

Elimination of Social Security in a Dynastic Framework *

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Abstract

In this paper we study the welfare effects of eliminating social security in a model with two sided altruism where social security provides insurance against lifetime and individual income uncertainty. Our findings indicate that households are able to shift the efficiency gains, generated through privatization of social security, across parents and children quite successfully. Contrary to a pure life-cycle setup, our framework yields significant support for even an uncompensated elimination of unfunded social security.

Keywords: Altruism; Social security privatization; Heterogenous agents; Welfare.

JEL Classification: E6; D52; C68; H55

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1. Introduction

Issues surrounding the social security system in the United States continue to generate attention from both economists and policy makers. There is a substantial literature examining the steady state effects of social security on capital accumulation and welfare as well as welfare implications of privatizing, or reforming social security. While most research in this area considers pure life-cycle models, in this paper we study the effects of eliminating social security in a dynastic framework. We think that analyzing social security in a dynastic framework is relevant for several reasons. First, it is interesting to evaluate the insurance role played by the social security system in an economy that, unlike the pure life-cycle model, allows for family insurance. This is particularly important since social security may crowd-out family insurance. Second, the effect of social security on capital accumulation in a dynastic framework is quite different from that in a pure life-cycle model, as emphasized by Barro (1974) in a seminal contribution, and by Fuster (1999) and Fuster, İmrohoroğlu and İmrohoroğlu (2003) in quantitative studies examining social security. Third, since the dynastic and the life-cycle frameworks are the two workhorses in macroeconomic analyses, it is important to compare the short-run and long-run effects of social security reform in these two frameworks. In this way, we can check the robustness of the results of privatizing social security in the literature that are obtained using pure life-cycle economies.

We study the elimination of unfunded social security in an economy where social security provides insurance against lifetime uncertainty and income risk. Retirement benefits are financed with a payroll tax that distorts labor supply decisions and may also hurt borrowing constrained individuals. Social security also affects saving for retirement and for bequests since our framework nests the life-cycle and altruistic models. In particular, our economy is populated by overlapping generations of individuals with two-sided altruism. Because parents care about their descendents, they save in order to insure their children against lifetime earnings risk. Because children are altruistic towards their parents, they may insure their parents against living longer than expected. While both social security and the family provide insurance against lifespan and earnings risks, social security can pool risks across different families at a point in time.

In Fuster et al. (2003), we use a similar setup, but with exogenous labor supply, to study the steady state impact of eliminating social security. Our findings indicate that steady-state welfare is lower in an environment without social security for most households. In this paper, we incorporate an endogenous labor/leisure choice and take into account the short-run welfare effects by computing equilibrium transition paths across steady states. We evaluate alternative schemes for eliminating the U.S. social security system that differ in the compensation of past social security claims and on the fiscal policy used to finance such compensation. We find that the majority of individuals in our economy are better off with the elimination of social security in all the transitional schemes considered. In our framework, most individuals are in favor of the elimination of social security because they enjoy a reduction in labor income taxes in addition to the elimination of the payroll tax.¹ The political feasibility of eliminating social security depends crucially on whether

¹We emphasize that the social security payroll tax is particularly distortionary because it is applied on

the government can credibly commit to keep its purchases of goods and services constant and reduce income taxes as the economy expands. As a result, our findings should not be interpreted as implying that the U.S. social security will likely be eliminated. Instead, our results indicate that in order to generate support for the elimination of social security the efficiency gains that are obtained through increases in labor supply need to be rebated back to the households in the form of a reduction in the tax burden that they face in an environment with family insurance. Moreover, despite the progressivity of the pension benefit formula in our model economy, individuals with low labor productivity benefit the most from the elimination of social security. This surprising finding is due to the fact that individuals with low earnings do not sufficiently value annuity insurance provided by social security since they have a short lifetime expectancy, consistent with evidence from the U.S. economy.² In addition, they are quite likely to be borrowing constrained and, as a result, benefit substantially from the elimination of the payroll tax.

Unlike the results in our paper, most previous studies in the literature find welfare losses for the majority of individuals alive at the time of social security reform. All of these studies use the life-cycle framework. For instance, Conesa and Krueger (1999) argue that the insurance role of social security against income risk outweighs the distortions of social security taxes, thus significantly reducing support for a transition to a fully funded system.³ Kotlikoff, Smetters and Walliser (2000) show that, even in an economy where social security does not play an insurance role, individuals alive at the moment of the elimination of social security suffer welfare losses. If the government does not honor past social security claims, middle aged and older individuals are worse off. If these claims are honored, then their financing imposes an important burden on the generations alive at the moment of social security elimination. Huang, İmrohoroğlu, and Sargent (1997) show that if the government issues a sufficiently large amount of debt and designs a scheme of lump sum transfers to compensate living generations (financing the temporary ‘entitlement debt’ with an additional temporary labor income tax), then it is possible to eliminate the unfunded social security system in a way that benefits everybody.⁴ Kotlikoff (1996) reports a similar finding. Interestingly, in our paper we do not rely on the government formulating lump-sum transfer schemes in order to generate support for eliminating social security. Even when the government does not honor past social security claims, we find that within-family intergenerational transfers allow for redistributing the efficiency gains of eliminating social security so that most individuals who are alive during the reform are better off. Because Ricardian equivalence does not hold in

top of personal income taxes. The intuition, as it is well known from the public finance literature, is that tax distortions increase proportionally with the square of the tax rate (see Atkison and Stiglitz (1980)).

²The results in Coronado, Fullerton and Glass (2000) indicate that once all relevant individual characteristics are taken into account social security system in the U.S. indeed becomes regressive.

³Because Conesa and Krueger (1999) do not model income taxes, the distortions of payroll taxes are minimized.

⁴In order to make the computation of the equilibrium transitional path simple, these authors endow individuals with a risk-sensitive, quadratic utility function. De Nardi, İmrohoroğlu and Sargent (1999), introduce a joy of giving bequest motive in their calibrated overlapping generations model but do not address the question of support for reform. Instead, they emphasize the aging of the U.S. population and conduct experiments that examine the welfare impact of various reform proposals.

our framework, government debt can make the financing of the transition less costly.⁵

The paper is organized as follows: Section 2 describes the model and Section 3 describes the calibration of the benchmark economy. Section 4 presents the results, Section 5 the sensitivity analysis, and Section 6 concludes.

2. The Model

2.1. Demographics and Endowments

The economy is populated by overlapping generations of households that are linked through altruistic transfers. Every period t a generation of individuals is born. They face random lives and some live through the maximum possible age $2T$. Conditional on survival, an individual's lifetime support overlaps during the first T periods with the lifetime support of his father, and during the last T periods with the lifetime support of his children⁶. At any point in time, the economy is populated by $2T$ overlapping generations of individuals with total measure one.

Individuals are endowed with one unit of time. In each period until they reach the mandatory retirement age of R , they supply labor services to the firms. At birth, each individual receives the realization of a random variable $z \in Z = \{H, L\}$ that determines his lifetime labor ability. z is a two-state, first-order Markov process with the transition probability matrix

$$\Pi(z', z) = [\pi_{ij}], \quad i, j \in \{H, L\},$$

where $\pi_{ij} = \Pr\{z' = j \mid z = i\}$, z' is the labor ability of the new born in the dynasty, and z is the labor ability of his father. The transition probabilities are consistent with the existence of a unique stationary measure of abilities $\lambda(z)$.⁷

Labor ability affects two features of an individual's lifetime opportunities. First, z determines the individual's age-efficiency profile $\{\varepsilon_j(z)\}_{j=1}^{2T}$. If $z = H$, an individual has a higher labor productivity throughout his life-span than an individual with $z = L$. Second, labor ability determines an individual's life expectancy. Let $\psi_j(z)$ denote the probability of surviving to age $j + 1$ conditional on having survived to age j for an individual with ability z for age $j = 1, 2, \dots, 2T$, where $\psi_{2T}(z) = 0$ and $z \in \{H, L\}$.

The size of cohort 1 (newborns), with ability z , relative to that of cohort $(T+1)$ (parents) is $\mu_1(z) = \lambda(z)(1+n)^T$ where $(1+n)^T$ is the number of children per parent and $\lambda(z)$ is the measure of newborn individuals with ability z . The relative sizes of the other generations are obtained recursively as follows:

$$\mu_{i+1}(z) = \frac{\psi_i(z)\mu_i(z)}{(1+n)}, \quad i = 1, \dots, 2T - 1.$$

⁵In our setup, government debt is not neutral because taxes are distortionary, there are incomplete markets, and dynastic links may break because of mortality shocks.

⁶In this framework fertility is exogenous. In a recent work Ehrlich and Kim (2003) argue that the pay-as-you-go system may have had an adverse effect on the total fertility rate in a panel of 57 countries.

⁷We assume that there are no insurance markets in the economy to diversify the risk of being born as a low ability-type individual.

The population growth rate, n , and conditional survival probabilities, $\psi_i(z)$, are taken as constant which makes the cohort shares time-invariant.

2.2. Technology

There are firms in this economy that use capital and labor to produce a single good according to the following production function: $Y_t = K_t^\alpha (A_t N_t)^{1-\alpha}$, where $\alpha \in (0, 1)$ is the output share of capital, Y_t is output at time t , K_t is aggregate capital input at time t , N_t is aggregate labor input at time t , and A_t denotes a technology index that grows at a constant rate γ . Capital depreciates at a constant rate $\delta \in (0, 1)$. Firms maximize profits renting capital and hiring labor from the households so that marginal products equal factor prices \tilde{r}_t , the rental price of capital and ω_t the wage per effective labor.

2.3. Social Security and Fiscal Policy

There is a pay-as-you-go social security system where pension benefits to retired individuals are financed by taxing earnings of the current workers. The payroll tax, τ , is set to balance the budget of the social security system each period. We assume that an individual's pension is a function of the average earnings of his ability group. This function tries to capture the progressivity of the US benefit formula and it is described in the calibration section of the paper.⁸

The government also taxes labor income, capital income and consumption in order to finance an exogenously given level of government purchases. The labor income tax is set such that the government budget balances.⁹

2.4. Altruistic Preferences and the Households' Decision Problem

Individuals derive utility from their own lifetime consumption and leisure, and from the felicity of their predecessors and descendants. The formalization of preferences follows Laitner (1992) in the sense that the father and the children maximize the same objective function. Because of this commonality of interests, during the periods when their lives overlap the father and the children constitute a single decision unit by pooling their resources. This decision unit is called a household and is constituted by an adult male, the "father", of age $T + 1$, and his $m = (1 + n)^T$ adult children of age 1. A household lasts T periods or until the father and the children have died.¹⁰ A dynasty is a sequence of households that belong to the same family line. If the children survive to age $T + 1$, each of them becomes a father in

⁸We assume that, within an ability group, there is no link between earnings of an individual and its future pension. Otherwise, it would imply that individuals' labor history is a state variable in the household problem which is computationally very burdensome.

⁹In addition, the government collects the asset holdings and capital income left over by deceased individuals who do not have descendants. These resources are transferred in a lump-sum fashion to the entire population.

¹⁰In a given household, all children are born at the same period and all of them die at the same period. Children in a given household are identical regarding their labor abilities and vector of conditional survival probabilities.

the next-generation household of the dynasty. Otherwise, the family line is broken, and this particular dynasty is over. Every period some dynasties disappear since there are individuals who do not reach age $T + 1$. We assume that these dynasties are replaced by new dynasties to maintain our assumption of a stationary demographic structure. Since mortality rates are higher for low ability individuals, the number of new dynasties of low ability is higher than the number of dynasties of high ability. A new dynasty begins with an individual of age 1 that holds zero assets.

Households are heterogeneous regarding their asset holdings, age, abilities, and their composition. The composition of a household changes when either the father or his m children die. Since the life-span shock that affects each of the children are perfectly correlated, there are three types of households. Households of type-1 are those where the father has died. Households of type-2 are those where the m children have died. Households of type-3 are those where both the father and the children are still alive.

The budget constraint facing an age- j household, where $j = 1, 2, \dots, T$ is the age of the youngest member(s), is given by

$$[\phi_s(h)c_{s,j} + \phi_f(h)c_{f,j}](1 + \tau_c) + (1 + \gamma)a_j = [1 + r(1 - \tau_k)]a_{j-1} + e_j(h, z, z') + [\phi_s(h) + \phi_f(h)]\xi, \quad (2.1)$$

where ϕ_s is an indicator function which takes the value m if the children are alive and 0 otherwise, while ϕ_f is an indicator function that takes the value unity if the father is alive and 0 otherwise; $h \in \{1, 2, 3\}$ is an indicator of household composition, r is the interest rate $r = \tilde{r} - \delta$, $e_j(h, z, z')$ denotes the after tax earnings, $c_{s,j}$ and $c_{f,j}$ are the consumption of the son and the father, a_j denotes the asset holdings to be carried over to age $j + 1$, ξ is a lump sum redistribution of accidental bequests left behind by single individual households and confiscated by the government, and τ_c and τ_k denote the consumption and capital income tax rates, respectively. Consumption, asset holdings, lump-sum transfers, and earnings are transformed to eliminate the effects of labor augmenting, exogenous productivity growth. In particular, we have normalized those variables by the level of the technology, A_t , at any period t .¹¹

The function $e_j(h, z, z')$ gives the net of tax earnings of an age- j household:

$$e_j(h, z, z') = \begin{cases} \phi_s(h)\omega(1 - \tau - \tau_\ell)\varepsilon_j(z')(1 - l_{s,j}) + \phi_f(h)B_{j+T}(z) & \text{if } j \geq R - T, \\ \phi_s(h)\omega(1 - \tau - \tau_\ell)\varepsilon_j(z')(1 - l_{s,j}) + \phi_f(h)\omega(1 - \tau - \tau_\ell)\varepsilon_{j+T}(z)(1 - l_{f,j}), & \text{otherwise,} \end{cases} \quad (2.2)$$

where $l_{s,j}$ and $l_{f,j}$ are the leisure of the son and the father, τ is the social security tax rate and τ_ℓ is the tax rate on labor income. $B_{j+T}(z)$ denotes the pension at age $j + T$.¹² An individual's pension remains constant during retirement while technology grows at the rate γ . Thus, the pension per effective labor decreases during retirement at rate γ . In other words, the retirement benefits of successive cohorts increase at the rate γ .

¹¹For the sake of clarity, we will drop the time subscripts from now on although we do not restrict attention to steady-states.

¹²When the age of the son is j , the age of the father is $j + T$.

For $j = T$, the budget constraint of the household is given by

$$[\phi_s(h)c_{s,T} + \phi_f(h)c_{f,T}](1 + \tau_c) + (1 + n)^T(1 + \gamma)a_T = [1 + r(1 - \tau_k)]a_{T-1} + e_T(h, z, z') + [\phi_s(h) + \phi_f(h)]\xi. \quad (2.3)$$

If the children survive to age $T + 1$, $(1 + n)^T$ new households are constituted in the dynasty and each of them will hold a_T assets. If the children do not survive to age $T + 1$, the family line breaks.

It is assumed that households face borrowing constraints and cannot hold negative assets at any age: $a_j \geq 0, \forall j$.

The economic problem of a household is to choose a sequence of consumption, leisure, and asset holdings given a set of policies for social insurance. We denote by $V_j(a, h, z, z')$ the steady state maximized value of expected, discounted lifetime utility of an age- j household with the state vector (a, h, z, z') . For a household of age $j \leq T$,

$$V_j(a, h, z, z') = \max_{\{c_s, c_f, l_s, l_f, a'\}} \left\{ [\phi_s(h)u(c_{s,j}, l_{s,j}) + \phi_f(h)u(c_{f,j}, l_{f,j})] + \beta \tilde{V}_{j+1}(a', h', z, z') \right\} \text{ subject to (2.1)-(2.3), } a_j \geq 0, \quad (2.4)$$

where

$$\tilde{V}_{j+1}(a', h', z, z') = \begin{cases} \sum_{h'=1}^3 \chi_j(h, h'; z, z') V_{j+1}(a', h', z, z') & \text{for } j = 1, 2, \dots, T - 1, \\ \psi_T(z')(1 + n)^T \sum_{z'' \in \{H, L\}} \pi_{z'z''} V_1(a', 3, z', z'') & \text{for } j = T, \end{cases}$$

$\chi_j(h, h'; z, z')$ is the probability that a household of age j and type h becomes type h' the next period given that the father is of ability z and the children of ability z' .¹³ Note that a household of age T faces two shocks. One is the life-span shock that affects the youngest members of the household, the other is the ability shock that affects the new generation of the dynasty. The youngest members will survive with probability $\psi_T(z')$ and constitute $(1 + n)^T$ new households; by construction these are type 3 households. The ability of the new generation of the dynasty is denoted by z'' and is correlated with the ability z' of the father.

2.5. Equilibrium and the Computational Method

Stationary recursive competitive equilibrium: Given a fiscal policy $\{G, B, \tau_k, \tau_c, \tau\}$, a stationary recursive competitive equilibrium is a set of value functions $\{V_j(a, h, z, z')\}_{j=1}^T$, households' decision rules

¹³This transition probability matrix is a function of the age of the household and of the abilities of the father and the son, and is given by

$$[\chi_j(h, h'; z, z')]_{h, h' \in \{1, 2, 3\}} = \begin{bmatrix} \psi_j(z') & 0 & 0 \\ 0 & \psi_{j+T}(z) & 0 \\ \psi_j(z')(1 - \psi_{j+T}(z)) & (1 - \psi_j(z'))\psi_{j+T}(z) & \psi_j(z')\psi_{j+T}(z) \end{bmatrix}.$$

$\{c_{s,j}(a, h, z, z'), c_{f,j}(a, h, z, z'), l_{s,j}(a, h, z, z'), l_{f,j}(a, h, z, z'), a_j(a, h, z, z')\}_{j=1}^T$, time-invariant measures of households $\{X_j(a, h, z, z')\}_{j=1}^T$, relative prices of labor and capital $\{\omega, \tilde{r}\}$, a lump sum distribution of unintended bequests ξ , and a labor income tax τ_ℓ , such that the following conditions are satisfied:

1. given fiscal policy, factor prices and lump-sum transfers, households' decision rules solve households' decision problems (2.4);
2. factor prices are competitive;
3. aggregation holds,

$$\begin{aligned}\tilde{K} &= \sum_{j,a,h,z,z'} a_{j-1}(a, h, z, z') X_j(a, h, z, z') (1+n)^{1-j}, \\ \tilde{N} &= \sum_{j,a,h,z,z'} [\phi_s(h)(1-l_{s,j}(a, h, z, z'))\varepsilon_j(z') + \\ &\quad \phi_f(h)(1-l_{f,j}(a, h, z, z'))\varepsilon_{j+T}(z)] X_j(a, h, z, z') (1+n)^{1-j}, \\ C &= \sum_{j,a,h,z,z'} [\phi_s(h)c_{s,j}(a, h, z, z') + \phi_f(h)c_{f,j}(a, h, z, z')] X_j(a, h, z, z') (1+n)^{1-j};\end{aligned}$$

4. the set of age-dependent measures of households satisfies

$$X_{j+1}(a', h', z, z') = \sum_{\{a,h: a'=a_j(a,h,z,z')\}} X_j(a, h, z, z') \chi_j(h, h'; z, z'), \quad \text{for } j = 1, \dots, T-1; \quad (2.5)$$

the invariant distribution of age-1 households is given by conditions

$$X_1(a', 3, z', z'') = \pi_{z'z''} \sum_{\{a,h,z: a'=a_T(a,h,z,z')\}} X_T(a, h, z, z') \chi_T(h, 3; z, z''), \quad (2.6)$$

and

$$X_1(0, 1, z', z'') = \lambda(z') \pi_{z'z''} - \sum_{a'} X_1(a', 3, z', z''), \quad (2.7)$$

that is, new dynasties, holding zero assets, substitute for the family lines broken during the last period;

5. the lump-sum redistribution of unintended bequests satisfies

$$\begin{aligned}(1+n)\xi \sum_{j,a,h,z,z'} X_j(a, h, z, z') (1+n)^{1-j} = \\ (1+r) \sum_{j=1}^T a_j(a, h, z, z') X_j(a, h, z, z') \left[1 - \sum_{h'=1}^3 \chi_j(h, h'; z, z') \right] (1+n)^{1-j},\end{aligned}$$

6. the government's budget is balanced

$$G = \tau_k r \left[\tilde{K} - \frac{\xi}{1+r} \right] + \tau_\ell \omega \tilde{N} + \tau_c C;$$

7. the social security tax is such that the budget of the social security system is balanced

$$\sum_{j=R}^{2T} \sum_{z=H,L} B_j(z) \mu_j(z) = \tau \omega \tilde{N};$$

8. the goods market clears

$$C + (1+n)(1+\gamma)\tilde{K} - (1-\delta)\tilde{K} + G = \tilde{K}^\alpha \tilde{N}^{1-\alpha}.$$

Since the purpose of this paper is to examine policies designed to eliminate the pay-as-you-go social security program, as our benchmark we start at a steady state where the average social security replacement rate is set to 44%. We then solve for a final steady state where the social security replacement rate is set to 0%. The solution method involves discretization of the state space. In this process, the maximum level of assets is taken to be 19 times the after tax wage at the initial steady state with a total of 450 grid points.¹⁴ In order to solve for the transition path, we follow Auerbach and Kotlikoff (1987) and Huang, İmrohoroğlu and Sargent (1997) and assume that the transition from the initial to the final steady state takes S periods. The next step is to guess a path of capital, labor, accidental bequests and labor income tax $\{\tilde{K}_i, \tilde{N}_i, \xi_i, \tau_{l,i}\}_{i=2}^{S-1}$ where the values of those variables at periods 1 and S are the initial and the final steady state values respectively.¹⁵ This information allows us to compute prices of labor and capital, and depending on the elimination scheme, the pension payments during the transition and the social security tax that balances the social security budget during the first $2T$ periods of the transition. Then we solve the individuals' problem at any period i using the value functions of period $i+1$ starting with the value functions at period S and obtaining the value function of period i by backward induction in equation (2.4). Next, we obtain the distribution of households at any period i using the distribution at period $i-1$ and individual decision rules, and use this distribution to aggregate asset holdings. This information allows us to update our initial guesses for the transition path. This procedure is repeated until there is convergence between the guessed and the resulting paths of capital, labor, accidental bequests and labor income tax.

¹⁴The sensitivity of the results to the grid is checked carefully. The maximum level of assets is not binding at the steady state or during the transition. Details of the solution method are available upon request from the authors.

¹⁵Depending on the elimination scheme that we consider, the set of variables that needs to be guessed during the transition path changes.

3. Calibration of the Benchmark Economy

3.1. Demographics

We assume that individuals are born when they are 20 years old and live to be at most 90 years old. If they survive, they retire from the labor market at the age of 65. Also conditional on surviving, individuals' fertile lifetimes conclude when they are 35 years old. At this time they have m children. If individuals reach the age of 55, they form a household with their m children. For computational reasons, a model period is five years. These assumptions imply the following parameter values for the model: $T = 7$ and $R = 10$. When children reach the model age 1 (real time age 20), the father's age is the model age of 8 (real time age 55) and this household starts making joint decisions.¹⁶ When the son is 3 periods old (real time age 30), the father who is at the model age of 10 (real time age 65) retires.

Although the model period is five years, in what follows we express flow variables as rates per year. The population growth rate is constant and consistent with the average annual population growth rate of the U.S. economy, that is, 1.2%. This implies for the model that $n = 0.012$ and $m = 1.52$.

3.2. Preferences and Technology

The exogenous productivity growth rate is taken as $\gamma = 1.4\%$, which is the postwar annual average in the U.S. Following İmrohoroğlu, İmrohoroğlu and Joines (1999), the income share of capital, α , and the depreciation rate, δ , are set at 0.31 and 4.4%, respectively. The subjective discount factor, β , is chosen so that the economy at the initial steady state produces a capital-output ratio of 3.0. This procedure yields a β of 1.018.

The instantaneous utility function is assumed to be

$$u(c, l) = (c^{1-\rho}l^\rho)^{1-\sigma}/(1-\sigma).$$

We choose a value for the intensity of leisure in the utility function such that individuals work 33% of their discretionary time ($\rho = 0.63$). We assume $\sigma = 4$ which implies an elasticity of intertemporal substitution of consumption $1/(1 - (1 - \rho)(1 - \sigma)) = 0.474$ which is a value in the range of estimates (see Auerbach and Kotlikoff (1987)).

3.3. Labor Productivity Shock

The profiles of efficiency units of labor for high and low ability individuals, $\varepsilon_j(\cdot)$, are calibrated to the profiles of efficiency units of labor of college and non-college graduate males, respectively. We construct these indices using data on earnings from the Bureau of the Census (1991).

We choose the values for the transition probabilities so that our benchmark economy matches two observations. First, the proportion of full-time male workers that were college

¹⁶Note that the children are born when the father was 35 years old, but the joint decision making only starts after the children reach the age of 20 and start working.

graduates in 1991 was 28% (see Bureau of the Census (1991), pg. 145). Second, the correlation between the wages of parents and children is 0.4 according to the estimates by Zimmerman (1992) and Solon (1992). These observations imply for this model that $\pi_{HH} = 0.57$ and $\pi_{LL} = 0.83$.

Labor ability determines both the lifetime productivity of the individuals and the vector of conditional survival probabilities. We obtain these probabilities for college and non-college graduate males in the U.S. economy from Elo and Preston (1996) who document that lifetime expectancy at the real age of 20 is 5 years longer for a college graduate than for non-college graduate.

3.4. Social Security and Taxation

In the U.S. economy, retirement benefits depend on individuals' average lifetime earnings via a concave, piecewise linear function. The marginal replacement rate decreases with average lifetime earnings indexed to productivity growth. It is equal to 0.9 for earnings lower than 20% of the economy's average earnings. Above this limit and below 125% of the economy's average earnings the marginal replacement rate decreases to 0.33. For income within 125% and 246% of the economy's average earnings the marginal replacement rate is 0.15. Additional income above 246% of the economy's average earnings does not provide any additional pension payment. In order to capture the progressivity of social security, we use different benefit formulas for individuals with low and high labor abilities.

In the benchmark economy, linking an individual's pension to his lifetime earnings would imply that children's and father's labor histories are state variables in the household problem which is computationally very burdensome. Instead, we assume that an individual's pension is a function of the average earnings of his ability group. The formula that we use to compute the pension captures the differential in pension across the average college and non college worker observed in the US economy. Individuals without college education have average lifetime earnings between 20% and 125% of the economy's average earnings. The average lifetime earnings of individuals with college education is between 125% and 246% the economy's average earnings. Therefore, the pension payment for each ability group is calculated as follows:

$$\begin{aligned} B_{nc}(M_{nc}) &= 0.9 \cdot (0.2M) + 0.33 \cdot (M_{nc} - 0.2M), \\ B_c(M_c) &= 0.9 \cdot (0.2M) + 0.33 \cdot (1.25M - 0.2M) + 0.15 \cdot (M_c - 1.25M), \end{aligned}$$

where M_{nc} and M_c are the average lifetime earnings of a non-college and a college graduate individuals respectively, and M denotes the economy's average earnings. This benefit formula implies that the average replacement rate (replacement rate of an individual that earns the average earnings of the economy) is 44%. We compute properties of two steady states, one in which the average replacement rate is 44% and another where it is set equal to zero.

In the benchmark economy, we set the government purchases of goods and services (G) equal to 22.5% of output and keep them constant across steady states. We assume a consumption tax rate of 5.5% and the capital income tax rate is taken to be 35%. The labor income tax is set such that the government budget balances which implies a tax rate equal

to 0.185 at the benchmark economy. The following table summarizes all the parameters used in the initial steady state.

Table 1: List of Parameters

Population		
$2T$	=	14 Maximum lifetime (90 years)
R	=	10 Retirement age (65 years)
n	=	0.012 Annual population growth rate
Utility		
σ	=	4 Coefficient of relative risk aversion.
ρ	=	0.63 Intensity of leisure in utility
β	=	1.018 Annual discount factor.
Production		
γ	=	0.014 Annual rate of growth of technology
α	=	0.31 Capital share of GNP.
δ	=	0.044 Annual depreciation rate.
$\lambda(H)$	=	0.28 Measure of individuals with high ability.
$\pi_{LL} = .83$	$\pi_{HH} = .57$	Transition probability matrix of abilities.
Fiscal Policy		
τ_k	=	0.35 Capital income tax rate
τ_c	=	0.055 Consumption tax rate
G	=	0.65 Government purchases

4. Results

We start this section by discussing the properties of the steady-state with a U.S. like social security system and compare them with the steady state properties of an economy where the social security program is eliminated. Next, we incorporate the equilibrium transition across steady-states and examine the elimination of the social security system. All the reforms we consider start from a steady state where the social security replacement rate is set equal to 44%, and end at a steady state with a 0% replacement rate.

4.1. Steady-State Results

Table 2 describes the properties of two steady states for this environment. In the initial steady state the economy has a unfunded social security system with a replacement rate $\theta = 0.44$. At the ending steady state, the social security system is completely eliminated by setting the replacement rate to 0%.

While we have not tried to match the U.S. wealth distribution, this model generates a significant amount of wealth inequality with a wealth Gini of 0.66 at the initial steady state. The corresponding number for U.S. is 0.78 (see, for instance, Castañeda, Díaz-Giménez

and Ríos-Rull (2003)).¹⁷ In this framework wealth becomes more concentrated with social security due to the increase in saving for bequests which is especially strong for the rich households. Consequently, eliminating social security decreases wealth inequality resulting in a Gini coefficient of 0.55.¹⁸

Table 2: Long Run Aggregate Effects of Social Security

θ	τ	τ_l	K	N	Y	K/Y	$r(1 - \tau_k)$	C	C/Y
0.44	0.093	0.185	100.0	100.0	100.0	3.0	3.8	100.0	57.15
0	0	0.158	112.5	107.7	109.1	3.1	3.6	111.5	58.41

A comparison of the two steady states reveals that the economy with a zero percent replacement rate generates 12.5% more capital, 7.7% more labor, 11% more consumption and 9.1% more output than an economy with a 44% replacement rate (average working hours increase from 33% to 36% of discretionary time due to the elimination of social security). Notice that taxation of labor income is considerably reduced when social security is eliminated since the sum of the labor income tax plus the social security tax rates decreases from 0.28 to 0.16. In this experiment where government revenues are held constant, G/Y decreases from 22.5% at the initial steady state to 20.6% at the new steady state. More importantly, consumption to output ratio in this economy increases from 57.15% to 58.41%.¹⁹

As discussed before, households in this model differ in terms of their demographic composition and labor ability. Because of lifetime uncertainty households can be classified into three categories according to their demographic composition. A household in which only the children are alive is denoted as type 1. When the father is the only member alive, the household is labelled as type 2. Households where both the father and the children are alive are denoted as type 3. A very small fraction of the population is of type 2 and none of the newborns can be of this type (children live at least one period). At a given point in time, 29% of households are type 1, 2% of households are type 2, and 69% of households are type 3.²⁰ Since individuals can be of high or low labor ability, type 3 households can be subdivided into four categories according to the abilities of the father and his children. We thus denote by HH a type 3 household where both the father and children are of high human capital. The remaining type 3 households are denoted as HL, LL, and LH, where the first letter indicates the ability of the father and the second the ability of the children.

¹⁷While the model is successful in replicating the lower tail of the wealth distribution, it does not match the upper tail as it happens in most of the dynastic and life-cycle models. In order to match the U.S. wealth distribution Krusell and Smith (1998) and Erosa and Koreshkova (2003) introduce stochastic discount factors while Castañeda, Díaz-Giménez and Ríos-Rull (2003) calibrate their model to the Lorenz curves of U.S. earnings and wealth.

¹⁸Fuster (1999) also finds this result. De Nardi (2003) and Laitner (2001) argue that intentional intergenerational transfers may explain the skewness of the empirical wealth distribution.

¹⁹In the sensitivity analysis we will argue that there are significant welfare gains associated with the decrease in the labor income tax burden due to the elimination of social security.

²⁰There are three different measures for each type: percent of newborn households of a particular type; percent of (all ages) households of a particular type; and percent of individuals belonging to households of a particular type.

Table 3: Welfare of Newborns

		Type 3				Type 1	
θ	τ	HH	HL	LH	LL	H	L
0.44	0.093	-137.58	-159.74	-162.93	-202.84	-150.07	-199.11
0	0	-134.62	-157.8	-154.82	-194.69	-137.79	-180.59
Measure of types		0.147	0.11	0.107	0.53	0.026	0.08

Table 3 provides information on new-born household preferences over the two social security replacement rates.²¹ All households would prefer to be born in an economy without social security. In this economy the efficiency gains due to the elimination of social security are large enough to generate welfare gains for all the human capital types in the economy. In particular, the welfare gains from the decrease of labor supply distortions (due to the elimination of the payroll tax for social security and the reduction in the personal income tax) and the increase in the aggregate capital stock more than compensate the welfare losses from losing the insurance roles provided by social security against life-span and earnings risks. Later, as part of a sensitivity analysis, we show that the increase in labor supply due to the elimination of social security is crucial for understanding the overall welfare gains. Indeed, if labor were inelastically supplied, households HH and HL would prefer to be born in an economy with social security.²² When labor supply is elastic, the benefits of eliminating social security are substantially higher for several reasons: 1) the elimination of the social security tax reduces labor distortions; 2) the increase in labor supply due to the elimination of the social security increases individual's earnings inducing a further increase in capital in the long run; 3) the resulting increase in output increases government's revenues, allowing a further but small reduction in the personal income tax.

Previous social security analyses conducted in life-cycle frameworks also find that individuals would prefer to be born into an economy without social security. In that framework, the changes in labor supply due to the elimination of the social security tax do not play as important a role on the welfare effects as in our model. Indeed, in a life-cycle model, the long-run benefit of eliminating social security comes from a huge increase in the capital stock. For example, Auerbach and Kotlikoff (1987) find that a social security system with a 60% replacement rate reduces the steady state capital stock by 24%. İmrohorođlu, İmrohorođlu and Joines (1999) report that capital stock decreases by 26% with a 40% social security replacement rate. Storesletten, Telmer and Yaron (1999) report changes in the capital stock ranging between 10% to 25%. Moreover, the change in the capital stock in those models is driven from an increase in the saving rate of the economy. Social security affects the saving rate because it redistributes income from individuals with high marginal propensities to save (young) to individuals with low marginal propensities to save (old). In our framework, however, old individuals do not necessarily have a low marginal propensity to save since

²¹The column entitled Type 1 in Table 3 presents the measure of newborn households of each type. Given the steady state comparisons of welfare, this is the appropriate measure to consider.

²²These results are similar to Fuster, İmrohorođlu and İmrohorođlu (2003) who examine the steady-state welfare effects of social security in an altruistic framework with inelastic labor supply and find that most households like to be born into an economy with some social security. Welfare consequences of reform, however, are not analyzed in that paper.

they also save for a bequest motive and the aggregate saving rate does not increase with the elimination of social security (see the K/Y in Table 2). Thus, our findings are driven more by the welfare gains due to the decrease in labor supply distortions.

4.2. Transitions

The steady state results presented above confirm the earlier findings in the literature that agents would prefer to be born into an economy without social security. In this section we investigate the behavior of the economy and welfare of the individuals along several transition paths that lead to elimination of the pay-as-you-go social security system. We consider several elimination schemes and compute the compensating variation in consumption that would make each household indifferent between the initial steady-state with social security and the elimination of the unfunded social security system. The welfare effects of the elimination scheme depend on the fiscal policies that are considered during the transition to the new steady state. We start with an uncompensated elimination scheme where individuals who had paid into the system are not compensated at all. While this may be an unlikely scheme for the elimination of the unfunded social security system, it provides a useful benchmark because of the ease with which one can define the losses and the gains. We examine the behavior of consumption, leisure, and inter vivos transfers in detail for this case. Later, we present several other elimination schemes where individuals who had paid into the social security system are fully compensated, and the compensation paid for by various tax and debt schemes.

Plan 1: Uncompensated elimination This plan considers a fully uncompensated elimination scheme where the government sets the payroll tax and the benefits to zero from the initial period. Thus, in this case individuals who had paid into the system are not compensated for their contributions. During the transition, the total revenues of the government are fixed. Figure 1 shows the evolution of capital stock and employment during the transition. Most of the convergence to the new steady state is completed in 70 years with this plan.

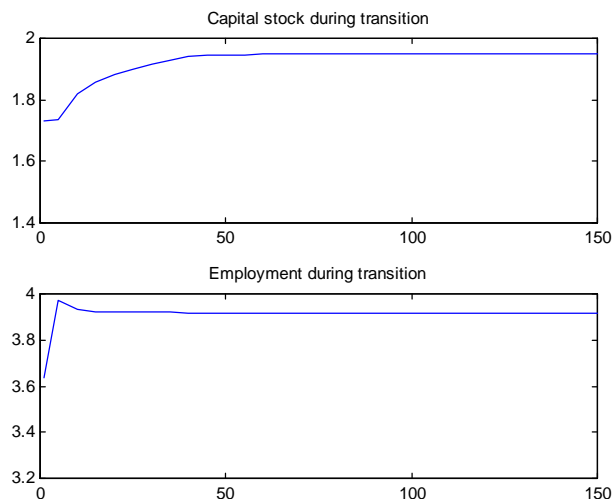


Figure 1: Uncompensated Elimination

Since employment increases immediately, the capital-labor ratio decreases first and then increases towards its higher long-run level. The evolution of the after tax interest rate, displayed in Figure 2, is just the inverse to the evolution of the capital-labor ratio. The after tax wage rate increases monotonically because both the social security tax and the labor income tax decrease during the transition.

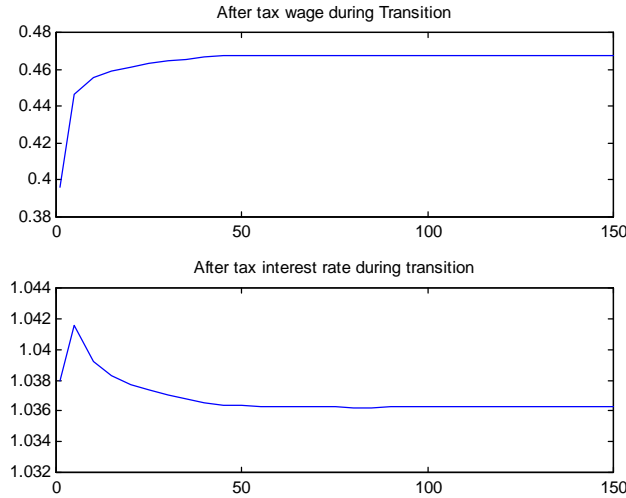


Figure 2: Uncompensated Elimination

Figures 3 and 4 display the compensating variation in consumption needed to equate the expected discounted utility of a household in the benchmark steady-state and along the transition to the no social security steady-state. If this value is greater than unity for a household of a given age, then that household prefers to move along the transition to the steady state with no social security program and the difference between this number and unity is the consumption loss due to social security. The horizontal axis represents the age of the son, which corresponds to the age of the household. At the time of the reform, households of ages 20 to 50 are alive and they either have fathers aged 55 to 85 (type 3 and 2), or their fathers may have died sometime during their lifetime (type 1).²³

The first panel in figure 3 displays the welfare of type 1 households. None of the households of this type are against this plan. These are young households whose father had died, thus they do not have fathers whose welfare they need to consider. As they get closer to the retirement age (which takes place at age 65) their support for the reform gets diminished because they lose more social security claims while they enjoy the higher wage for a shorter period of time. However, for the ages this household is defined there is overall support for the elimination of social security.

²³For type 2, the horizontal axis represent the age of the father since this is a household whose son may have died anytime in the life span of the father.

Among individuals belonging to type 1 households, those with low ability are the ones that benefit the most from elimination of social security (LL and HL) even though the social security benefit formula is progressive. There are two reasons why low ability individuals benefit from the elimination more than high ability ones. First, low ability individuals have a shorter life expectancy and, thus, they care less about the annuity insurance provided by social security than high ability ones. Second, low ability individuals are more likely to be borrowing constrained, and the elimination of the social security payroll tax relaxes these constraints.²⁴

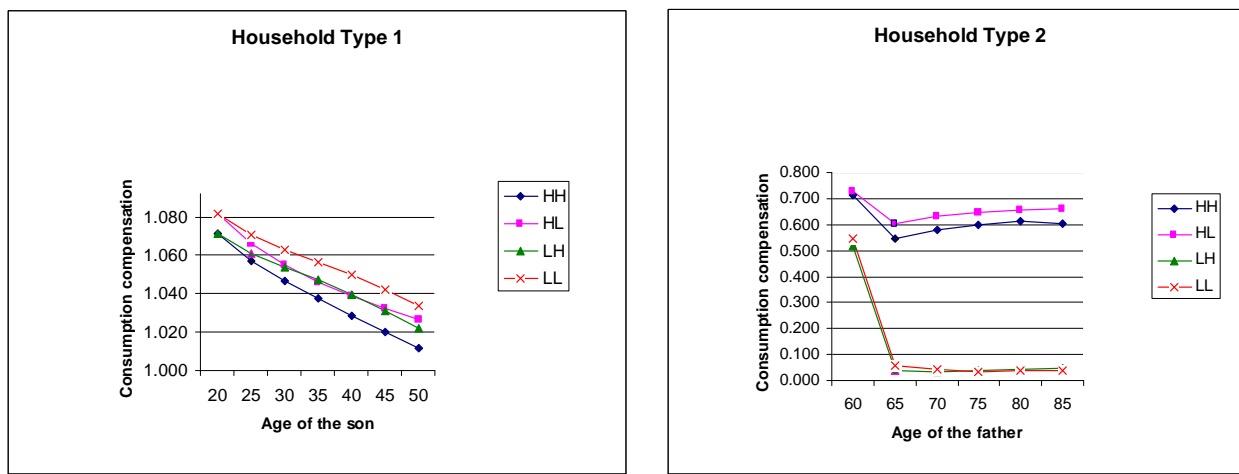


Figure 3: Welfare Effects of Uncompensated Elimination

The second panel in Figure 3 displays the welfare of type 2 households where the son had died sometime during the lifetime of the father. Thus for this type, the horizontal axis represents the age of the father. These individuals are hurt the most by the sudden elimination scheme since they are all either retired or very close to retirement age and have no sons whose welfare they might care about. In fact, the welfare losses for these individuals are extremely high. All of these households, who make up 2% of the population, are against this reform.²⁵ Among individuals belonging to type 2, the ones that lose the least with the elimination of social security are those with high ability (HH and HL). These households are wealthier and thus rely less on pension income for their consumption than individuals with low ability.

Type 3 households, who constitute the majority of households, have different preferences about this elimination depending on their age and the abilities of their members, as can be

²⁴In our framework, 23% of the individuals are borrowing constrained (have zero assets) at the initial steady state. Jappelli, Pischke and Souleles (1998) discuss the difficulty in identifying the liquidity constrained households in the data. They consider several measures of liquidity constraints and report that, 14.4% of the households "have been turned down for a loan", 23.6% of households have "no credit card or a line of credit", and 65% of households "have low assets" in the Survey of Consumer Finances.

²⁵Later, when we introduce elimination schemes that at least partially compensate the losses of these individuals, we observe a big decline in their welfare losses.

seen from Figure 4. In general, the welfare gains display a non-monotonic path since welfare gains are decreasing with the age of the household from ages 20 to 30 and then increasing with the age of the household from ages 30 to 50. The household that loses the most is the age-30 household because the father is about to retire. Such father (age 65) has contributed to the system until his retirement and loses all the benefits. Younger households lose less than the age-30 household because their members have contributed less to the system. Older households lose less than the age 30-household because the father has received some benefits already.

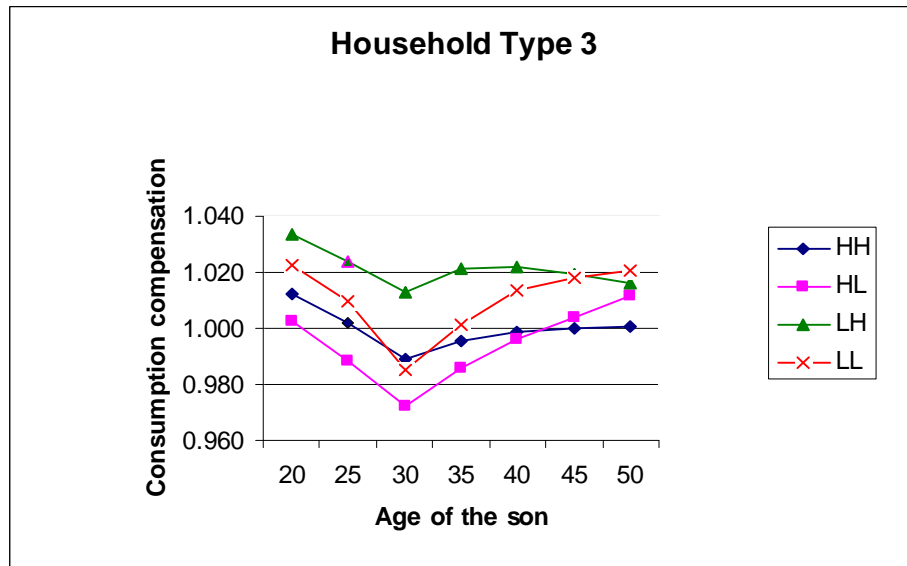


Figure 4: Welfare Effects of Uncompensated Elimination

In addition to differences in welfare due to age, there are also significant differences among different ability types. For example, a household of ability LH is in favor of the elimination regardless of its age. This household gets a low return of social security because it pays high taxes due to the fact that the son has high ability and receives relatively low pension since the father has low ability. On the contrary, the household HL pays low taxes and receives relatively high pension which explains why it is the one that benefit the least from the elimination of social security. In general, households where the father is low ability benefit more from the elimination than households where the father has high ability. Although households with low ability father are poorer and, thus, rely more on pensions to finance their retirement, they are in favor of the elimination because they receive family transfers as we will see in the next section. Moreover, they have a shorter life expectancy and care less about the annuity insurance provided by social security than households with high ability fathers.

We have also examined how household's wealth affect the consumption compensation associated with the elimination of social security. As displayed in Figure 2, interest rate decreases and the wage rate increases significantly during this transition. This particular change in factor prices benefits households whose main income comes from labor and hurts

the asset rich households. At the same time, since the asset rich households are in a better position to buffer the sudden elimination of social security, they may require less of a compensation for the reform. These opposing effects give rise to a rich set of results in examining the relationship between wealth and changes in welfare due to reform. Our findings indicate that, in general the required consumption compensation decreases with wealth, that is, a wealthier household is less likely to agree to the reform. For example, HH households of age 25 and older, who are in the 60th or higher wealth decile actually are against the elimination of social security. For LL individuals, on the other hand, their willingness to go through reform increases as they get wealthier.

Overall, 26.5% of individuals in this economy are against this elimination scheme while 73.5% are for the scheme. Households who are against the elimination of the social security system for this case are of abilities HL and ages 25-40, HH of ages 30-40, and LL of age 30. Welfare losses for these individuals are in the range of 3% or less. Conesa and Krueger (1999) who study a life-cycle model with an uncompensated elimination scheme report that the support for such a reform, in their model ranges between 40% to 21%. In one of their cases all the agents of age 37 or younger vote for the elimination, and everybody older votes against it. Welfare losses for the older generation range between 20% to 60% (in equivalent consumption). In Kotlikoff (1996), an uncompensated elimination scheme causes the oldest members of the economy to suffer a reduction in welfare that is equivalent to a 26% decrease in life time consumption and leisure. Our results indicate that in this framework with two sided altruism the results of uncompensated elimination look significantly different for a majority of households compared to a life-cycle model. There is more support for this elimination scheme and except for type 2 households, who constitute a very small fraction of the population, the welfare losses are much smaller in this model than in a life-cycle framework. In the following section we examine the role of inter vivos transfers in allowing families to share the burden of the transition through changes in transfers between the father and the son.

Additional Properties In this section we analyze some of the properties of the economy under this plan in order to gain more insight into the preferences of different households towards the elimination of social security. In particular, we examine the inter vivos transfers and consumption profiles of different households to assess their attitudes towards eliminating social security.²⁶ Figure 5 displays net inter vivos transfers as a fraction of income per effective labor at the initial steady state between the father and the son for a household of type 3, whose son is born at the time of the reform. In the following panels, positive numbers indicate a transfer from the father to the son and negative numbers indicate transfers from the son to the father. The dashed line in each panel indicates the net transfers at the steady state with social security and the solid line indicates the transfers during the transition. For some of these households there is not a significant difference between the transfers in the steady state versus during the transition. For example, in the HL household, where the father has a higher income than the son, there are only transfers from the father to the son.

²⁶Description of the computation of inter vivos transfers, which are transfers made between the father and the son while they are all alive, can be found in Fuster, İmrohoroğlu and İmrohoroğlu (2003).

We observe a small decrease in these transfers when social security is eliminated. For the HH household most of the intervivos transfers are also from the father to the son. Even though they both have the same ability level, when the son is born the father attains a high income due to the age-efficiency profile and is in a better position to support his son. If we examine the intervivos transfers for the LH household, one in which the father has low ability and the son has high ability, we observe that the steady state with social security implies transfers from the son to the father after the son is 25 years old (father is 60 years old). When social security is eliminated the transfers from the son to the father increase, perhaps compensating some of the loss the father experiences. A similar pattern is detectable for the LL household. Notice that among all these households LH and LL households are in a better position to support their fathers. In fact, these are the households who support the elimination of the social security system in Figure 4. In particular, LH households of all ages benefit the most from the transition to the new system. In this household, the son enjoys the elimination of the social security tax, increase in the wage rate and is able compensate his father who suffers due to the abrupt elimination of social security benefits.

Using data from The Survey of Consumer Finances for 1983-85, Gale and Scholz (1994) find that in the U.S. about 75% of transfers involve parents giving to children. In our model with social security we find that 89% of intervivos transfers are from fathers to sons. Our results also indicate that intervivos transfers can play an important role in case of a change in policy. In the final steady state of this experiment, when social security is eliminated, transfers to sons decrease to 66.6% of total transfers.

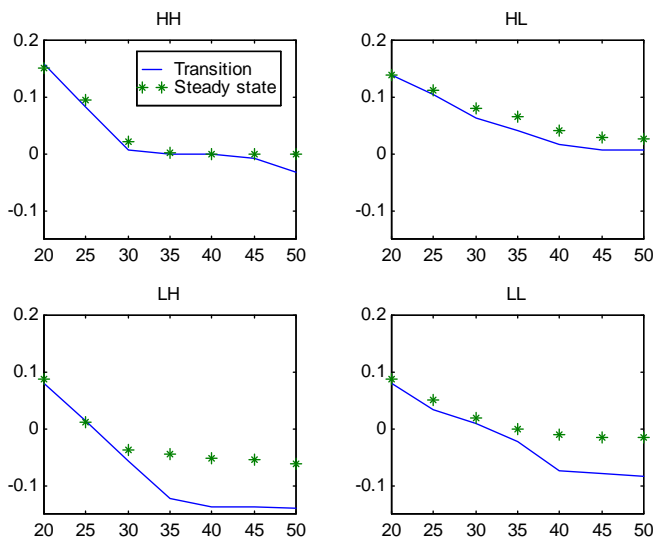


Figure 5: Intervivos transfers.

In the following graph we display the consumption profiles for the son, born at the time of the reform, of a type 3 household to further examine what takes place during the transition. Notice that the consumption profiles of all the households are higher during the transition compared to the steady state. These are the young members of the household who now are

working for a higher wage rate. Indeed, the leisure profiles of these individuals reveal the fact that they all work more hours during the transition.

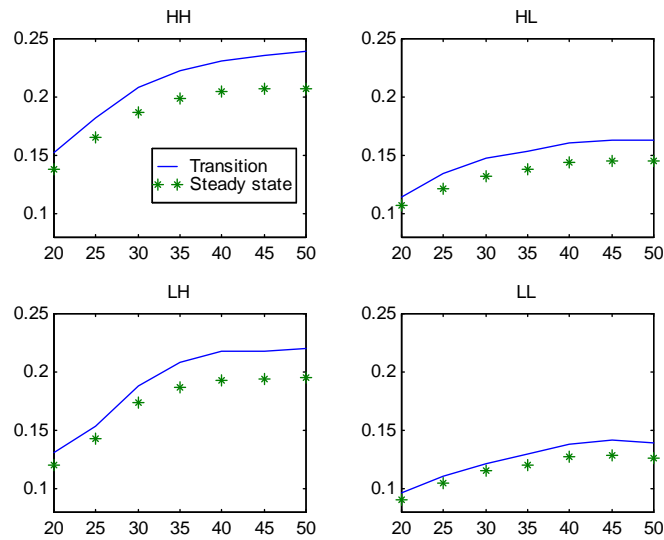


Figure 6: Consumption of Son

Next figure displays the consumption profile of the father in the same type 3 household who is age 55 at the time of the reform. The profiles in this figure confirm the conjecture that the inter vivos transfers allow for the fathers to maintain their consumption levels during the transition.

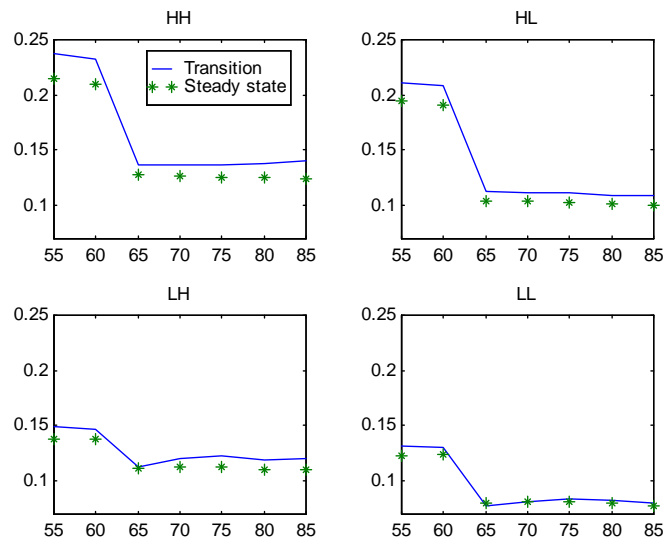


Figure 7: Consumption of Father

Plan 2: Full Compensation-Tax Finance In this scheme individuals who had paid into the social security system are fully compensated. The government announces that individuals, from the reform date onwards, will not accumulate any more social security claims, and that retired individuals and others who have paid into the system will receive a pension corresponding to the social security claims that they accumulated in the past. These pensions will be financed by a payroll tax. The payroll tax rate decreases from 9.3% to 0% gradually in 65 years.

Capital and employment converge to their long-run level more slowly than in Plan 1. This is because there are pensions during 65 years while in Plan 1 pensions are eliminated the first period of the reform. The capital stock and employment increase slowly towards its long run level (see Figure 8).²⁷

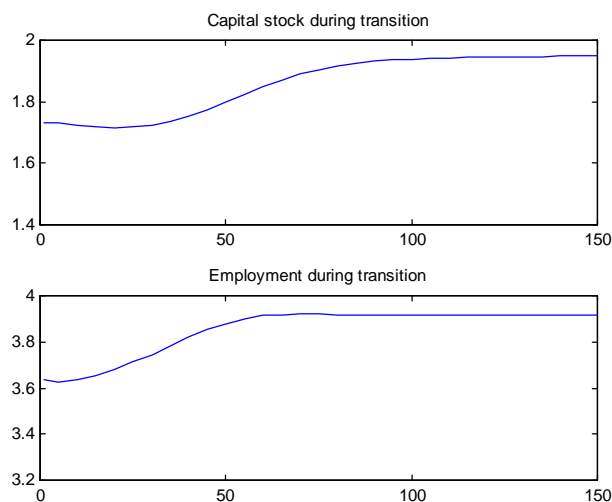


Figure 8: Compensated Elimination

The capital-labor ratio decreases during 45 years and then increases towards its higher long-run level. The decrease of the capital labor ratio is due to the fact that employment increases before the capital stock increases. Figure 9 shows the evolution of the after tax prices during this transition.

²⁷The first value represented in these figures corresponds to the value at the initial steady state.

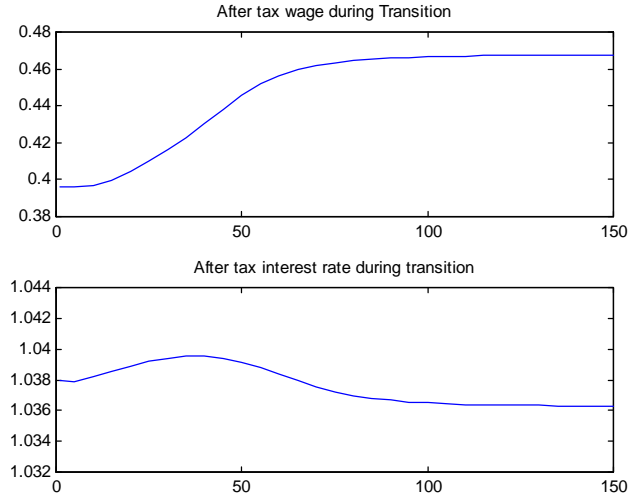


Figure 9: Compensated Elimination

Figure 10 shows the evolution of output and the labor income tax during the transition. As mentioned before the labor income tax goes down in this framework. Since we are keeping government revenues constant, as output increases a lower labor income tax rate is sufficient to pay for the given level of government purchases. This additional efficiency gain that is taking place due to the privatization of social security plays an important role in our results.

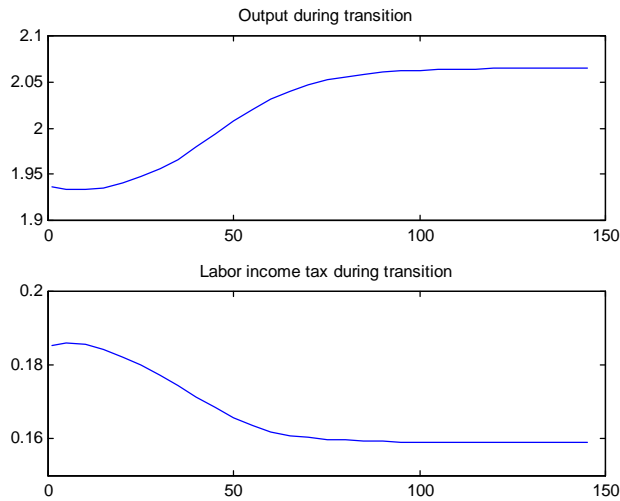


Figure 10: Compensated elimination.

An interesting outcome of this transition is its effect on the inter vivos transfers. Figure 11 displays these transfers for type 3 households. In the uncompensated elimination scheme that was explained previously we had observed significant changes in the pattern of inter vivos transfers during the transition. Since in this elimination scheme the fathers are fully

compensated by the government, there is no need for the sons to compensate their fathers. Consequently, the pattern of inter vivos transfers between the steady state and the transitions are now very similar.

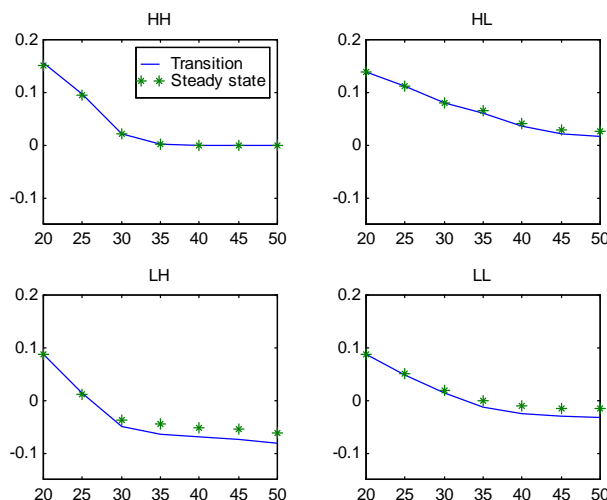


Figure 11: Intervivos Transfers

In this social security reform, all type 3 households benefit from the elimination of social security with the exception of the household with a son of age 20 and high abilities of its members (HH). This is a household where the father is not retired yet and is not able to accumulate social security claims for the last 10 years of his career which provide the highest return. In general, the welfare gains of this elimination scheme are higher if the son has low ability than otherwise (that is, LL and HL benefit more than LH and HH do). The households where the son has low ability are more likely to be borrowing constrained in our model because they would like to borrow against the expected higher earnings of the future generations of the dynasty. Therefore, these households benefit more from the decrease of the payroll tax that takes place during the transition. Overall, our results indicate that there is a large support for this elimination plan since only 4.4% of individuals are against it.²⁸ Moreover, the welfare changes for different household types are in the range of -0.12 to 1.5 percent of consumption at the benchmark steady state. In absolute value these welfare changes are much smaller than the ones implied by the uncompensated elimination (see Figures 3 and 4).

Plan 3: Full Compensation-Debt Finance. Similar to plan 2, in this scheme individuals who had paid into the social security system are fully compensated. The government

²⁸In order to measure the sensitivity of the welfare effects to the change in the labor income tax rate, we performed an experiment where the labor income tax is fixed to the level at the initial steady state and government's surplus generated along the transition is given back to individuals in a lump sum fashion. Our findings for welfare taking into account the transitions in this case are quite similar to the results reported so far since only 9% of individuals oppose the elimination of social security when the government uses a lump-sum transfer to redistribute the excess revenue along the transition.

announces that individuals, from the reform date onwards, will not accumulate any more social security claims, and that retired individuals and others who have paid into the system will receive a pension corresponding to the social security claims that they accumulated in the past. These pensions will be financed by taxing labor earnings and by new government debt. We choose the period in which debt will be eliminated to be 50 years. We let the tax rate to decline from 9.28% to 6.8% for the first 50 years of the reform. During the first 25 years of the reform the tax rate is lower in plan 3 than in plan 2. In this sense, we are shifting the tax burden to the future generations born after year 25 of the transition. After 50 years into the transition, since there are pension payments to be made for 15 more years, we use an additional earnings tax to finance them.²⁹

Similar to the previous elimination schemes, the capital stock and employment increase during the transition. This increase is more pronounced after year 65 of the reform when debt and taxes are zero. During the transition the maximum debt to capital ratio is close to 5%. The transition takes longer when government debt is used than otherwise because debt generates a crowding out effect on the capital stock.

Our results indicate that only 1.65% of individuals are against this reform. There is near-unanimous support for this plan because debt transfers the tax burden to the future. The individuals that lose with this elimination scheme are older than 60 years and do not have children (they belong to Type 2 households). The distributional impact of the reform is very similar to the one observed in plan 2. It is worth noting that the welfare gains are higher for all household types when debt is used to finance past social security claims than otherwise.

5. Sensitivity Analysis

In this section we further investigate the major factors behind our results. We have identified two features of the model that are important in the results reported so far. First, in this framework with altruism, changes in labor supply play an important role in generating welfare gains during the elimination of social security. To investigate this further we examine changes in welfare in an environment with inelastic labor. This experiment requires re-calibrating the steady state. The benchmark economy is the steady state with social security. The parameter values in this calibration coincide with the ones presented in table 1 with the exception of the preference parameters $\rho = 0.00000001$, $\sigma = 2$ and $\beta = 0.99$. The parameter ρ represents the intensity of leisure in the utility function. The values of ρ and σ imply an elasticity of intertemporal substitution equal to 0.5. The value of β is chosen so that the capital output ratio is equal to 3. Government expenditure is equal to 1.77 which implies a government expenditure to output ratio equal to 0.224.

The following table illustrates the long-run effects of social security in the model with inelastic labor.

²⁹ An alternative would have been to use an extra consumption tax.

Table 4: Aggregate Effects of Social Security (Inelastic Labor)

θ	τ	τ_l	K	N	Y	K/Y	$r(1 - \tau_k)$	C	C/Y
0.44	0.094	0.182	100.0	100.0	100.0	2.95	3.9	100.0	57.63
0	0	0.178	106.5	100.0	101.9	3.08	3.65	101.16	57.17

Table 4 shows that the crowding out effect of social security is only 6.5% when labor is inelastically supplied. Output increases only 1.9% and there is essentially no decrease in the labor income tax rate that is required for keeping revenues constant. Consumption to output ratio in this economy goes down slightly. Table 5 reports the steady-state welfare effects of social security in this model. Notice that, in this case, Type 3 households with high ability fathers prefer to be born in an economy with social security since the long run gains associated with the elimination of social security are now smaller. Given the small gains in consumption to output ratio at the new steady state and the fact that some households would like to be born into economies with social security, it is likely that we may not find much support for the elimination of social security once transitional costs are included.

Table 5: Welfare of Newborns (Inelastic Labor)

		Type 3				Type 1	
θ	τ	HH	HL	LH	LL	H	L
0.44	0.094	-64.15	-73.66	-73.07	-87.59	-63.79	-79.71
0	0	-65.03	-75.4	-72.06	-87.23	-61.00	-75.64
Measure of types		0.147	0.11	0.107	0.53	0.026	0.08

We compute the transition path towards the elimination of social security for plan 2 (full compensation of past social security claims) described for the model with elastic labor. We find that when labor is inelastically supplied 99.8% of individuals are against this elimination scheme. This exercise indicates that efficiency gains realized through changes in labor supply play a very important role in creating support for the elimination of the social security system.

Next, we demonstrate that the revenue neutral experiment, that is common to the public finance literature, that has been implemented in the benchmark has important consequences for our results. There had been a reduction in the labor tax burden that individuals faced in the experiments conducted so far. In order to check the importance of this feature, we compute the transition towards the elimination of social security assuming that the labor income tax is constant and that the excess revenue of the government is used to increase government purchases of goods and services. The ratio G/Y remains constant around 22.5%. As can be seen from Table 6, labor supply increases by 7.5% and output increase by 8.9% in this case. However, the new steady state implies a decrease in the consumption output ratio. That is, the gains in output that are observed due to the increase in capital and labor are used up as higher government purchases that provide no utility to households.

Table 6: Aggregate Effects of Social Security (Increase G)

θ	τ	τ_l	K	N	Y	K/Y	$r(1 - \tau_k)$	C	C/Y
0.44	0.093	0.185	100.0	100.0	100.0	3.0	3.8	100.0	57.15
0	0	0.185	111.9	107.5	108.9	3.08	3.64	108.05	56.72

Table 7 shows the welfare at the two steady states for the different household types. In this case, the HH and HL households would again prefer to be born into an economy with social security.

Table 7: Welfare of Newborns (Increase G)

θ	τ	Type 3				Type 1	
		HH	HL	LH	LL	H	L
0.44	0.093	-137.58	-159.74	-162.93	-202.84	-150.07	-199.11
0	0	-139.04	-162.9	-160.07	-201.2	-142.75	-187.19
Measure of types		0.147	0.11	0.107	0.53	0.026	0.08

Given that the long-run welfare gains are smaller in this case, it is likely that there will be less support for the elimination of social security. Indeed, similar to the findings in the inelastic labor case, 98.4% of individuals in this environment are against the reform. The welfare changes for different household types are in the range of -1.7 to 0.16 percent of consumption at the benchmark steady state.

We conclude that whether or not government revenues are kept constant have important implications for the support of the elimination of social security. This result indicates the importance of modeling the other aspects of the government budget constraint while examining the effects of eliminating social security. The efficiency gains associated with the reduction of income taxes is implicit in Kotlikoff (1996) and is not modelled in Conesa and Krueger (1999) who abstract from income taxes.

6. Conclusions

In this paper we study the welfare effects of eliminating social security in a dynastic framework where social security provides insurance against lifespan and individual income uncertainties. Retirement benefits are financed with a payroll tax that distorts labor supply decisions and may also hurt borrowing constrained individuals. Social security also affects saving for retirement and for bequests since our framework nests the life-cycle and altruistic models.

We evaluate alternative schemes for eliminating the U.S. social security system that differ in the compensation of past social security claims and on the fiscal policy used to finance such compensation. We find that the majority of individuals in our economy are better off with the elimination of social security in all the transitional schemes considered. Eliminating social security leads to large efficiency gains because of the elimination of the payroll tax. In our economy, the reduction of payroll taxes leads to an increase in the labor supply and,

through the expansion of economic activity, to a further reduction of personal income taxes. Our findings indicate that households are able to shift the efficiency gains, generated through privatization of social security, across parents and children quite successfully. Contrary to a pure life-cycle setup, our framework yields significant support for even an uncompensated elimination of unfunded social security.

In our framework, most individuals are in favor of the elimination of social security because they enjoy a reduction in labor income taxes in addition to the elimination of the payroll tax. The political feasibility of eliminating social security depends crucially on whether the government can credibly commit to keep its purchases constant and reduce income taxes as the economy expands. As a result, our findings should not be interpreted as implying that the U.S. social security will likely be eliminated. Instead, our results indicate that in order to generate support for the elimination of social security the efficiency gains that are obtained through increases in labor supply need to be rebated back to the households in the form of a reduction in the tax burden that they face in an environment with family insurance.

Most analyses about the elimination of social security have been conducted in a pure life-cycle framework. A contribution of our paper is to show that abstracting from altruistic preferences has important implications for the findings of such analyses. It would be interesting to study the sensitivity of our results to the degree of altruism of individuals, that is, the discount rate of the utility of descendants and predecessors.³⁰ Our model does not allow to conduct such sensitivity analysis because it assumes that individuals do not discount the utility of their relatives. Such assumption implies that parents and children have the same objective function during the periods when their lifetime overlaps and, therefore, they pool their resources and jointly solve a maximization problem. Relaxing this assumption would imply that parents and children behave strategically. Modeling this behavior is not a trivial task and we leave it for future work.

References

- [1] Atkinson, A.B. and Stiglitz, J. E. (1980). Lectures on Public Economics, McGraw-Hill, New York, N. Y.
- [2] Auerbach, A. J. and Kotlikoff, L. J. (1987). *Dynamic Fiscal Policy*, Cambridge University Press, New York, N. Y.
- [3] Barro, R. J. (1974). Are Government Bonds Net Wealth?, *Journal of Political Economy* 82 , 1095-1117.
- [4] Bureau of the Census. (1991). Money Income of Households, Families, and Persons in the United States.
- [5] Conesa, J. C. and Krueger, D. (1999). Social Security Reform with Heterogeneous Agents, *Review of Economic Dynamics* 2, number 4, 757-795.

³⁰By increasing such discount rate the model will get closer to a pure life cycle framework.

- [6] Castañeda, A., Díaz-Giménez, J. and Ríos-Rull, V. (2003). Accounting for the U.S. Earnings and Wealth Inequality, *Journal of Political Economy* 111(4), 818-857.
- [7] Coronado, J. L., Fullerton, D. and Glass, T. (2000). The Progressivity of Social Security, NBER Working Paper 7520.
- [8] De Nardi, M. (2003). Wealth Inequality and Intergenerational Links, *Review of Economic Studies*, forthcoming.
- [9] De Nardi, M., İmrohoroğlu, S. and Sargent, T. J. (1999). Projected U.S. Demographics and Social Security, *Review of Economic Dynamics* 2, number 3, 638-665.
- [10] Ehrlich, I. and Kim, J. (2003). Social Security, Demographic Trends, and Economic Growth: Theory and Evidence from the International Experience, mimeo, State University of New York at Buffalo.
- [11] Elo I. and Preston, S. (1996). Educational Differences in Mortality: United States, 1979-1985. *Social Science and Medicine* 42: 47-57.
- [12] Erosa, A. and Koreshkova, T. (2003). Progressive Taxation in a Dynastic Model of Human Capital, mimeo, University of Toronto.
- [13] Fuster, L. (1999). Is Altruism Important for Understanding the Long-Run Effects of Social Security?, *Review of Economic Dynamics* 2, number 3, 616-637.
- [14] Fuster, L., İmrohoroğlu, A and İmrohoroğlu, S. (2003). A Welfare Analysis of Social Security in a Dynastic Framework, *International Economic Review*, 44, number 4, 1247-1274.
- [15] Gale, W. G. and Scholz, J. K. (1994). Intergenerational Transfers and The Accumulation of Wealth, *Journal of Economic Perspectives* 8, number 4, 145-61.
- [16] Huang, H., İmrohoroğlu, S. and Sargent, T. J. (1997). Two Computations to Fund Social Security, *Macroeconomic Dynamics* 1 (1), 7-44.
- [17] İmrohoroğlu, A., İmrohoroğlu, S. and Joines, D. (1999). Social Security in an Overlapping Generations Economy with Land, *Review of Economic Dynamics* 2, number 3, 638-665.
- [18] Jappelli, T., Pischke, J. S. and Souleles, N. (1998). Testing for Liquidity Constraints in Euler Equations with Complementary Data Sources, *Review of Economics and Statistics* 80, 251-262.
- [19] Kotlikoff, L. (1996). Simulating the Privatization of Social Security in General Equilibrium, NBER working paper 5776.
- [20] Kotlikoff, L., Smetters, K. and Walliser, J. (2000). Distributional Effects in a General Equilibrium Analysis of Social Security, forthcoming in *The Distributional Effects of Social Security Reform*, edited by Martin Feldstein, University of Chicago Press, Chicago.

- [21] Krusell, P. and Smith, A. A. (1998). Income and Wealth Heterogeneity in the Macroeconomy, *Journal of Political Economy* 106(5), 867-896.
- [22] Laitner, J. (1992). Random Earnings Differences, Lifetime Liquidity Constraints, and Altruistic Intergenerational Transfers, *Journal of Economic Theory* 58,135-170.
- [23] Laitner, J. (2001). Wealth Accumulation in the U.S.: Do Inheritances and Bequests Play a Significant Role? Mimeo, University of Michigan.
- [24] Solon, G. (1992). Intergenerational Income Mobility in the U. S., *American Economic Review* 82, 393-408.
- [25] Storesletten, K., Telmer C. I. and Yaron, A. (1999). The Risk Sharing Implications of Alternative Social Security Arrangements, *Carnegie-Rochester Conference Series on Public Policy*, vol 50, pp 213-260.
- [26] Zimmerman, D. (1992). Regression Toward Mediocrity in Economic Stature, *American Economic Review* 82, 409-429.