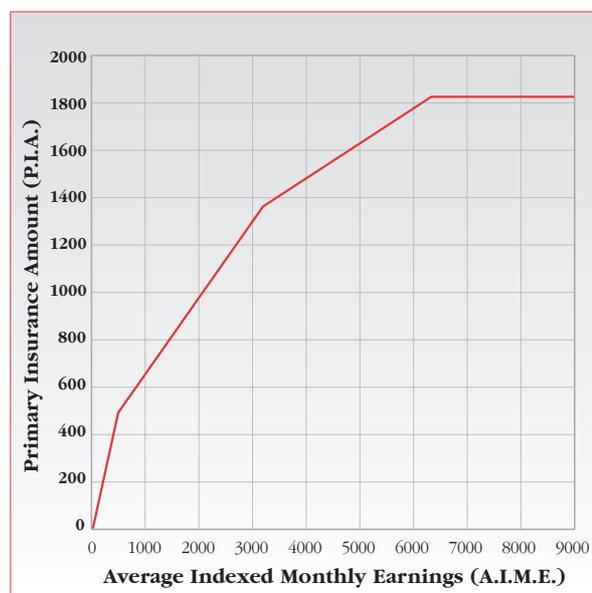
A social security system can play an important role in providing insurance against labor income risk. Again, as well-known results in economic theory indicate, insurance markets may fail to provide these services in the presence of private information. It is quite plausible that individuals have private information about their labor market history. Indeed, it is easy to imagine that individuals know more about their ability and possibilities in the labor market than insurance

companies. When an individual does not do well in the labor market, it is also plausible that insurance companies are uncertain about whether this is due to bad luck or the fact that he or she has not spent enough effort while working or searching for a job. As a result, markets may fail to provide insurance against labor income risk and, thus, there may be a role for social security to fulfill.

Social security provides insurance against labor income risk if the formula that relates pension benefits to contributions is “progressive”, that is, benefits increase less than proportionally with the contributions made. In this case, individuals with high earnings receive a lower pension per euro contributed than individuals with low earnings so that there is a redistribution from individuals with high lifetime wages to individuals with low lifetime wages. If earnings variability is due to some extent to random events in an individual’s life, such as luck, a progressive benefit formula provides insurance by treating unlucky individuals relatively better.

Most social security systems in the world are progressive. This is particularly true in the USA. Pension benefits in the USA depend on average lifetime earnings according to a formula that pays 90 cents for each of the first \$531 monthly earnings, 32 cents per dollar in the interval between \$531 and \$3,202 of monthly earnings, and 15 cents per dollar the interval between \$3,202 and \$6,350.¹¹ An increase of earnings above \$6,350 does not increase the pension (see Figure 1). In other countries, benefits increase at a fixed proportion with contributions but the progressivity is introduced by imposing a (conservative) maximum pension benefit or a generous minimum pension. For instance, in Spain individuals with 35 years of contributions

Figure 1 Benefit formula of the U.S. social security system in the year 2000.¹²



receive a pension equal to their average earnings (during the last 15 years of contributions) but with the caveat that there is a minimum and a maximum pension.

Capital income risk

Because in a pay-as-you-go social security system contributions are used to pay current retirees, contributions are not invested in the capital market. As a result, the pension benefits are not directly related to the rate of return of capital so that individuals are not subject to capital market rate of return risk. Notice that if the social security system were fully-funded or private, then pension benefits would be directly affected by the rate of return on capital. In this

case, for instance, fluctuations in the stock market returns could have important effects on pension benefits.

6. Distributive effects of social security

The social security system transfers resources among individuals through different channels and these effects often interact in complicated ways. As a result, the distributive implications of social security are far from trivial. Since the impact of social security differs across heterogeneous individuals, an analysis that focuses only on the aggregate effects of social security is likely to miss important things. In order to study these issues, economists need models of the macroeconomy that take into account the vast heterogeneity among individuals in real world economies. Fortunately, recent developments in computational methods and improvements in computer power allow us to solve this type of model. In this section I describe some recent findings of my research to illustrate the important distributive consequences of the social security system.¹³

In a recent contribution, we study the welfare effects of the U.S. social security system in a model economy populated by individuals that differ in age, education, labor productivity, mortality rate and wealth.¹⁴ To this end, we built an artificial economy that mimics the behavior of the U.S. economy quite well and that, in particular, has in place a social security system that taxes labor income of workers and distributes pension benefits to retirees in the same way as it is prescribed by the U.S. social security system. Then we performed an experiment that consists

in eliminating the social security system in the artificial economy and studied how the economy with no social security differs in terms of aggregate statistics and in terms of the distribution of income, wealth and welfare. We paid particular attention to the study of *who* benefits and *who* loses from the elimination of social security.

In the model economy, as in the U.S. economy, social security is a pay-as-you-go system that redistributes income intergenerationally and intragenerationally. Individuals face uncertain lifetimes and it is assumed that there are no insurance markets against this risk. As a result, social security plays an important role as a provider of annuity insurance. This insurance is provided by paying pension benefits to old individuals as long as they are alive. Pension benefits are modeled as a progressive function of an individual's lifetime average earnings, according to the pension benefit formula in the USA. As discussed in the previous section of this *Opuscle*, a progressive benefit formula provides insurance against labor earning risk. Since we assume that there are no markets providing such insurance, social security can play a positive role in this dimension. It should be noticed, however, that the redistribution implied by the benefit formula (from workers with high earnings to workers with low earnings), is affected by the fact that individuals with low earnings tend to live a shorter life than individuals with high earnings. As a result of their lower expected lifetime, individuals with low earnings are likely to receive pensions for a shorter period than individuals with high earnings. The differential mortality across income levels thus implies a redistribution towards individuals of high earnings. This effect can be important in the USA where the life expectancy of a college educated male is five

years longer than the life expectancy of a non-college graduate male. Indeed, we find that differential mortality is important for understanding the distributive effects of the U.S. social security system.

In our research we find that most individuals in the economy would be worse off with the elimination of social security. Crucial to this result is the fact that social security provides insurance against lifetime and earnings uncertainty that are not provided by the markets in the model economy. This insurance role has a positive effect on the welfare of most people. In particular, annuity insurance is particularly important for individuals with long life expectancy, who are the ones with college education in the model economy. Surprisingly, some individuals with low earnings are worse off with social security. As we shall later explain, these individuals do not benefit much from the provision of annuity insurance and the payroll tax financing pension benefits hurts them quite significantly.

Another important finding, is that social security reduces the capital stock by an amount much smaller than the one reported by previous authors. While we find that social security reduces the capital stock by 6%, Auerbach and Kotlikoff (1987) and Imrohoroglu *et al.* (1995) found a reduction of capital of 24% and 55%, respectively. The key insight here is that, unlike previous authors, we consider a framework where individuals save not only for financing consumption during retirement but also for financing intergenerational transfers. As emphasized in Section 3, when individuals save in order to make transfers to other family members, as the empirical evidence supports, the negative effects of social security on capital accumulation are reduced significantly. As a consequence, a majority of the population are

better off by maintaining the current social security system because the positive insurance effects dominates the (relative small) negative effect of social security on the aggregate capital stock.

Even though the progressivity of the U.S. benefit formula, we find that the individuals that are worse off with social security are the ones that are poor and have low earnings. This surprising finding is the outcome of two factors. First, the benefit formula is not as progressive as it appears once differential mortality is taken into account. Second, the financing of social security with a payroll tax particularly hurts the poor. This is because the income of poor individuals is mostly given by their labor earnings, unlike rich people whose income is mostly generated by capital. In addition, poor individuals are likely to be credit constrained. This occurs when individuals have temporarily low earnings and want to borrow in order to smooth consumption over time but do not obtain credit due to capital market imperfections. As a result of their inability to borrow, their consumption is equal to their labor earnings. A payroll tax hurts individuals in this situation because it reduces their earnings and, thus, their already low consumption.

Interestingly, we find that the U.S. social security system leads to an important increase in wealth inequality. Behind this observation there are two mechanisms at work. Social security reduces both the supply of savings and of labor which, naturally, changes the relative prices of these two inputs. Because capital becomes scarcer than labor, the rate of return on capital (payment for capital services) increases more than the wage rate (payment for labor services) in the presence of the U.S. social security. This change in relative prices has a distributive impact from

poor to rich individuals given that capital income is only important for rich individuals. It should be said, however, that this mechanism is not quantitatively very important. The second mechanism which is key in explaining the concentration of wealth, is that social security decreases savings for retirement and increases savings for financing bequests (see Section 3 of this *Opuscle*). Since bequests are highly concentrated among rich individuals, social security decreases savings of most individuals in the economy except the richest.¹⁵

7. Social Security Reform

The recent demographic trends in developed countries have raised the concern that the pay-as-you-go social security system may not be sustainable. These trends are related to the large increase of life expectancy and the important decrease in fertility rates since social security was first introduced. For instance, in Spain life expectancy increased from 41 years in 1920 to 77 years in 1991 while the fertility rate decreased from 2.6 children per women in 1970 to 1.3 in 1993 (see Montero 2000). Another demographic event that will affect the financing of social security is the retirement of the baby-boom generation.¹⁶ These trends will have a considerable impact on the dependency ratio which is given by the ratio of retired to working age population (see Table 2).

The aforementioned demographic changes will imbalance social security systems that are of a defined benefit and pay-as-you-go type (which is the most common system across countries). An increase of lifetime expectancy leads to a larger number of retirees. In a defined benefit system, this leads to a proportional increase of social

Table 2
Forecast of dependency ratios¹⁷

	Dependency ratio (%)	Year
Germany	102	2035
Italy	56	2050
Spain	56	2050
Sweden	35	2050
Canada	40	2075
USA	41	2070

security expenditures. This effect is likely to be important: Boldrin *et al.* (1999) find that the ratio of pensions to GDP could well duplicate by the year 2050 in the EMU countries. The increase in the dependency ratio also leads to a decrease of social security contributions.

Most social security systems are expected to face a significant imbalance that will peak when the baby-boom generation retires. This imbalance will eventually call for a significant increase of taxes or a decrease in the generosity of pensions, neither of which is popular. In trying to ameliorate the financial stress of social security, some countries have reformed their systems. One example is Sweden, which has adopted a defined contribution system with a pay-as-you-go financing method. In a defined contribution system, pension is computed as the annuity value of past contributions based on the individual's life expectancy. Under this system, an increase in life expectancy leads to a reduction of the pension so that the sustainability of the system is not affected by demographic trends.

Most reforms of social security have attempted to decrease the rate of growth of expenditures so that the current system could be in place for future generations. The changes typically apply to eligibility rules only and are not sufficient to solve

the financial stress of social security. For instance, in the USA the reform introduced in 1983 increased the normal retirement age from 65 to 67 years old for workers reaching age 62 after the year 2022. Retirement age has also been postponed in Germany by the reform introduced in 1992. Retirement age will increase from age 60 to 65 and from age 63 to 65 for women and for people with 35 or more years of contributions, respectively.

A more drastic reform took place in Chile where the pay-as-you-go system was substituted by a social security organized in individual accounts. Since the current system is of a fully-funded and defined contribution type, its financial sustainability will not be affected by demographic changes. However, switching from a pay-as-you-go to a fully-funded system is not easy because it raises the question of who pays the pensions of individuals that have contributed to the old system. In Chile, pensions corresponding to the old system were partly financed by a government surplus (see Diamond 1999). Since the rate of return of individual accounts has been high overall, the Chilean reform has been considered a success by many economists.

A drawback of fully-funded systems is that individuals bear capital income risk. In contrast, in a pay-as-you-go system pensions are not affected by fluctuations in the return of capital (see section 5 in this *Opuscle*). In this system, the return of social security is tied to the rate of growth of wages. Since the rate of growth of wages has been historically negatively correlated with the return of capital, Boldrin *et al.* (1999) argue that a social security that combines a funded with a pay-as-you-go system provides insurance by diversifying the risk associated with retirement income.

8. Conclusions

Social security is at the forefront of the political debate. Advocates of reform call for a fully-funded social security organized in individual accounts while defensors of pay-as-you-go social security emphasize its social protection for low earners and survivors. The main argument against the pay-as-you-go system has been that social security contributions discourage private savings for retirement and, since they do not affect public savings, decrease the economy's aggregate savings. The main conclusion of our recent research is that a pay-as-you-go social security system (of the type in place in the USA) may be beneficial for a significant fraction of the population.¹⁸ This is explained by the fact that the benefit obtained from the insurance role against uncertain lifetimes compensates for the negative impact on welfare due to the decrease of capital accumulation.

We have also discussed the effects of social security on labor supply. Proponents of individual accounts emphasize that since these accounts link the pension to the tax contributions that individuals pay, they do not discourage labor supply. In this *Opuscle* we have learned that a defined benefit system also has good work incentives if the benefit formula relates the pension with the complete earnings history of workers. Recent reforms of social security in some countries like Italy and Sweden try to improve the work incentives of social security.

The debate on social security currently focuses on the financial sustainability of the defined benefit pay-as-you-go system. The concern about the sustainability of social security is motivated by the aging of the population in developed

countries due to the increase of life expectancy and the decrease of fertility rates. These changes imply the increase of social security expenditure relative to contributions if the system is defined benefit and pay-as-you-go. Although forecasts indicate that an imbalance of social security is very likely, a reform of the system is politically difficult. In some countries the reform has attempted to decrease the rate of growth of expenditures. In other countries like Chile, the reform has been more drastic because the pay-as-you-go system has been replaced with a fully-funded system organized in individual accounts.

Economic theory does not imply, however, that eliminating entirely the pay-as-you-go system would be desirable. Moreover, a defined contribution system is not necessarily better than a defined benefit system or vice versa. In fact, as Peter Diamond argues, the evidence shows examples of well and badly designed social security systems regardless of whether they are defined benefit or defined contribution types.¹⁹ Strong positions in favor of a particular system are usually influenced by ideology. More economic research is needed to enlighten the discussion on social security reform.

Notes

- (1) I thank Andrés Erosa and Jordi Galí for their helpful comments and suggestions.
- (2) Source: Gruber and Wise (1999). The data on taxes and expenditures correspond to the period 1993-1997 and the years vary depending on the country.
- (3) Conesa and Garriga (2000) follow the methodology developed by Auerbach and Kotlikoff (1987) to quantify the effects of eliminating social security in the Spanish economy. They find that the capital stock would increase by 40% if social security were eliminated.
- (4) See Kotlikoff and Summers (1981).
- (5) See Davies and Shorrocks (1998).
- (6) See Fuster (1999) and Fuster, Imroboroglu and Imroboroglu (2001, 2002).
- (7) In many countries there is a maximum level of taxable earnings implying that the payroll tax is regressive. It is not trivial whether a progressive benefit formula combined with a regressive payroll tax leads to a progressive or regressive effective marginal tax.
- (8) See Fuster (1999).
- (9) Conesa and Krueger (1999) is an influential paper in the literature because it studies not only the long run effects, but also the short run effects of social security in a model with heterogeneous individuals that face lifetime and income risk.
- (10) See Friedman and Warshawsky (1990).
- (11) This is the formula used for an individual retiring in the year 2000.
- (12) Quantities are expressed in U.S. dollars of 2000. Source: U.S. Social Security Administration.
- (13) See Fuster, Imroboroglu, and Imroboroglu (2001, 2002).
- (14) See Fuster, Imroboroglu, and Imroboroglu (2001, 2002).
- (15) See Caballé and Fuster (2003) for an analysis of the impact of a pay-as-you-go social security system on the distribution of altruistic transfers.
- (16) In Spain, the baby-boom generation corresponds to the cohorts born between 1965-1970, which were relatively large.
- (17) Source: Gruber and Wise (1999). In the case of Germany, the dependency ratio is defined as the ratio of population older than 60 to the population of ages between 20 to 59. In the cases of Italy, Sweden, and Spain the dependency ratio is defined as the ratio of population older than 65 to the population of ages between 15 to 64 years old (working population). For Canada and the U.S. the dependency ratio is the ratio of population older than 65 to the population of ages between 20 to 64 years old.
- (18) See Fuster, Imroboroglu, and Imroboroglu (2002).
- (19) See Diamond (1999).

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