SOCIAL SECURITY AND CROSS-COUNTRY DIFFERENCES IN HOURS: A GENERAL EQUILIBRIUM ANALYSIS

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ABSTRACT

In this paper, I develop a general equilibrium life cycle model with both an intensive and extensive margin of labor supply. I use the model to assess the effects of changes to various features of social security on labor supply outcomes. Of particular interest are changes to the scale of the program and to the relevant eligibility rules. I find that the cross-country differences in social security programs account for 35-40% of the differences in aggregate hours worked between the U.S. and Belgium, France and Germany. Furthermore, I find that both the scale of the program and the eligibility rules are important determinants of retirement behavior.

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1 INTRODUCTION

The differences in aggregate hours of work between the U.S. and continental Europe are striking. In 2003 aggregate hours of work in Belgium, France and Germany relative to the U.S. equaled 0.71, 0.68 and 0.73, respectively. The lower market work in the aforementioned countries is in large part due to the lower employment rate of older workers in these countries. In particular, in 2003 the employment rate of people aged 55-64 in Belgium, France and Germany relative to the U.S. equaled 0.47, 0.62 and 0.65, respectively. There are also sizable differences in social security programs between the U.S. and the continental European countries – both in the scale of benefits and in the eligibility rules associated with collecting social security. While spending is only one aspect of social security, it is illustrative to note that social security expenditure constituted roughly 4.2% of GDP in the U.S. in 2003, whereas countries such as Belgium, France and Germany spent 11.3%, 13.1% and 13.4% of GDP on social security, respectively, in the same year.

In this paper I build a general equilibrium model of life cycle labor supply that features endogenous retirement and human capital accumulation, which I parameterize to match U.S. data on life cycle profiles for hours worked and wages. I then use the model to study the extent to which differences in social security, and more generally tax and transfer programs, can account for the cross-country differences in aggregate hours worked between the U.S. and the continental European countries of Belgium, France and Germany.[1]

The findings of this paper are fourfold. First, the differences in social security account for 35-40% of the current differences in aggregate hours worked between the U.S. and Belgium, France and Germany. Second, I examine the extent to which different features of social security are important in accounting for the cross-country differences in aggregate hours of work. The key differences between the continental European and U.S. social security programs are in the scale of benefits and in the eligibility rules associated with collecting social security. I show that these two features are of roughly equal importance in accounting for the cross-country differences in labor supply outcomes. The

[1] Gruber and Wise (1998) also comment on the link between social security and retirement behavior across countries.

implication of this is that the differences in social security across countries cannot be summarized by one statistic. Third, the presence of a social security system has important implications for how other tax and transfer programs influence labor supply. For example, when one increases the scale of a lump-sum transfer in a model with social security, all of the action is on the intensive margin of labor supply. Fourth, once I include other differences in labor taxation in addition to social security, I find that tax and transfer programs account for roughly 60% of the difference in aggregate hours worked between the U.S. and Belgium, France and Germany.

My results regarding the importance of social security in accounting for the cross-country differences in aggregate hours worked in 2003 are also consistent with time series evidence. In particular, the employment rates of people aged 55-64 in continental Europe relative to the U.S. have declined considerably from their 1970 values of 0.92 in France and 0.83 in Germany. At the same time, there have been important changes in social security. In particular the first age at which one can collect social security in, for example, France was lowered from 65 to 60 in the early 1970s. In my model I show that the change in social security between 1970 and 2003 is consistent with the large drop in employment among older individuals.

My paper contributes to the literature on the role of tax and transfer policies in accounting for the cross-country differences in hours worked, pioneered by Prescott (2004) and extended by Rogerson (2006), Ohanian, Raffo and Rogerson (2008) and McDaniel (2007a).[2] Relative to these, the key difference is that I explicitly model social security, whereas they simply assume a lump-sum transfer.[3] This allows me to study the impact of particular features of social security, thereby studying the key driving forces behind retirement behavior. This in turn lends itself to policy recommendations germane to the ongoing debate on social security. There is an extensive literature on social

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[2] Proposed explanations for the differences in aggregate hours also include labor and product market regulation, wage setting and preferences. See Alesina, Glaeser and Sacerdote (2005) for an analysis on the role of unions and Bertrand and Kramarz (2002), Fonseca, Lopez-Garcia and Pissarides (2001), Fang and Rogerson (2006) and Messina (2003) for an analysis on the role of product market regulation in accounting for the cross-country differences in hours worked.

[3] Ljungqvist and Sargent (2006) critique Prescott (2004), and others, for not modeling the explicit details of tax and transfer programs.

security.[4] As far as I know, however, this is the first paper to conduct a general equilibrium analysis of the cross-country differences in social security.

An outline of the paper follows. Section 2 presents the model, while section 3 outlines the parameterization of the model. Section 4 considers the effects of various features of social security on labor supply outcomes, whereas section 5 discusses the role of other tax and transfer policies. Section 6 introduces a time series component to the analysis. Section 7 discusses the robustness of these results, and section 8 concludes.

2 MODEL

I consider a discrete time overlapping generations framework, in which a measure one of identical, finitely lived individuals is born every period. A model period is a year, and individuals live for 56 periods with certainty. Model age zero corresponds to age 22 in the data. I assume that individuals are endowed with one unit of time each period. Letting *a* denote age, individuals have preferences over sequences of consumption (*c*) and hours supplied to the market (*h*) given by:

$$\sum_{a=0}^{55} \beta^a \left[\ln(c_a) - b {h_a}^{1/\gamma+1} \right],$$

where β is the discount factor and $b \geq 0, \gamma \geq 1$. As is standard, I assume preferences have offsetting income and substitution effects. The functional form choice for disutility from working is standard and convenient, since the preference parameter γ determines the responsiveness of hours of work to changes in the tax rate along the intensive margin in a standard labor supply model.

I assume that human capital is accumulated via a learning by doing technology, where by working today the individual increases his/her wage tomorrow.[5] In particular, I assume that the human capital stock of an individual evolves according to the following function:

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[4] See for example Gustman and Steinmeier (1986), Pozzebon and Mitchell (1989), Stock and Wise (1990), Berkovec and Stern (1991), Rust and Phelan (1997), French (2005), Gruber and Wise (2004, 2007), Coile and Gruber (2007), Coile and Levine (2009).

[5] Following Heckman (1976) and Imai and Keane (2004), modeling human capital accumulation is important for preference parameter estimates, particularly γ, which we know is the key preference parameter for tax questions.

$$s_{a+1} = (1-\delta_s)s_a + \Lambda e^{-da} g(h_a)^{\alpha} ,$$

where $0 \le \delta_s \le 1, 0 \le \alpha \le 1, \Lambda \ge 0, d \ge 0$. This human capital production function captures three central features of the human capital accumulation process: depreciation, learning, and the possibility that learning becomes harder with age.[6]

In order to match the dramatic drop in hours of work at retirement, I assume a non-convexity in the mapping from hours supplied to the market to labor services, as in Prescott, Rogerson and Wallenius (2009).[7] Specifically, if an individual with human capital stock *s* devotes *h* units of time to market work, it yields $l = s\, g(h)$ units of labor services. For simplicity, I assume that $g(h)$ takes the specific form

$$g(h) = \max\{0, h - \bar{h}\}, \bar{h} > 0 ,$$

as in Rogerson and Wallenius (2009).[8] One justification for the non-convexity is fixed costs associated with commuting, getting setup in a job and being supervised. The intuition behind the non-convexity is that it is very different to have one worker working 40 hours per week than 40 workers working one hour per week.[9]

The aggregate production function is given by:

$$Y_t = AK_t^{\theta} L_t^{1-\theta} ,$$

where K_t is the aggregate capital stock at date *t* and L_t is the aggregate input of labor services at date *t*. The parameter values are such that $A \ge 0, 0 \le \theta \le 1$.

I assume that there is a government in the economy, which levies a proportional payroll tax, τ_1, on labor income, the proceeds of which are used to finance a pay-as-you-go (PAYG) social security program. I assume that starting at age 66 the individual

[6] For an alternative life cycle model with human capital accumulation see Kitao, Ljungqvist and Sargent (2008).

[7] Alternatively, one could have the disutility from working increase with age. However, to get people to work into their sixties and then retire, something abrupt would need to happen with the disutility schedule at older ages. Therefore, this is not a very compelling story.

[8] Prescott, Rogerson and Wallenius (2009) consider a more general specification where *g* is initially convex and then concave.

[9] The penalty for part-time work documented by Moffitt (1984), Keane and Wolpin (2001) and Aaronson and French (2004) provides evidence of the existence of non-convexities.

receives social security benefits, regardless of when the individual stops working.[10] The social security benefit is made up of two parts: the flat rate portion and the earnings dependent portion. The benefit formula is modeled as:

$$B = b_1 + b_2 I \,,$$

where I is average earnings from the 35 highest years and $b_1 \geq 0, b_2 \geq 0$. The government balances its budget in steady state. The government also levies a second proportional tax on labor income (including the social security benefit), τ_2, the proceeds of which are rebated lump-sum (T) back to the consumer period by period.

2.1 STEADY STATE EQUILIBRIUM

I assume that at each date there are markets for labor services, capital and consumption. Furthermore, I assume competitive behavior in all markets. I implicitly allow for borrowing and lending by allowing individuals to hold negative amounts of capital[11].

I focus on the steady state equilibrium. I denote the steady state life cycle paths for consumption, hours supplied to the market, physical capital and human capital by c_a, h_a, k_a, and s_a, respectively, and the steady state values for the aggregate capital stock and the aggregate input of labor services by K and L, respectively. All prices will be constant in the steady state. I normalize the price of output to one. The price per unit of labor services is denoted by w. The rental rate on physical capital is denoted by r. The interest rate in the economy is the rental rate on capital less depreciation. In equilibrium, factors of production will be paid their marginal products:

$$\theta A \left(\frac{K}{L} \right)^{\theta - 1} = r$$

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[10] While this does not precisely correspond to the social security program in the U.S., I will later argue that this is a good approximation. Specifically, I will argue that in the U.S., to a first approximation, the present value of lifetime social security benefits does not depend on the age at retirement, holding income constant.

[11] I could formulate the problem with two assets, physical capital and one period ahead bonds. However, as in equilibrium they must offer the same rate of return (and there is no uncertainty to differentiate them), individuals are indifferent about how to allocate their portfolio between the two, and only care about the total. Therefore, it is simplest to formulate the problem with only one asset.

$$(1-\theta)A\left(\frac{K}{L}\right)^{\theta}=w$$

The utility maximization problem of a newborn agent can be written as:

$$\max_{c_a,h_a,k_a,s_a} \sum_{a=0}^{55}\beta^a\left[\ln(c_a)-bh_a^{1/\gamma+1}\right]$$

$$\begin{aligned}
s.t.\quad & c_a+k_{a+1}-(1+r-\delta_k)k_a=(1-\tau_1-\tau_2)ws_ag(h_a)+T,\ a=0,\ldots,43\\
& c_a+k_{a+1}-(1+r-\delta_k)k_a=(1-\tau_1-\tau_2)ws_ag(h_a)+(1-\tau_2)B+T,\ a=44,\ldots,55\\
& s_{a+1}=(1-\delta_s)s_a+\Lambda_a g(h_a)^{\alpha},\ a=0,\ldots,54\\
& B=b_1+b_2I\\
& c_a\geq 0,\ 0\leq h_a\leq 1\\
& k_0,s_0\ \text{given}
\end{aligned}$$

Given that lifetimes are deterministic, individuals will not carry over any capital beyond their last period of life, $k_{56}=0$.

In steady state, the life cycle for an individual is the same as the cross-section. Thus, in steady state the aggregate inputs will be determined as:

$$K=\sum_{a=0}^{55}k_a$$

$$L=\sum_{a=0}^{55}l_a$$

and the aggregate feasibility constraint is:

$$\sum_{a=0}^{55}c_a+\delta_kK=AK^{\theta}L^{1-\theta}$$

3 PARAMETERIZATION

As noted previously, a model period is a year. Recall that the initial period for a given individual corresponds to age 22.[12] I assume that the individual starts off with a

[12] Because I am abstracting from educational decisions, I want people to have completed their schooling by the time they enter my sample. I use age 22 as the starting age, as a person starting college at the age of 17 or 18 will have completed a four-year degree by age 22. Note that 84% of 22 year-olds in the dataset work.

zero asset position, $k_0 = 0$. The following parameters must be assigned a value for the quantitative analysis:

(1) preference parameters β, b and γ

(2) fixed time cost $\bar{h}$

(3) human capital technology parameters α, Λ, d and δ_s

(4) production technology parameters A, θ and δ_k

(5) government policy parameters b_1, b_2, τ_1 and τ_2

The policy parameters are chosen to match a stylized representation of the U.S. social security system. The remaining parameters are chosen to match moments of the data, particularly the time series averages for aggregate variables and the life cycle profiles for hours worked and wages. I now describe the process of parameterizing the model in more detail.

3.1 TARGETING AGGREGATES

The discount factor, β, the capital share parameter, θ, and the rate of depreciation of the capital stock, δ_k, are chosen to target an annual interest rate of 4%, a capital to output ratio of 3, and an investment to output ratio of 20% per annum. This results in θ=0.33 and δ_k=0.07. These are in line with estimates in the literature. The scale factor A is basically a choice of units. I could set it equal to 1. Instead, I set it so that the skill price of human capital, w, equals one.

3.2 TARETING LIFE CYCLE PROFILES

The non-policy parameters that still need to be assigned a value are $\bar{h}$,b, γ, α, Λ, d and δ_s. I divide the fixed time cost into two components:

$$\bar{h} = \bar{h}_1 + \bar{h}_2,$$

where $\bar{h}_1$ corresponds to the commute cost and $\bar{h}_2$ the set-up cost. I assume that the hours object in the data includes the cost of getting set up in a job and being supervised, but not the commute cost. $\bar{h}_1$ is chosen to match a commute time of 50 min per day. The parameters $\bar{h}_2$, b, γ, α, Λ, d, and δ_s are then chosen to match the life cycle profiles for hours and wages.[13] Because I have no within cohort heterogeneity in my model, everyone will choose to retire at the same age. In other words, I do not get a distribution of retirement ages, as in the data. In parameterizing the model I must choose a retirement age to target. One possibility is to match the median age at retirement. In the U.S., this corresponds to approximately age 62. However, as the objective of this paper is to understand the differences in work after the age of 60, the fraction of work being done after the age of 60 in the U.S. seems like an appropriate statistic to target. With individuals starting work at age 22, this corresponds to targeting a retirement age of 66 in my model.[14]

In searching for parameter vectors that minimize the distance between hours and wages in the model and the data, I found that there are many local optima. In particular, there are many values of α that produce almost equally good fits to the data. I interpret this to mean that cohort data does not appear to contain enough variation to identify the technology parameters. Heckman (1976) encountered this same issue when estimating the parameters of a Ben-Porath type human capital model using cohort data. Imai and Keane (2004), on the other hand, use maximum likelihood estimation to estimate a life cycle model with human capital accumulation in the form of learning by doing on individual, panel level data. Since their data contains cross-sectional variation, they are able to identify the technology parameters. I use their value of α=0.23 as a natural benchmark. Later I will discuss how the results vary, depending on the value of α.

3.2.1 CONSTRUCTING LIFE CYCLE PROFILES FOR HOURS AND WAGES

I now outline how the targeted life cycle profiles for hours and wages are constructed from the data. Employing a framework similar to the one here, with the exception that the length of the working life is exogenously determined, Wallenius (2007) finds that the intertemporal elasticity of substitution parameter estimates are highly sensitive to the length and age range of the targeted time series. Given this finding, I wish to target long life cycle profiles for hours worked and wages in my model. I use

[13] The data is described in the next section.

[14] If I were to target a retirement age of 62, the fraction of work being done after the age of 60 in the model would be too low relative to the data, 4% compared with 12%.

CPS data[15] to construct life cycle profiles for an average cohort. The appropriate CPS data for hours and wages is available for the years 1976-2006. As is standard in the literature, I restrict my sample to employed males.

I impute hours supplied to the market as a fraction of the total time endowment. Following the literature, I assume that the time endowment is 14 hours a day, 7 days a week. The measure of hours worked for a particular individual for a given year is then given by:

$$fraction\ of\ time\ spent\ working = \frac{total\ annual\ hours\ worked}{365 \times 14}.$$

The hourly wage rate for an individual is calculated as:

$$\frac{annual\ wage\ and\ salary\ income}{annual\ hours\ worked}.$$

Note that the hours object in the model that is being matched to the data is $h_a - \bar{h}_1$. Recall that $\bar{h}_1$ is the time cost associated with commuting. Correspondingly, the wage object in the model that is being matched to the data is $\frac{ws_a(h_a - \bar{h}_1 - \bar{h}_2)}{h_a - \bar{h}_1}$.

The data gives partial life cycle profiles for a large number of cohorts. To illustrate, one example of a cohort is 22 year olds in 1976, 23 year olds in 1977, 24 year olds in 1978 and so forth. To construct average life cycle profiles, I compute growth rates for average hours and average hourly wages between consecutive ages for each cohort and then average across all cohorts where data is available for given consecutive ages. When combined with an initial condition, this procedure allows me to construct life cycle profiles for hours and wages for an average cohort.

Incomes are made comparable across time by adjusting for increases in the price level using the Consumer Price Index. Since the initial wage in the model is equal to an endowment, only relative wages are of interest. Therefore, the initial human capital stock for an individual is normalized to one, $s_0 = 1$.

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[15] Data from: Miriam King, Steven Ruggles, Trent Alexander, Donna Leicach, and Matthew Sobek. *Integrated Public Use Microdata Series, Current Population Survey: Version 2.0*, Minneapolis, MN: Minnesota Population Center, 2004.

Figures 1 and 2 plot the average fraction of time spent working and average wages, respectively, for ages 22-65 for the sample. Hours worked rise throughout the twenties and early-thirties, after which they level off. Starting in the fifties, hours decline slightly. Wages rise steeply early on, and level off in the forties.

Figure 1

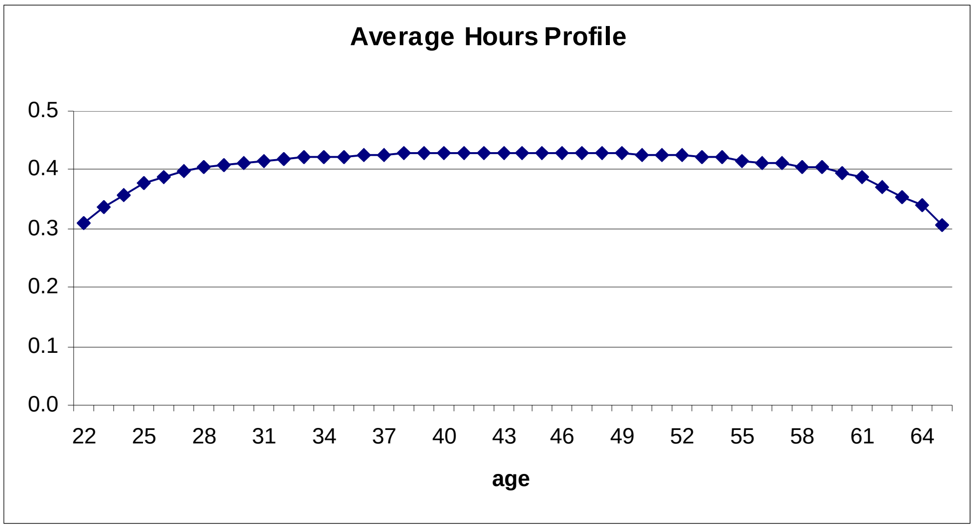
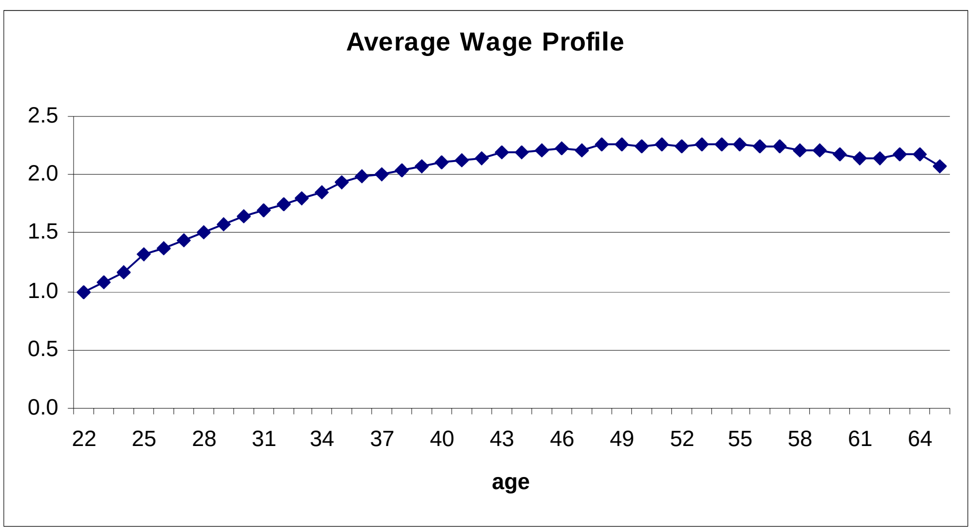


Figure 2



3.3 POLICY PARAMETERS

The policy parameters are chosen to match the U.S. social security program. Note, however, that the social security program modeled in this paper is a somewhat stylized representation of the U.S. social security system. It is designed to capture three central features of U.S. social security: (1) benefits are linked to earnings, but (2) the response is less than one-for-one, and (3) one does not have to retire to collect benefits.

In the U.S. the social security tax, which reflects the joint contributions of the employer and employee, is equal to 0.124. The wage base for the social security tax in 2008 is $102,000. No social security tax is paid on income in excess of this amount. I abstract from the cap on the social security tax, as the average person in my sample does not have annual income in excess of this amount. Thus, I set τ_1=0.124.

In the U.S., a worker's retirement benefit is a piece-wise linear function of the average income of the highest 35 years. The retirement benefit is 90% of average monthly income up to the first kink, and 32% of the excess of monthly income over the first kink but not in excess of the second kink, plus 15% of monthly income in excess of the second kink. In 2008, the first kink occurs at $711 and the second kink at $4,288. I choose the flat rate portion of the retirement benefit in my model, b_1, to match 90% of the first $711 the individual earns each month. The earnings dependent portion, b_2, reflects the accrual of benefits after the first kink. Similar to the cap on the social security tax, I abstract from the second kink of the retirement schedule, as the average person in my sample does not have income in excess of the second kink. In the model, the social security benefit is scaled in order to balance the budget of the social security program. One can think of the benefit formula as being $B = b_0(b_1 + b_2 I)$, where b_0 is chosen to balance the budget.

As noted previously, in the model I assume that individuals begin receiving social security benefits at age 66, regardless of when they stop working. In actuality, people in the U.S. are eligible for social security starting at age 62. However, for an individual whose full-retirement age is 65, benefits are adjusted downward by 5/9 of 1 percent per month for each month in which benefits are received in the three years immediately prior to the full-retirement age.[16] Workers claiming benefits after the full-retirement age earn a delayed retirement credit, which is 2/3 of 1 percent for each month up to age 70. The rules state that people do not have to stop working to collect benefits. If a person is below the full-retirement age and works while collecting social security benefits, he/she is subject to an earnings test and benefits are reduced if earnings exceed a certain threshold. However, these individuals are compensated after reaching the full-retirement age in the form of higher benefits. The adjustments for early claiming are considered roughly actuarially fair. The adjustments for delayed claiming are somewhat less than actuarially fair, which creates an incentive to retire at the full-retirement age. In the model I make the simplifying assumption that the present value of lifetime social security benefits is independent of the age at which the individual begins collecting social security, holding income constant. This is a useful starting point.

In the model the additional tax on labor income, τ_2, is chosen so that together the two labor taxes equal the average effective tax on labor income in the U.S. in recent years, 0.3.[17] This gives τ_2=0.176.[18]

3.4 BENCHMARK PARAMETERIZATION

Recall that in the benchmark model individuals work ages 22-65, i.e., retire at age 66.[19] In equilibrium, the social security benefit is scaled up by 5.6% (i.e., b_0 =1.056) to balance the budget. The scaling of the benefit does not affect the relative importance of the flat-rate and earnings dependent portions of the benefit. The resulting social security

[16] The full-retirement age is gradually being raised from 65 to 67. For someone whose full-retirement age is 66, the reduction of benefits is 5/9 of 1 percent per month for every month in which benefits are received in the three years immediately prior to the full-retirement age and 5/12 of 1 percent for every month before that.

[17] Several authors estimate effective tax rates for various countries. See for example Mendoza, Razin and Tesar (1994), Prescott (2004) and McDaniel (2007b).

[18] The social security tax of 0.124 does not include the medicare tax. As medicare benefits are not earnings dependent, I assume that they are part of the lump sum transfer. Thus, the medicare tax is part of τ_2.

[19] There are clearly some issues with selection at older ages. One way to address this is to stop targeting data before age 65, even though people in the model work until age 65. The results reported in this paper are based on targeting data up to age 62. I have also completed the analysis targeting data until age 65, and the results are very similar.

benefit implies a replacement rate of roughly 45% of average lifetime earnings. This is in line with estimates in the literature.[20]

Table 1 presents the benchmark parameter values for the model. A few points are worth noting.

Table 1: Model Parameters

PARAMETER	**VALUE**
Preferences	
β	0.977
b	3.095
γ	1.41
Production Technology	
$\bar{h}_1$	0.08
$\bar{h}_2$	0.09
A	0.91
θ	0.33
δ_k	0.07
Human Capital Technology	
α	0.23
Λ	0.145
d	0.025
δ_s	0.01
Government	
b_1	0.081
b_2	0.3
τ_1	0.124
τ_2	0.176

[20] Mitchell and Phillips (2006), for example, estimate a replacement rate of 48% of average lifetime earnings for a worker with the medium Social Security Administration profile (an earnings trajectory developed by the Office of the Actuary).

A large literature has sought to identify the intertemporal elasticity of substitution for labor from the variation of wages and hours over the life cycle. These studies typically found very small elasticities for prime aged males, in the range of .3 or less.[21] A value of γ=1.4 may seem rather large compared with these estimates. Imai and Keane (2004), however, showed that once allowing for human capital accumulation, the estimates of the preference parameter can be significantly larger than the traditional estimates. In fact, their estimate of the elasticity is as high as 3.8. While Wallenius (2007) cautions that Imai and Keane may over-estimate the effect of learning by doing on the intertemporal elasticity of substitution parameter, estimates in the neighborhood of 1.2-1.4 are plausible once allowing for human capital accumulation.

The small but positive value for d implies that learning becomes somewhat harder with age, whereas the small value for δ_s indicates that the human capital stock depreciates only slightly from one period to the next. The fixed time cost $\bar{h}_2$ is equal to 0.09. This implies that roughly 23% of hours supplied to the market (non-inclusive of commute time) are spent getting set-up in a job and being supervised.[22] Note also that in the parameterization β>1/(1+r), implying that consumption increases with age.

Figures 3 and 4 plot hours worked and hourly wages relative to the targeted data. The model provides a reasonably good fit to the wage data. However, there is a small disparity in the hours profiles, with hours rising slightly more steeply in the 30s and 40s and declining more rapidly at older ages in the model than in the data. The fact that the retirement benefit is based on average earnings from the 35 highest years, not average lifetime earnings, causes a kink in the hours schedule.[23] This contributes to the steeper rise in hours in the 30s and 40s relative to the data. In the model, there is a tension in simultaneously matching the K/Y ratio and the hours worked profile in the data. This is one factor behind the steeper decline in hours worked at older ages. The capital share

[21] For early examples see Ghez and Becker (1975), MaCurdy (1981), and Heckman and MaCurdy (1980). For a more recent survey of the literature, see Hall (2007).

[22] The addition of home production to the model would reduce the size of the non-convexity needed to induce retirement. The intuition for this is that in a model with home production, leisure time does not change as abruptly when people retire.

[23] Introducing uncertainty in wages would smooth out the kink, as the individual would not know at the start of the model which years constitute the highest income years.

parameter, θ, is used to target the appropriate K/Y ratio, whereas the discount factor, β, adjusts in order to target the interest rate, which is fixed in the model. Note that the value of β impacts the shape of the hours worked profile. For the benchmark value of θ=0.33 the value of β is such that the hours profile declines somewhat at older ages.

Figure 3

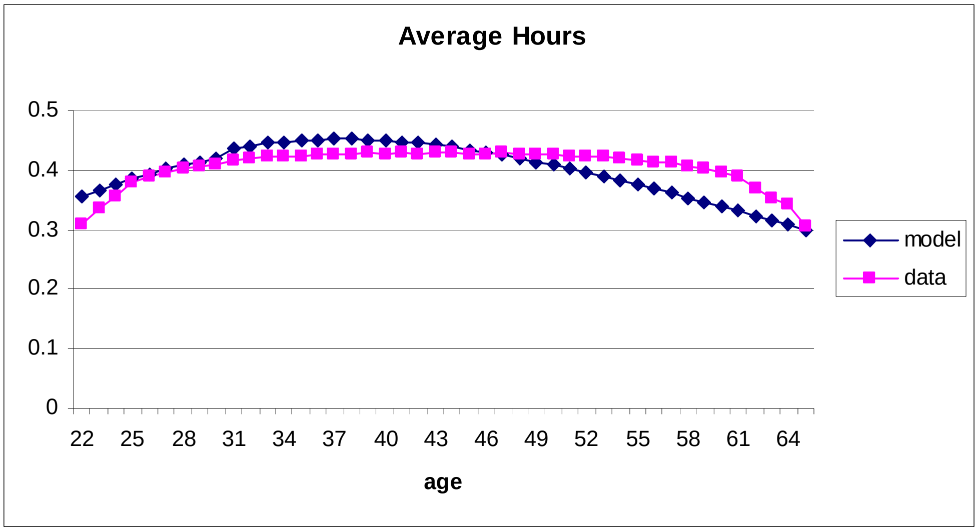
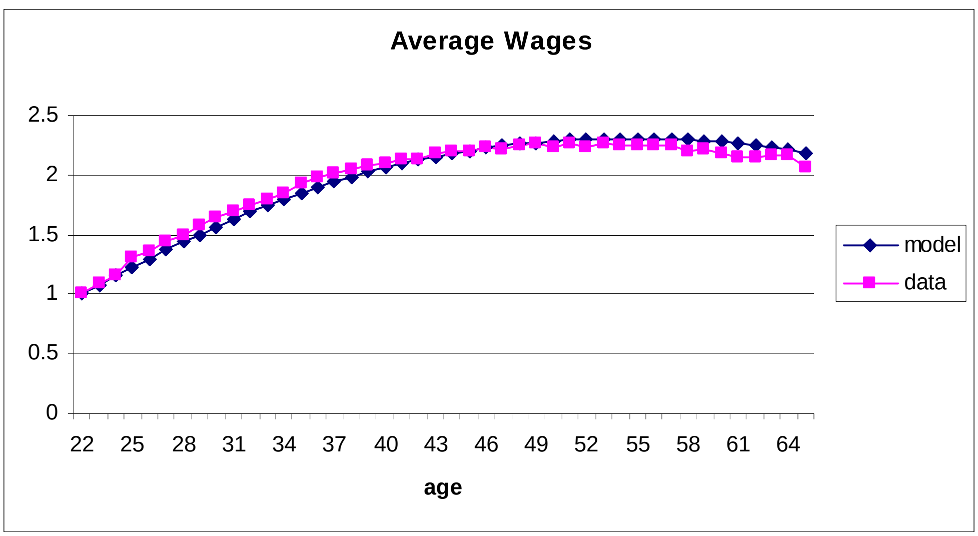


Figure 4



To summarize, although there is some room for further improvement in matching the life cycle profile for hours in the data, the model does a good job of matching the salient features of life cycle labor supply. The development and parameterization of a model that features both an intensive and extensive margin of labor supply, and that can be used to adequately assess the role of tax and transfer programs – particularly social security – in accounting for the cross-country differences in aggregate hours, is a contribution of this paper.

4 WHAT IF THE U.S. IMPLEMENTED FRENCH SOCIAL SECURITY?

Having developed and parameterized the model, I now study the quantitative implications of changes to various features of social security. The focus here is on labor supply effects. Later in this section I briefly report the implications for other key economic statistics. I begin by outlining the differences in the U.S. and French social security systems, and proceed by asking what would happen if the U.S. were to implement the social security system in place in France in 2003. The approach is to compare the steady state benchmark allocation of the U.S. with the steady state allocation under the French social security system of 2003. Although the U.S. and French social security systems differ along several dimensions, the key differences are in the scale of the program and in the eligibility rules associated with collecting social security. To better understand what features of the differences in social security programs are driving the results, I look individually at the impact of each of these features on labor supply allocations.

I conduct the same analysis with the Belgian and German social security programs as with the French. The results for the Belgian and German systems, along with a description of the social security programs in place in these countries can be found in the appendix.

4.1 SOCIAL SECURITY IN FRANCE IN 2003

The French social security system underwent a reform in 2004. The rules described here are those in effect in 2003, as the effects of the 2004 reform have not yet had time to show up in the data.[24]

The social security program in France differs from the U.S. social security system along many dimensions. A key distinction is that in France people are eligible for social security benefits starting at age 60, but to begin receiving them one must stop working.[25] Recall that in the U.S. the benefit formula was modeled as $B = b_0(b_1 + b_2 I)$, where I is the average income from the 35 highest years. Unlike in the U.S., in France there is no flat rate portion of retirement benefits. In other words, b_1=0. Furthermore, in France b_2 is a function of the number of years of social security contributions. The maximum value of b_2 is 0.5, and it is obtained with 40 years of social security contributions. The coefficient is reduced by 1.25 percentage points for each missing quarter to reach 160 quarters. In France benefits are tied to earnings from the highest 25 years. As in the U.S., social security in France is a PAYG system financed through a payroll tax. The joint contributions of the employer and employee are reported as 16.45%. However, the social security program requires an annual government subsidy. In the model, I set the payroll tax so as to balance the social security budget in steady state.

4.2 LABOR SUPPLY EFFECTS OF SOCIAL SECURITY

I now keep all non-policy parameters fixed at the benchmark level, but alter the benefit formula and the rules regarding social security to reflect the French system. A new interest rate and price per unit of labor services corresponding to the new steady state equilibrium are computed.

Under the French social security system, aggregate hours decrease by 10.9% relative to the benchmark. This implies that the differences in social security programs

[24] The descriptions of the continental European social security programs are based on information from Gruber and Wise (2004) and http://etk.fi/Page.aspx?Section=41102.

[25] Following the 2004 reform one no longer has to stop working to collect social security, as long as the sum of earnings and the social security benefit does not exceed the level of earnings prior to collecting social security.

account for roughly 35% of the current differences in aggregate hours of work between the U.S. and France, reported in the introduction.

I now turn to how the drop in aggregate hours is divided between the extensive and intensive margins of labor supply. In the economy with the French social security system, people find it optimal to work ages 22-59, i.e., retire at age 60. Comparing hours worked in the age range where people are working under both policies, ages 22-59, I find that hours worked when working are 0.1% lower with the French social security program than in the benchmark. Virtually all of the action is thus on the extensive margin of labor supply.

As previously noted, the French and U.S. social security programs modeled here differ along several dimensions, namely in: (1) the scale of the program, (2) the rules regarding eligibility and working, (3) the number of years on which the benefit is based and (4) the relative importance of the flat rate and earnings dependent portions of the benefit. To better understand which features of social security are driving the results outlined above, I look individually at the effects of altering the scale of the program and the eligibility rules associated with collecting social security.

I start with the experiment where only the scale of the program is altered. In particular, set total social security payments per period in steady state equal to the French level, but keep the eligibility rules and the b_1 and b_2 coefficients as in the United States. That is, increase τ_1 so as to generate the desired tax revenue for social security payments and adjust b_0 so as to balance the social security budget in steady state. The second column of Table 2 shows the results of this experiment. The top portion of the table reports the percentage change in aggregate hours, H, the percentage change in hours worked when working, h, and the optimal working life. The last line of the table reports the social security tax that balances the budget. For comparison, the results for the economy with the French social security system are summarized in the first column of the table. When the scale of social security in the U.S. is increased to the French level, aggregate hours decline by 6.8% relative to the benchmark U.S. economy. Hours worked when working are 1.7% lower than in the benchmark, and people now find it optimal to work ages 22-62. While increasing the scale of social security in the U.S. to the French level results in a sizable drop in aggregate hours, the drop in aggregate hours is considerably smaller than that from implementing the French social security system in the United States. This result highlights the fact that scale alone is not a sufficient statistic of social security. Note also that when only the scale of social security is altered, the labor supply response is split more evenly between the intensive and extensive margins of labor supply than in the previous experiment where the rules regarding eligibility and working were also altered.

Table 2: Effects of Scale and Eligibility Rules

	French Social Security	*Altering Scale Only*	*Altering Eligibility Rule Only*
%Δ H	-10.9	-6.8	-8.3
%Δ h	-0.1	-1.7	+2.9
working life	22-59	22-62	22-59
τ_1	0.23	0.22	0.135

Now consider the experiment where only the eligibility rules are altered. In particular, allow people to start collecting social security at age 60 but require that they stop working to do so. Keep the scale of the program – total social security payments per period in steady state – fixed at the benchmark U.S. level. The results are summarized in the last column of Table 2. When the U.S. adopts the social security eligibility rules of France, aggregate hours decrease by 8.3%. People find it optimal to work ages 22-59. During ages 22-59, hours worked are actually 2.9% *higher* than in the benchmark. The fact that one cannot continue to work while collecting social security benefits creates a big incentive to retire when one first becomes eligible for social security. To gain intuition for this, it is instructive to compute the effective tax rate on labor income at different ages. To compute the effective tax rate, first compute the *increase* in after tax income associated with working. Then compute what this is as a fraction of pre-tax labor earnings, if the individual were to work. The effective tax rate is then 1 minus this fraction. If the individual stops working prior to age 60, he/she gets nothing. So, in that case the effective tax rate is simply the sum of τ_1 and τ_2. If the individual stops working at age 60, he/she receives a social security benefit. This implies that the effective labor tax rate jumps sharply at age 60, providing a strong incentive to retire at precisely this age.[26] The two margins of labor supply are substitutes in terms of generating income. So, when people retire earlier than they otherwise would, because they are required to stop working in order to collect social security, people increase hours worked along the intensive margin. While the same mechanisms were at work in the economy with the French social security system, there the higher social security tax resulted in a slight decrease in hours worked when working relative to the benchmark.

The analysis reveals that the scale of the program and the rules regarding eligibility and working are both important determinants of labor supply behavior. Note that if one were to add up the effects of altering the scale of the program and the rules associated with collecting social security, one would get a larger total effect than that from implementing the French social security system in the United States. Recall that the U.S. and French social security programs differ along other dimensions as well. In particular, there is no flat-rate portion of the social security benefit in France, b_1=0. Note that when b_1=0 social security is less distortive, because people know that their social security benefit is completely tied to their labor supply decisions. To illustrate, when b_1 is set to zero, holding the tax rate and other parameters fixed at the benchmark level, aggregate hours increase by 2.6% relative to the benchmark.

4.3 DISTINGUISHING SOCIAL SECURITY FROM LUMP-SUM TRANSFER

To date, the literature studying the role of tax and transfer programs in accounting for the cross-country differences in aggregate hours worked has modeled tax and transfer programs as a proportional tax accompanied by a lump-sum transfer (see for example Prescott (2004), Rogerson (2008) and Ohanian et al (2008)). In this sub-section, I argue that the U.S. social security system is not well approximated by a lump-sum transfer, and that the modeling details of tax and transfer programs matter for the results. This exposition ties into the finding of the previous sub-section that scale is an insufficient statistic of tax and transfer programs.

[26] To illustrate, in the economy with the French social security system the effective labor tax jumps form 0.4 to 0.78 at age 60.

The importance of the modeling details of tax and transfer programs is best conveyed by contrasting the experiment from the previous sub-section of increasing the scale of social security in the U.S. to the French level with increasing the scale of the lump-sum transfer in the U.S. by the same amount. For ease of comparison, the first column of Table 3 summarizes the results from the experiment of increasing the scale of social security, whereas the second column reports the results from increasing the scale of the lump-sum transfer. From the table it is apparent that the drop in aggregate hours is considerably larger when the scale of the lump-sum transfer is increased (10%) than when the scale of the social security transfer is increased (6.8%). In fact, the difference is a factor of roughly 1.5.

Table 3: Contrasting Social Security Transfer and Lump-sum Transfer

	Altering Scale of Social Security	*Altering Scale of Lump-sum Transfer*
$\%\Delta\ H$	-6.8	-10
$\%\Delta\ h$	-1.7	-7.5
working life	22-62	22-64

Furthermore, the drop in aggregate hours is split very differently between the intensive and extensive margins of labor supply for the two policies. When the scale of the lump-sum transfer is increased, considerably more of the action is on the intensive margin than when the scale of the social security benefit is increased. The intuition is as follows: When the scale of the lump-sum transfer is increased, people decrease hours worked when working more than the working life, as retiring earlier places emphasis on lower wage years in the calculation of the social security benefit. This result implies that there is some interesting interaction between the two tax and transfer policies.

The preceding analysis illustrates that U.S. social security is less distortive than a lump-sum transfer. The reason for this is that social security is partly forced saving. There is, nonetheless, a clear distinction between social security and a pure forced savings system. To see this, note that if benefits are exactly equal to taxes paid at the individual level, and individuals understand this, then they disappear from the budget equation and hence have no impact. In other words, a forced savings system of this nature would produce results exactly like those from an economy with no social security.

Although social security is partly forced saving, my calculations show that the extent to which it is something more than forced saving is quite substantial in terms of the implications for hours of work.

The message to take away form this analysis is that the details of the tax and transfer system are important in terms of the aggregate effects of labor taxes.[27] Moreover, using scale as the only dimension of a tax and transfer program, and assuming the transfer is lump-sum, gives very different results than explicitly modeling social security.

4.4 OTHER IMPACTS OF SOCIAL SECURITY

So far the focus of my study has been solely on the labor supply implications of various features of social security. While not the focus of my analysis, it is of interest to note how a few other key statistics, such as the capital to output ratio and productivity, differ across the benchmark U.S. economy and the economy with the French social security system. Feldstein (1977) notes that there is substitutability between private saving and social security. In particular, since social security is partly forced saving, higher social security taxes depress capital accumulation. Recall that requiring people to stop working in order to collect social security induces a higher rate of retirement among older people. Feldstein notes that this in turn can increase saving. The intuition is that if someone plans to work until they die, they do not need to save as much as someone who plans to retire at, say, 65. In my model, the combined effect of these forces is such that the capital to output ratio in the economy with the French social security system is 1.2% lower than in the benchmark. Similarly, productivity, as measured by output per hour, is 1.7% lower than in the benchmark. In the model, the effects of changes to social security on the capital to output ratio and productivity are small. The results seem reasonable, as neither statistic is very different for France than the United States.

Note also that prices differ somewhat across the two model economies. Specifically, the price of a unit of labor services is slightly lower in the economy with the

[27] Ragan (2005) and Rogerson (2007) also emphasize that how the tax revenue is spent matters a lot. This is particularly true in Scandinavia, where labor taxes are high but, e.g., subsidized daycare and elderly care are widely available.

French social security system than in the benchmark economy, w=0.994, whereas the interest rate is slightly higher, i=0.0413.

5 OTHER DIFFERENCES IN TAX AND TRANSFER PROGRAMS

My findings indicate that differences in social security account for 35-40% of the differences in hours worked between the U.S. and Belgium, France and Germany. After accounting for the differences in social security taxes, big differences in average effective labor taxes still remain. Several authors have produced estimates of effective tax rates for various countries, including Mendoza et al (1994), Prescott (2004) and McDaniel (2007b). While there are small differences in methodology across studies, all find roughly a twenty percentage point difference in average effective tax rates between the U.S. and countries such as Belgium, France and Germany. This implies that in my model differences in social security taxes account for roughly 60% of the differences in effective labor tax burdens between the U.S. and continental Europe. Given the results of the previous sub-section, one can hypothesize that the modeling details of the remaining differences in tax and transfer programs are also important. However, as it is likely that at least some transfers resemble lump-sum transfers, here I conduct the simple experiment of increasing the non-social security labor tax and corresponding lump-sum transfer to match the remainder of the twenty percentage point difference in average effective labor taxes between the U.S. and continental Europe. This exercise can be thought of as a starting point for more detailed analysis.

Given a social security tax of 0.23 in the economy with the French social security system, set τ_2=0.27 to match an average labor tax burden of 0.5. The results are presented in the second column of Table 4. To highlight the effect of raising the non-social security labor tax, the results for the economy with the French social security system (τ_2=0.176) are restated in the first column of the table. Raising the non-social security tax reduces labor supply along the intensive margin only. The reason for this is that the large jump in the effective tax rate at age 60 creates a big incentive to retire precisely when one first becomes eligible to collect social security. After the increase in τ_2, aggregate hours are 18.3% lower relative to the benchmark, implying that tax and transfer programs account for roughly 60% of the difference in aggregate hours between the U.S. and France.

Table 4: Increasing the Non-Social Security Tax

	French Social Security	*French Tax and Transfer Programs*
$\%\Delta\ H$	-10.9	-18.3
$\%\Delta\ h$	-0.1	-8.3
working life	22-59	22-59

The overall effect of tax and transfer programs on aggregate hours worked in my model is thus similar to that of Prescott (2004), who attributes roughly two thirds of the cross-country differences in aggregate hours to tax and transfer programs. An important distinction, however, is that in my model a large share of the differences in aggregate hours can be attributed to differences in the eligibility rules associated with collecting social security – and not just the differences in the scale of tax and transfer policies. This yields different policy implications to those found in his paper.

6 TIME SERIES EVIDENCE

The focus of the analysis has been on comparing the labor supply implications of the social security program in place in the U.S. with those in place in continental Europe in the year 2003. Since the employment rate of older workers in Belgium, France and Germany relative to the U.S. has decreased considerably since the 1970s, it is also of interest to compare the labor supply implications of the social security systems in place in the continental European countries in 1970 to those in place in 2003. I again use France as the illustrative example.

Note also that the overall effective labor tax burden was lower in 1970 than in 2003, 0.4 compared with 0.5, in France.

The key distinction between the 1970 French social security system and the system in place in France in 2003 is that in 1970, the first age at which one could collect social security was 65 and no early retirement was available for the majority of people. As in 2003, in 1970 the maximum value of the b_2 coefficient equaled 0.5, and it did not increase were one to continue working past the age of 65.

Suppose one asked what would happen if the economy with the French social security system and the French overall effective labor tax burden of 2003 were to revert to the social security system and overall effective labor tax in place in 1970. This would produce an allocation with considerably more market work than the 2003 French social security system and average effective labor tax, with aggregate hours 15.5% higher relative to the economy with the French tax and transfer programs of 2003. People would choose to work ages 22-64, thereby retiring at age 65, and hours worked when working would be 4.5% higher than in the economy with the 2003 French tax and transfer programs. The rule requiring that one stop working to collect social security would again provide incentives to stop work when one first becomes eligible for social security. In the absence of early retirement, however, this would occur at a much later age than under the 2003 system. Consequently, the budget balancing social security tax under the 1970 system would also be considerably lower, 0.17 to be exact.[28]

The analysis indicates that differences in social security are consistent, not only with the cross-sectional, but also the time series evidence on the labor supply behavior of older workers.

7 SENSITIVITY ANALYSIS

In this section I discuss the robustness of the results to changes in the parameter vector. As noted earlier, there are many specifications corresponding to a range of values for α that all produce a relatively good fit to the data. In the benchmark I set α=0.23, which is roughly the estimate of Imai and Keane (2004). The primary differences in specifications, as α is varied, are for the values of γ and $\bar{h}_2$. The other parameters are rather similar across specifications. As documented by Wallenius (2007), smaller values of α typically correspond to smaller values of γ, and vice versa. To gain intuition for this, start with the benchmark parameterization and lower α, holding γ fixed. As learning becomes less important, people work less when young. When the elasticity is nonetheless fixed at a high value, this causes the hours profile to become steeper. So, to get a good fit to the data with a smaller value of α, γ too must be smaller. Smaller values of γ in turn correspond to larger values of $\bar{h}_2$. This is intuitive: a small γ implies that people prefer

[28] This implies that τ_2=0.23.

smooth hours, and since retirement is a large, abrupt change in hours, a large fixed cost is required to induce retirement.

The value of α=0.23, and the corresponding value of γ=1.41, is close to the upper end of values for α and γ that produce a decent fit to the data. However, there are specifications where both are somewhat lower, that also produce a decent fit to the data. One such parameterization is presented in Table 5, along with the benchmark one.

Table 5: Alternative Parameterizations

	BENCHMARK	**ALTERNATIVE**
Preferences		
β	0.977	0.978
b	3.095	3.212
γ	1.41	1.2
Production Technology		
$\overline{h}_1$	0.08	0.08
$\overline{h}_2$	0.09	0.12
A	0.91	0.91
θ	0.33	0.33
δ_k	0.07	0.07
Human Capital Technology		
α	0.23	0.05
Λ	0.145	0.122
d	0.025	0.025
δ_s	0.01	0.01
Government		
b_1	0.081	0.081
b_2	0.3	0.3
τ_1	0.124	0.124
τ_2	0.176	0.176

I now discuss how the results vary across specifications. As a representative example, I present the results from the experiment where social security in the U.S. is scaled to the French level, but the rules and benefit formula are as in the United States. This is again synonymous with increasing the social security tax to roughly 0.22. The results with the alternative parameterization are similar to those with the benchmark parameterization, although aggregate hours decrease slightly less with the alternative parameterization, 6.7% compared with 6.8%. The reason for the small difference is that when γ is smaller, there is slightly less action along the intensive margin of labor supply.[29] Despite the small differences in results, the responses to policy changes are of comparable magnitudes for the different parameterizations. Therefore, I do not report results for alternative parameterizations in any further detail.

8 CONCLUSIONS

Total time devoted to market work in continental Europe is currently only about 70% of the U.S. level. In this paper, I examine the role of social security in accounting for these cross-country differences in aggregate hours. Given that roughly half of the differences in aggregate hours are due to differences in employment to population ratios, which in turn are in large part due to differences among the old, social security seems like a promising candidate explanation. Furthermore, isolating the impact of social security on aggregate hours worked is a natural starting point due to the size of and the large differences in social security programs across countries.

In this paper I develop and parameterize a general equilibrium model of life cycle labor supply and retirement, where the key ingredients of the model are an extensive and intensive margin of labor supply. I then use the model to evaluate changes to various features of social security, particularly to the scale of the program and the associated eligibility rules.

The findings of this paper are fourfold. First the differences in social security account for 35-40% of the current differences in aggregate hours worked between the

[29] Rogerson and Wallenius (2009) showed that while γ does not have a large impact on the responsiveness of aggregate hours to a change in the tax rate, it matters for how the aggregate response is broken down into changes along the intensive and extensive margin. Particularly, the larger the value of γ, the more action there is along the intensive margin.

U.S. and the continental European countries of Belgium, France and Germany. Second, when I individually examine the role of the scale of the program and the eligibility rules associated with collecting social security in accounting for the differences in aggregate hours of work, I find that these two key features of social security systems are of roughly equal importance in accounting for the cross-country differences in labor supply outcomes. This indicates that the cross-country differences in social security cannot be summarized by one statistic. Third, the presence of a social security system has important implications for how other tax and transfer programs influence labor supply. For example, when one increases the scale of a lump-sum transfer in a model with social security, all of the action is on the intensive margin of labor supply. Fourth, once I include other differences in labor income taxes in addition to social security, I find that tax and transfer programs account for roughly 60% of the difference in aggregate hours worked between the U.S. and the continental European countries of Belgium, France and Germany.

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APPENDIX

Social Security in Belgium and Germany

I now provide a brief description of the social security programs in Belgium and Germany. In Germany, the so called social security program covers only private sector employees. There is a separate program for government employees. In what follows I focus solely on the private sector. In Belgium people are eligible for social security benefits starting at age 60, while in Germany it is possible to start collecting social security benefits at age 62 (if the worker has at least 35 years of contributions). In both countries one can earn only a small amount while collecting social security.[30] The limits are tight enough to result in the same behavior as if one were required to stop working to collect social security benefits. Benefits are tied to lifetime earnings. In Belgium and Germany there is no flat rate portion of retirement benefits, b_1=0. The value of b_2 depends on the number of years of social security contributions.[31] The maximum value of b_2 in Belgium is 0.6 and is obtained with 45 years of social security contributions. The coefficient is adjusted downward by a factor of 1/45 for every missing year of contributions. The value of b_2 in Germany is such that one earns 1.5% of average lifetime earnings for every year of work. Prior to the social security reform in 1992, there was no reduction in benefits from early retirement in Germany. Following the reform, benefits are reduced by 0.3% per month for every month that social security is collected prior to reaching the full-retirement age of 65. This yields a maximum reduction of 10.8%.

In both countries social security is a PAYG system financed through a payroll tax. The joint contributions of the employer and employee are reported as 16.36% and 19.3% in Belgium and Germany, respectively. However, as was the case with the French social security system, the social security programs require an annual government subsidy. In the model, I set the payroll tax so as to balance the social security budget in steady state.

[30] In Germany one is allowed to earn 325 euros per month and Belgium one is allowed to earn between 500 and 900 euros per month, depending on marital status etc.

[31] In Germany benefits are also dependent on the relative earnings position. The values of b_2 used in the model are for the average worker.

Summary of Results for Belgium and Germany

Altering the benchmark U.S. model to reflect the Belgian social security system yields results very similar to those from the experiment where the U.S. implemented the French social security system. Specifically, aggregate hours fall by 11.7% relative to the benchmark. People again find it optimal to work from age 22 to age 59. That is, it is optimal to retire at age 60. Hours worked are 0.9% lower along the intensive margin relative to the benchmark. The results are summarized in the first column of Table 8.

Table 8: Altering U.S. Social Security to Resemble Belgium and Germany

	Belgium	*Pre-reform Germany*	*Post-reform Germany*
%Δ *H*	-11.7	-8.9	-8.2
%Δ *h*	-0.9	-1.9	-1.2
working life	22-59	22-61	22-61
τ_1	0.23	0.24	0.22

For the case with the German social security system, I report results for both the pre-reform benefit formula and the post-reform one. The main message to emerge form this comparison is that modest reductions in the generosity of social security benefits, such as the 1992 German reform, have little impact on labor supply, particularly retirement decisions.

I now discuss the results in more detail, starting with the pre-reform case, where there is no reduction in benefits from early retirement. The results are presented in the second column of Table 8. With this policy, people find it optimal to work from age 22 to age 61, i.e., retire at age 62. Aggregate hours fall by 8.9% relative to the benchmark. During ages 22-61, hours worked are 1.9% lower than in the benchmark. The somewhat smaller drop in aggregate hours relative to the economies with the Belgian and French social security programs is explained by the fact that people are eligible for social security benefits starting at age 62, instead of age 60. Consequently, there is slightly more action along the intensive margin in the economy with the German social security system than in the economies with the Belgian or French systems.

Now compare these results to those from the post-reform case, where benefits are reduced by 0.3% per month for every month that social security is collected prior to reaching the full-retirement age. The results are presented in the third column of Table 8. This exercise illustrates that moderately reducing the generosity of social security benefits does not create powerful incentives for people to remain employed longer or even to increase hours worked when working by much. The reduction in benefits has no impact on optimal retirement behavior. That is, with this policy people still find it optimal to work from age 22 to age 61. The social security tax needed to balance the budget is lower following the reform, as the generosity of benefits has been reduced. People work slightly more while employed with the lower social security tax. Thus, aggregate hours fall by 8.2% relative to the benchmark, compared with 8.9% prior to the reform. From this result one can conclude that, if – given the aging populations in many countries – getting people to delay retirement is indeed the goal of the government, changing the rules regarding eligibility and working while collecting social security benefits would create much bigger incentives for the continued employment of older workers than moderately reducing the generosity of benefits.