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ABSTRACT

This paper provides two main contributions. First, it provides a new theory of wealth inequality that merges two forces generating inequality: bequest motives and inheritance of ability across generations; and an earnings process that allows for more earnings risk for the richest. Second, it uses a calibrated framework to study the effects of changing estate taxation on inequality, aggregate capital accumulation and output, the economic advantage of being born to a given parental background, and welfare. Our calibrated model generates realistically skewed distributions for wealth, earnings, and bequests and implies that parental background is a crucial determinant of one's expected lifetime utility. We find that increasing the estate tax rate would significantly reduce wealth concentration in the hands of the richest few and would reduce the economic advantage of being born to a super-rich family, but also would lower aggregate capital and output. Lastly, it would also generate a significant welfare gain from the ex-ante standpoint of a newborn under the veil of ignorance.

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1 Introduction

There is much debate about wealth inequality and the importance of parental background in determining one's lot in life. Many papers measure and document the importance of parental background and initial conditions at the individual level. At the aggregate level, the large amount of wealth that is transmitted across generations includes physical wealth and human capital and has been extensively measured and debated. There is also a lot of discussion about the role of taxation and estate taxation in particular.

This paper provides two main contributions. First, it provides a new theory of wealth inequality that merges two sources of inequality previously proposed: bequest motives and inheritance of ability across generations; and an earnings process that allows for more earnings risk for the richest. Second, it uses our calibrated framework to study the importance of parental background in our benchmark economy and the effects of changing estate taxation on aggregate capital accumulation, inequality, parental background as a source of inequality, and welfare. Our calibrated model generates realistically skewed distributions for wealth, earnings, and bequests, and is thus a good laboratory to use to study these questions.

Given the still unresolved debate on how we should best model bequest motives and the widespread rejection of the implications of the perfectly altruistic model, we adopt a tractable "warm-glow" formulation that, when appropriately calibrated, matches the key features of the observed distribution of bequests. In addition, we allow for two possible formulations of voluntary bequest motives: in the first formulation, households derive utility from leaving bequests net of taxes (a "more altruistic" kind of formulation); while in the second one, households derive utility from bequests gross of taxes (more of a "wealth in the utility function formulation").

Regardless of whether bequests net or gross of taxes enter the utility function, to be consistent with the observed distribution of bequests, our calibrated bequest motives are of the luxury good kind; that is, people desire to leave bequests only when they are rich enough. Hence, households that get rich because they received positive earnings shocks and/or large bequests want to share their luck with their descendants. The bequest motive thus raises the saving rate of the already rich and endogenously generates a positive correlation of the saving rates across generations. In addition, more successful parents tend to have higher-earning offspring, which makes for an even more concentrated distribution of wealth and a higher correlation of savings across generations.

We calibrate our framework to match key moments of earnings inequality, aggregate savings, the fraction of wealth transmitted across generations, one moment of the observed bequest distribution, the fraction of estates that pay the estate tax, and the total estate tax revenue as a fraction of output. We consider revenue-neutral reforms and study the effects of balancing the government budget constraint using either a labor income or a capital income tax adjustment.

Our incomplete market framework generates, absent any policy or exogenous changes, a stationary distribution of wealth. As done by Conesa et al. [12] we employ an ex-ante welfare criterion (before ability is realized) that measures expected (with respect to idiosyncratic shocks and parental background) lifetime utility of a newborn in a stationary equilibrium. Because our households also differ by parental background, in addition to this ex-ante welfare measure discussed above, we compute the ex-ante expected lifetime utility of a newborn worker conditional on his parent's ability. This allows us also to discuss the importance of parental background in influencing expected lifetime utility and the extent to which taxation can affect the importance of parental background. Our calibrated model yields several interesting findings.

First, our benchmark model allows for four types of parental backgrounds: lower-earnings, middle-earnings, high-earnings (rich), and super-high earnings (super-rich), and implies that one's parental background is an important determinant of one's expected lifetime utility, especially for the rich and super-rich.

Second, changing estate taxation to levels of the order of the statutory ones that were common around the year 2000 would lower aggregate capital and output, but would also reduce wealth inequality and especially the concentration of wealth in the hands of the wealthiest 1%. In terms of ex-ante welfare gains, people entering the economy under the veil of ignorance would experience a large welfare gain from increased estate taxation.

Third, in the economy with higher estate taxation, the effect of parental background in influencing expected lifetime utility would be much lower and would especially reduce the benefits of being born to rich and super-rich families.

Fourth, our results about the effects of higher estate taxation on the aggregates, on inequality, and on the importance of parental background are surprisingly consistent regardless of whether bequests net or gross of estate taxes enter the utility function, once these models are calibrated to match the same facts as closely as possible. In addition, even the ex-ante welfare measures are surprisingly similar. The main area of divergence between the two versions of the model concerns the welfare costs of increased estate taxation for the super-rich. In the case of utility from gross estate taxes, the super-rich leaving bequests do not lose utility from leaving a bequest of a given size when estate taxes are higher. They do, however, tend to receive smaller bequests net of taxes because their parents do not save more to preserve the size of net bequests when estate taxation is higher. In the experiments that we consider the first effect dominates for the wealthiest 1% and the welfare costs of increasing estate taxation are thus smaller in the case of gross bequests entering the utility function.

The paper is organized as follows. Section 2 frames our contribution in the context of the previous literature. Section 3 discusses some facts about estate taxation in the United States. Section 4 presents the model. Section 5 discusses the model's calibration choices. Section 6 highlights the calibrated model's implications. Section 7 investigates the effects of various estate tax reforms. Section 8 compares our results with those in the previous literature. Section 9 concludes and discusses directions for future research.

2 Related Literature

Our analysis builds on the model developed by De Nardi [16] (and further refined by Yang [52] and De Nardi and Yang [21]) by introducing an earnings process calibration based on the one proposed by Castañeda et al. [11], which helps in matching the observed wealth concentration (see Cagetti and De Nardi [8] for a survey on wealth inequality). We use this improved framework to study the effects of parental background and estate taxation.

An extensive literature, both empirical and theoretical, shows that the transmission of physical and human capital from parents to children is a very important determinant of household wealth in the aggregate economy (see Kotlikoff and Summers [43] and Gale and Scholz [28]) and of wealth and earnings ability over the household's life cycle (see Hurd and Smith [36] and Becker and Tomes [4]). As a result, they are also prime forces to include to study the effects of parental background on inequality and the effects of estate taxation.

Another set of papers has pointed out the importance of initial conditions at labor market entry in determining lifetime inequality (and one's success in the labor market and expected lifetime utility); see Keane and Wolpin [37] for an earlier contribution and Huggett et al. [35] for a more recent one. We also study this dimension, as well as the effect of parental background on lifetime utility and inequality.

The literature studying the effects of estate taxation in quantitatively calibrated models that match the observed wealth inequality includes Cagetti and De Nardi [9] and Castañeda et al. [11]. While Cagetti and De Nardi (and their previous paper Cagetti and De Nardi [7]) do so in a model with entrepreneurial choice while Castañeda et al. do not, both use a simplified life cycle with stochastic aging and assume completely altruistic parents. In contrast, we model the life cycle structure and two types of intergenerational links carefully in a framework that also matches the observed distribution of bequests and generates a realistic increase of wealth inequality over the life cycle. We compare our results with those reported in these previous papers in Section 8.

Our analysis is also connected to the qualitative literature on the effects of estate taxation under different bequest motives (see, for example, Gale and Perozek [27], Cremer and Pestieau [14], Pestieau and Sato [48], and Hines [33]). Our contribution is quantitative in nature, and we address the issue of the sensitivity of the results to the assumed bequest motives in two ways. First, we consider two different formulations of bequest motives; one formulation (our main one) in which parents care about bequests net of estate taxes, which is closer to an altruistic formulation; and another formulation in which parents care about the bequest left gross of taxes, a less "altruistic" formulation, which is closer to the "wealth in the utility function" formulation advocated by Carroll [10]. Second, we compare our findings with those of Cagetti and De Nardi [7] and Castañeda et al. [11], papers that assume perfectly altruistic dynasties.

There is also a literature testing the empirical implications of parental altruism or trying to infer bequest motives using rich micro-level data sets. This branch of the literature has some bearing on the choices we might want to make when modeling bequest motives. For instance, the completely altruistic model, in which children's utility enters parent's utility, has implications for intergenerational risk sharing that have been rejected by Altonji et al. [3], among others. An interesting paper by Laitner and Juster [45] finds heterogeneity in bequest motives for the relatively affluent retirees in his sample. A contribution by Kopczuk [41] aimed at estimating and uncovering a specific bequest motive that might or might not be present, depending on some households' characteristics, both observable and unobservable. Our view based on these findings is that, while the jury is still out on how to best model bequests, a minimum requirement that a reasonable bequest motive should satisfy is that it should generate a realistic distribution of bequests, including the observation that many households die living bequests of negligible value. In addition, given that the intergenerational risk-sharing implications of complete altruism have been rejected, the bequest motive should not be of the perfectly altruistic type. Given these considerations and the empirical success of our paper (and its variations in bequest motives) in matching wealth and bequest inequality, we see our exercise as a valid contribution in evaluating the effects of parental background and estate taxation, and we discuss the sensitivity of our results to some versions of bequest motives. Finally, as we discussed in the paragraph above, we also compare our results with those in the previous papers that have used the fully altruistic model as a benchmark.

Finally, our paper proposes a positive analysis of estate taxation, as opposed to a normative one (for a relatively recent contribution of this kind, see Farhi and Werning [22]).

3 Some Facts about Estate Taxation

Gale et al. [26], Aaron and Gale [24], Gale and Perozek [27], and Kopczuk ([39], [40], and [38]) provide interesting overviews of the history and issues concerning estate and gift taxation and their changes over time. In this paper, we focus on the year 2000 tax code, as it represents more typical tax rates of the period for which are are calibrating our model.

Federal law typically imposes an integrated set of taxes on estates, gifts, and generation-skipping transfers. The gross estate includes all of the decedent's assets. The allowed estate tax implied exemption level was $675,000. However, Gale and Slemrod [29], Aaron and Munnell [1], Kopczuk et al. [42], and Schmalbeck [49] argue convincingly that there are many ways to reduce effective estate taxation. The marginal federal tax rate for taxable returns above that amount was starting at 37% and topping out at 55%.

Credit is given for state inheritance and estate taxes. Most states now levy "soak-up taxes" that only shift revenues from the federal to the state treasuries without adding to the total tax burden on the estate.

Although many experts agree that effective estate taxation can be reduced substantially by appropriate estate management and valuation, there is considerable uncertainty about how much people can and do reduce the estate tax burden by using both legal and illegal ways. There is, in contrast, no dispute about the observed revenues from the estate and gift tax and the fraction of estates that do pay estate taxes. In terms of revenue, only about 2% of the estates of adult decedents pay any estate taxes, and their revenue is about 0.3% of U.S. output (See, for example, Gale and Slemrod [29]).

In the process of calibrating our model, we follow De Nardi [16] and assume a simple form for estate taxation that allows for an exemption level and a constant tax rate above the exemption level; and we use our model-generated data to match the fraction of estates paying estate taxes and estate tax revenues as a fraction of output. Interestingly, we find numbers that fall well within the bounds proposed by the previous literature. Given that our model matches asset holdings so well, and given the considerable uncertainty about effective estate tax avoidance and evasion, we see this as a useful way to proceed.

4 The Model

The model is a discrete-time, incomplete-markets, overlapping-generations economy with an infinitely lived government.

4.1 The Government

Social Security benefits, $P(\widetilde{y})$, are linked to one's realized average annual earnings $\widetilde{y}$, up to Social Security cap $\widetilde{y}_c$, and are financed through a labor income tax (τ_s).

The government taxes capital at rate τ_a, labor income and Social Security pay-outs at rate τ_l, and estates at rate τ_b above the exemption level x_b to finance government spending G.

The two government budget constraints, one for Social Security and the other one for government spending, are balanced during each period.

4.2 Firm and Technology

There is one representative firm producing goods according to the aggregate production function $F(K; L) = K^\alpha L^{1-\alpha}$, where K is the aggregate capital stock and L is the aggregate labor input. The final goods can either be consumed or invested into physical capital, which depreciates at rate δ.

4.3 Demographics and Labor Earnings

Each model period lasts five years. Agents start their economic life at the age of 20 ($t = 1$). By age 35, ($t = 4$), the agents' children are born. The agents retire at age 65 ($t = 10$). From that period on, each household faces a positive probability of dying, given by $(1 - p_t)$, which only depends on age.[1] The maximum life span is age 90 ($T = 14$), and the population grows at a constant rate n. Figure 1 displays the structure of the overlapping generations model.

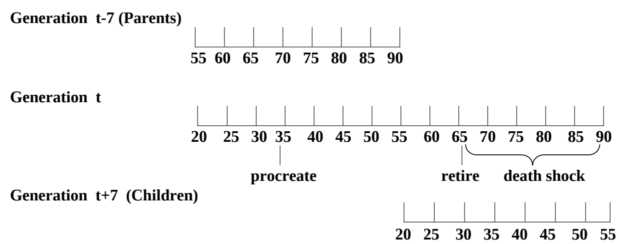

Figure 1: Model Demographics.

Total labor productivity of worker i at age t is given by $y_t^i = e^{z_t^i + \epsilon_t}$, in which ϵ_t is the deterministic age-efficiency profile. The process for the stochastic earnings shock z_t^i is: $z_t^i = \rho_z z_{t-1}^i + \mu_t^i,\ \mu_t^i \sim N(0, \sigma_\mu^2)$.

To capture the intergenerational correlation of earnings, we assume that the productivity of worker i at age 55 is transmitted to children j at age 20 as follows: $z_1^j = \rho_h z_8^i + \nu^j,\ \nu^j \sim N(0, \sigma_h^2)$, as parents are 35 years (seven model periods) older than their children.

4.4 Preferences

Preferences are time separable, with a constant discount factor β. The period utility function from consumption is given by $U(c) = (c^{1-\gamma} - 1)/(1 - \gamma)$.

People derive utility from holding onto assets because they turn into bequests upon death. This form of 'impure' bequest motive implies that an

[1]We make the assumption that people do not die before age 65 to reduce computational time. This assumption does not affect the results since in the U.S., the number of adults dying before age 65 is small.

individual cares about total bequests left to his/her children, but not about the consumption of his/her children.

The utility from bequests b is denoted by

$$\phi(b) = \phi_1 \left[(b(\tau_b, x_b) + \phi_2)^{1-\gamma} - 1 \right].$$

The term ϕ_1 measures the strength of bequest motives, while ϕ_2 reflects the extent to which bequests are luxury goods. If $\phi_2 > 0$, the marginal utility of small bequests is bounded, while the marginal utility of large bequests declines more slowly than the marginal utility of consumption. We also consider the case in which gross bequests enter the utility function. In that case, we set $b(\tau_b, x_b) = b$.

Our formulation is thus more flexible than in De Nardi [16], Yang [52], and De Nardi and Yang [21] because we allow for two kinds of bequest motives. In the first one, parents care about bequests net of taxes. In the second one, parents care about bequests gross of taxes. A more altruistic parent would take into account that some of the estate is taxed away, but parents might just care about what assets they leave, rather than how much their offspring receive. It is therefore interesting to look at the effects of estate taxation in both cases, especially since the qualitative literature stresses that different bequest motives might imply very different policy outcomes (see, for example, Gale and Perozek [27]).

4.5 The Household's Recursive Problem

We assume that children have full information about their parents' state variables and infer the size of the bequests that they are likely to receive based on this information. The potential set of a household's state variables is given by $x = (t, a, z, \widetilde{y}, S_p)$, where t is household age (notice that in the presence of a fixed age gap, one's age is also informative about one's parents' age), a denotes the agent's financial assets carried from the previous period, z is the current earnings shock, and $\widetilde{y}$ stands for annual accumulated earnings, up to a social security cap $\widetilde{y}_c$, which are used to compute Social Security payments. The term S_p stands for parental state variables other than age and, more precisely, is given by $S_p = (a_p, z_p, \widetilde{y}_p)$. It thus includes parental assets, current earnings, and accumulated earnings. When one's parent retires, z_p, or current parental earnings, becomes irrelevant and we set it to zero with no loss of generality.

From 20 to 60 years of age ($t = 1$ to $t = 9$), the agent works and survives for sure to next period. Let $V_w(t, a, z, \widetilde{y}, S_p)$ and $V_w^I(t, a, z, \widetilde{y})$ denote the value functions of a working age person whose parent is alive and dead, respectively, where I stands for "inherited." In the former case, the household's parent is still alive and might die with probability p_{t+7}, in which case the value function for the orphan household applies, and assets are augmented by inheritances in per-capita terms. That is,

$$(1) \quad V_w(t, a, z, \widetilde{y}, S_p) = \max_{c,a'} \Big\{ U(c) + \beta p_{t+7} E\big[V_w(t+1, a', z', \widetilde{y}', S_p')\big) + \beta(1 - p_{t+7}) E\big[V_w^I(t+1, a' + a_p'/N, z', \widetilde{y}')\big] \Big\},$$

subject to

$$(2) \quad c + a' = (1 - \tau_l) wy - \tau_s \min(wy, 5\widetilde{y}_c) + [1 + r(1 - \tau_a)]a,$$

$$(3) \quad a' \geq 0,$$

$$(4) \quad \widetilde{y}' = \big[(t-1)\widetilde{y} + \min(wy/5, \widetilde{y}_c)\big]/t,$$

$$(5) \quad \widetilde{y}_p' = \left\{ \begin{array}{ll} \big[(t+6)\widetilde{y}_p + \min((wy_p/5, \widetilde{y}_c)\big]/(t+7) & \text{if } t < 3 \\ \widetilde{y}_p & \text{otherwise} \end{array} \right\}$$

$$(6) \quad a_p' = a_p'(S_p),$$

where N is the average number of children determined by the growth rate of the population. The expected values of the value functions are taken with respect to (z', z_p'), conditional on (z, z_p). The agent's resources depend on labor endowment y and asset holdings a.

Average yearly earnings for children and parents evolve according to equations (4) and (5), respectively. Since current income y refers to a five-year period, current income is divided by five when the yearly lifetime average labor income ($\widetilde{y}$) is updated. Equation (6) is the law of motion of assets for the parents, which uses their optimal decision rule.

The value function of an agent who is still working but whose parent is dead is

$$V_w^I(t,a,z,\widetilde{y}) = \max_{c,a'}\left\{U(c) + \beta E\big[V^I(t+1,a',z',\widetilde{y'})\big]\right\}, \tag{7}$$

subject to (2), (3), and (4).

From 65 to 85 years of age ($t = 10$ to $t = 14$), the agent is retired and receives Social Security benefits and his parent is already deceased. He faces a positive probability of dying, in which case he derives utility from bequeathing the remaining assets.

$$V_r(t,a,\widetilde{y}) = \max_{c,a'}\left\{U(c) + \beta p_t V_r(t+1,a',\widetilde{y}) + (1-p_t)\phi(b)\right\}, \tag{8}$$

subject to (3),

$$c + a' \;=\; [1 + r(1-\tau_a)]a + (1-\tau_l)P(\widetilde{y}), \tag{9}$$

and, in the case of net bequest motives,

$$b \;=\; \left\{ \begin{array}{ll} a' & \text{if } a_{\prime} < x_b, \\ (1-\tau_b)(a'-x_b) + x_b & \text{otherwise,} \end{array} \right\} \tag{10}$$

while in the case of gross bequest motives,

$$b = a', \tag{11}$$

regardless of the structure of the estate tax.

4.6 Definition of Stationary Equilibrium

We focus on a stationary equilibrium concept in which factor prices and age-wealth distribution are constant over time. The collection of all of the agents' possible states is denoted by x. An equilibrium is described as follows.

Definition 1 *A stationary equilibrium is given by government tax rates, trans-*

fers, and spending $(\tau_l, \tau_s, \tau_a, \tau_b, x_b, P(\widetilde{y}), G)$*; an interest rate* r *and a wage rate* w*; value functions* $V(x)$*, allocations* $c(x)$*,* $a'(x)$*; and a constant distribution of people* $m^*(x)$*, such that the following conditions hold:*

(i) Given government tax rates and transfers, the interest rate, the wage rate, and defined benefit policies, the functions $V(x)$*,* $c(x)$ *and* $a'(x)$ *solve the described maximization problem for a household in state* x*.*

(ii) m^* *is the invariant distribution of households over the state variables for this economy.*[2]

(iii) All markets clear.

$$C = \int c\, m^*(dx), \;\; K = \int a\, m^*(dx), \;\; L = \int \epsilon y\, m^*(dx),$$
$$C + (1+n)K - (1-\delta)\, K + G = F(K; L).$$

(iv) The price of each factor is equal to its marginal product.

$$r = F_1(K, L) - \delta, \;\; w = F_2(K, L).$$

(vi) The government budget constraints are balanced at each period.

$$G = \tau_a r \int a\, m^*(dx) + \tau_l w L + \int \tau_b (1-p_t) I_{t>9} \max(a' - x_b, 0) m^*(dx) + \tau_l \int I_{t>9} P(\widetilde{y}) m^*(dx),$$
$$\int I_{t>9} P(\widetilde{y}) m^*(dx) = \tau_s w L.$$

5 Calibration

Unless stated otherwise, we report parameters at an annual frequency. Table 1 lists the parameters that are either taken from other studies or can be solved independently of the endogenous outcomes of the model. Regarding the latter, due to the assumption of exogenous labor supply and retirement decisions, the tax rate on Social Security only depends on the earnings shocks and the population demographics, which are exogenous to the model.

[2]We normalize m^* so that $m^*(X) = 1$, which implies that $m^*(\chi)$ is the fraction of people alive that are in a state χ.

	Parameters		Value
Demographics	n	annual population growth	1.2%
	p_t	survival probability	see text
Preferences	γ	risk aversion coefficient	1.5
Labor earnings	ϵ_t	age-efficiency profile	see text
	y	labor earnings levels	see text
	Q_y	labor earnings transition matrix	see text
	ρ_h	AR(1) coef. of prod. inheritance process	0.40
	σ_h^2	innovation of prod. inheritance process	0.37
Production	α	capital income share	0.36
	δ	depreciation	6.0%
Government policy	τ_a	capital income tax	20%
	$P(\widetilde{y})$	Social Security benefit	see text
	τ_s	Social Security tax	12.0%

Table 1: Exogenous parameters used in the benchmark model.

We set the population growth rate, n, to the average value of population growth from 1950 to 1997 from the Council of Economic Advisors [13]. The p_t's are the vectors of conditional survival probabilities for people older than 65 and are set to the survival probabilities for people born in 1965 (Bell et al. (1992)). We take the risk aversion coefficient, γ, to be 1.5.

The deterministic age-profile of labor earnings ϵ_t has been estimated by Hansen [31]. Since we impose mandatory retirement at the age of 65, we set $\epsilon_t = 0$ after that age ($t > 9$). Our calibration of labor earnings process is based on the observation that the Panel Study of Income Dynamics (PSID) provides excellent data on the earnings dynamics for much of the population, but not for those of the richest households (see, for instance, Bosworth and Anders [5]). To match the earnings dynamics of all the population, we thus proceed as follows.

1. We assume four possible earnings states: low, middle, high, and super-high. We take the support of the earnings shocks from Castañeda et al. [11]. The resulting grid points for y are [1, 3.15, 9.78, 1,061].

2. We take the persistence ρ_h of the earnings inheritance process from Zim-

merman (1992) and Solon (1992) and the variance σ_h^2 from De Nardi (2004). We then discretize the earnings inheritance process as proposed by Tauchen [51].

3. We take PSID estimates on the persistence (0.92) and variance (0.38) over five-year periods from Table A.1 in Appendix A in De Nardi [16]; and we discretize this process for the lowest three grid points using Tauchen [51] to make sure that our process accurately represents the estimated earnings dynamics for much of the population. This gives us a three by three transition matrix.

4. We pick the remaining six elements of our four by four transition matrix to match the following aspects of the earnings distribution: The Gini coefficient and the share of total earnings earned, respectively, by the top 1%, 5%, 20%, 40%, and 60%. We also impose adding-up restrictions.

Appendix 10.1 reports the transition matrices for the earnings process over time and across generations and the invariant distribution over earnings states upon entering the economy.

The share of income that goes to capital, α, is set at 0.36 (Cooley and Prescott (1995)) and depreciation is 6% (Stokey and Rebelo (1995)).

The capital income tax rate τ_a is set at 20% as in Kotlikoff et al. (1999). The Social Security benefit $P(\widetilde{y})$ mimics the Old Age and Survivor Insurance component of the Social Security system and is set as

$$P(\widetilde{y}) = 0.9\min(\widetilde{y}, 0.2) + 0.32\max(0, \min(\widetilde{y}, 1.24) - 0.2) + \\ 0.15\max(0, \min(\widetilde{y}, 2.47), 1.24).$$

In this formula, the bend points are expressed in terms of average earnings and the Social Security earnings cap is $\widetilde{y}_c = 2.47$. The marginal rates of Social Security benefits are taken from Huggett and Ventura (2000). More specifically, their formula applies to an economy with average earnings of one. The bend points are multiplied by average earnings in our model economy to make the formula consistent with our model economy. The tax rate on labor income τ_s is set at 12.0% to balance the Social Security budget.

Moment		Data	Benchmark	Gross Bequests	No Bequest Motives
Wealth-output ratio		3.10	3.10%	3.10%	3.11%
Bequest-wealth ratio		0.88-1.18%	0.88%	0.88%	0.58%
90th perc. bequest distribution		4.34	4.51	4.29	4.71
Fraction of estates paying taxes		2.0%	1.92%	1.92%	2.04%
Revenue from estate tax/output		0.33%	0.33%	0.33%	0.32%
Government spending/output		18%	18.00%	18.00%	18.00%
Parameters					
β	discount factor		0.9454	0.9455	0.9525
ϕ_1	bequest utility		-5.4473	-6.1561	0.0000
ϕ_2	bequest utility shifter (in \$ 2000)		1095	1376	0.0000
τ_b	tax on estates		21.43%	21.30%	62.94%
x_b	estate exemption level (in \$ 2000)		756	786	745
τ_l	tax on labor income		19.20%	19.20%	19.20%

Table 2: Parameters calibration for the benchmark model and the model with no voluntary bequests.

Table 2 lists the parameters we use to calibrate the model. We choose β, to match the capital output ratio, and in the cases in which a bequest motive is present, we choose ϕ_1, and ϕ_2 to match the bequest-wealth ratio (Gale and Scholz [28]) and the 90th percentile of the bequest distribution normalized by income (Hurd and Smith (2002)). In the data, the bequest-wealth ratio is 0.88% when only bequests are included, but rises to 1.18% if inter-vivos transfers and college expenses are included in the measure of bequests. Although one might argue that we should calibrate to the total of such transfers because we do not model the last two components explicitly, we calibrate to the lower bound of the range to be conservative. Regarding the bequest distribution, we use the one for single decedents instead of the one for all decedents. As argued in De Nardi (2004), typically a surviving spouse inherits a large share of the estate, consumes part of it, and only leaves the remainder to the couple's children.

The discount factor affects savings and average wealth in the economy. The term ϕ_1 measures the strength of bequest motives, thus we choose the aggregate bequest as a moment. The term ϕ_2 reflects the extent to which bequests are luxury goods, thus affecting the upper tail of the bequest distribution.

Our calibration for the model with net bequest in the utility function implies that, during the last period of life, when the individual knows that he/she will die for sure next period, the marginal propensity to bequeath out of an additional dollar above the estate tax threshold is 56%, while the threshold above which the person wants to start bequeathing is $1.095 million (normalized using $57,135 as average income in 2000). The corresponding numbers for the gross bequests model are, respectively, 53% and $1.376 million.

We choose the tax parameters τ_b, x_b, and τ_l to match the fraction of estate tax revenue to output (0.33% Gale, Hines, and Slemrod [26] and Gale and Slemrod [25]), the fraction of estates that pay estate taxes (2.0%, Gale, Hines, and Slemrod [26] and Gale and Slemrod [25]) and the ratio of government spending to output (18%, Council of Economic Advisors [13]). The implied exemption level expressed in terms of year 2000 dollars turns out to be $756,000, which is only modestly higher than the $675,000 exemption that was in place at that time.

In the model without bequest motives, we choose the parameters β, τ_b, x_b, and τ_l to match the capital output ratio, the fraction of estate tax revenue to output, the fraction of estates that pay estate taxes, and the ratio of government spending to output.

An inspection of Table 2 reveals that, unlike our calibrated model with voluntary bequest motives, the model without bequest motives cannot match the flow of aggregate bequests to aggregate wealth. In fact, it only captures 66% of it, and thus overstates the estate tax rate (63%), setting it even higher than the statutory tax rate (55%), which applies only to the largest bequests. The higher tax rate mechanically comes from the fact that the flow of bequests is too small and yet the estate tax revenue has to match the observed revenue in the data.

To better gauge the quantitative implications of the model, we begin by evaluating the cross-sectional earnings implications of the exogenous earnings process that we feed into the model. Table 3 first reports the percentage of earnings earned at selected percentiles as a fraction of total earnings generated by the model and then displays the corresponding figures computed from the

1992 SCF observed data for the adult population (calculated by Castañeda et al. [11]; Table 7 on page 845). The model earnings process produces a cross-sectional earnings distribution that is very close to that computed from the SCF data.

		Percentile (%)					
	Gini	1	5	20	40	60	80
SCF	0.63	14.76	31.13	61.39	84.72	97.21	100.00
All models	0.62	14.64	31.93	62.45	84.05	93.00	100.00

Table 3: Percentage of earnings in the top percentiles.

We present our numerical results as follows. In Section 6 we discuss three versions of the model and their implications, how they compare with the actual data, and how they differ across models. We also discuss the importance of parental background in affecting lifetime expected utility and the distribution of the tax burden.

In Section 7, we study the long-run effects of various estate taxation reforms, in which we use either the tax on capital or the tax on labor income to re-establish budget balance. In each run, unless otherwise indicated, we solve for the dynamic programming problem, impose budget balance for the government, and adjust prices to re-establish market clearing.

6 Numerical Results

6.1 The Wealth Distribution

Table 4 reports values of the wealth distribution. The first line refers to data from the 1998 SCF taken from Budria et al. [6] and shows that, in the data, wealth is highly unevenly distributed. The wealthiest 1% of people hold 35% of net worth, while the wealthiest 5% hold 58% of total net worth. The second line of data reports the corresponding numbers for the benchmark model with intergenerational links and bequest motives and bequests net of taxes entering the utility function. The third line of data reports the corresponding numbers

		Percentile (%)					
	Gini	1	5	20	40	60	80
1998 SCF	0.80	34.7	57.8	69.1	81.7	93.9	98.9
Benchmark model	0.80	35.2	51.9	66.1	82.9	95.3	99.6
Gross bequests model	0.80	35.3	52.1	66.3	83.0	95.3	99.6
No bequest motives	0.76	25.8	44.1	59.7	78.5	93.5	99.1

Table 4: Percentage of total wealth held by households in the top percentiles. First line: 1998 SCF data. Second line: Benchmark model with voluntary bequests in which net bequests are in the utility function. Third line: Model with voluntary bequests in which gross bequests are in the utility function. Fourth line: Model without voluntary bequests.

for the model with intergenerational links and bequest motives, and bequests gross of taxes entering the utility function[3].

Both versions of the model with voluntary bequests, whether the utility from bequests is net or gross of taxes, when appropriately calibrated to match our aggregate target moments, succeed in generating the observed wealth concentration.

The fourth line of data reports values for the wealth distribution generated by a model without voluntary bequests that is calibrated as discussed previously. This version of the model succeeds in generating wealth holdings in the hands of the richest 1% that are larger than the share of earnings of the richest 1%. The key mechanism generating this is that the earnings super-rich have a 20% probability of sliding into a much lower earnings state each period and thus save at very high rates to smooth consumption over time. Despite this additional saving motive for the high earners, however, the model falls short of matching the observed fractions of wealth held by the richest. The comparison between the model with and without voluntary bequest motives highlights the role of the voluntary bequest motive, calibrated as a luxury good, in generating a higher concentration of wealth in the hands of the richest few and raising overall wealth inequality as measured by the Gini coefficient. The intuition is that this kind of bequest motive raises the saving rate of the rich, who

[3]Since all of our 20 years olds are born with zero net worth, we exclude them from our calculations of wealth inequality.

thus leave larger estates to their children; they in turn also save more, thus increasing wealth concentration.

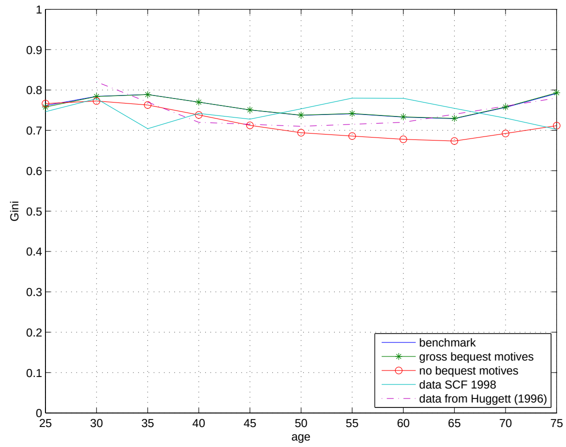

Figure 2: Gini coefficient of wealth by age.

Figure 2 displays the evolution of a summary measure of wealth concentration, the Gini coefficient, by age. The figure reports two different series for the data. The first one, from Huggett [34], displays a U-Shaped form by age; while the second one, from Kuhn [44], is flatter. Both lines imply a high concentration of wealth at all ages.

The Gini coefficient of wealth by age produced by our benchmark model with net bequests in the utility function coincides with the one in the model with gross bequests in the utility function (green, starred line) and is therefore not distinguishable from the latter. All of our models produce Gini coefficients by age in the ballpark of the data, but the models with voluntary bequests better match the observed Gini coefficient for wealth at all ages when compared to the implications of the model without voluntary bequests. This indicates that the model with voluntary bequests not only better matches the cross-sectional wealth inequality at all ages, but also better reproduces some of its evolution over the life cycle.

6.2 The Importance of Parental Background

Parental background (or earnings) affects one's prospects in life through two channels in our framework. First, since richer parents leave larger bequests, it influences the amount of expected bequests that one will receive. Second, since one's initial earnings draw is correlated to one's parental earnings and is then persistent over time, it also influences one's lifetime earnings.

In this subsection, we discuss the value of being born to a family with different parental backgrounds (or earnings). Later, when evaluating various policy reforms, we assess to what extent estate, capital income, and labor income taxes can affect the luck (or lack thereof) of being born in a certain parental background rather than another one in our framework.

In our calibration, the earnings of both parents and children can assume four values: low-earnings, middle-earnings, high-earnings, and super-high earnings. We perform our calculations of the value of being born in a certain parental socio-economic class as follows. Take a new worker with parental background i. Find the median of the other parental state variables (assets and associated lifetime earnings) with current parental earnings or background at the time when the child enters the labor market. Also find the median of the new workers' state variables (initial earnings) conditional on their parental earnings or background. Take the corresponding value function for all of these state variables. Repeat this process for a new worker with parental background j. Compare the two value functions, and compute the one-time asset compensation requested to make the newborn born to a given family background indifferent to being born to a family with another level of parental earnings or background, and divide by average income to normalize. One way of interpreting this comparison is that it calculates the value of being born to a typical background, conditional on parental socio-economic status, and all of the median associated state variables that go along with it, with a different parental socio-economic status and all associated other median state variables.

The last row of data in Table 5 shows that newborn workers whose parents

	To		
From	1st	2nd	3rd
2nd	0.06	-	-
3rd	5.59	5.43	-
4th	35.71	35.50	28.41

Table 5: Moving from a parental background to another. Asset compensation required for moving from a parental background level to another, normalized as a fraction of average income.

are at the highest earnings at age 55 need to be compensated, respectively, by 35.7, 35.5, and 28.4 times average income to be moved to the state of being born to a family with the low (1st), middle (2nd), or high level (3rd) of parental earnings. A newborn worker with parents in the 3rd (high) earnings background has to be compensated by over five times average income to be born to a family with middle- or low-earning parents. Finally, low (1st) and middle (2nd) earning families are quite similar in terms of the lifetime utility that they provide to their children, compared with the high or super-high earners.

These calculations thus suggest that the value of being born into a family with a high or super-high socio-economic background is very large, and that parental background is an important determinant of the lifetime utility of the richer households in our calibrated model. In contrast, the effects of parental background are much smaller for the households born to the low- and middle-income parental level. Since in our economy the fraction of people born with a high- and super-high parental earning background is very small (about 2%), for the majority of people in our economy the effect of parental background on lifetime expected utility is smaller.

6.3 Tax Incidence

To evaluate the distribution of the tax burden and to better understand how tax reforms change it, Tables 6 and 7 report some figures corresponding to people who are, for example, at the top 1%, 1-5%, and so on of the wealth distribution. First, we report the average age in each wealth quantile because age

Wealth Percentile	Age	Capital tax	Labor tax	Estate Tax	Total tax
0-1%	64.26	35.79	7.74	98.84	15.65
1-5%	61.80	18.14	7.66	1.16	9.86
5-10%	59.18	14.94	8.87	0.00	10.05

Table 6: Percentage of the total for a given tax paid by a selected wealth percentile.

Wealth Percentile	Age	Capital tax	Labor tax	Estate tax	Total tax
0-1%	64.26	1.69	1.26	0.395	3.35
1-5%	61.80	0.21	0.31	0.001	0.53
5-10%	59.18	0.14	0.29	0.000	0.43
average	50.70	0.05	0.16	0.004	0.21

Table 7: Average amount of a given tax paid by a group, as a fraction of average income in our economy.

is an important variable affecting earnings and capital accumulation, hence, looking at average age helps us to understand the mechanisms behind a given tax burden. Second, in Table 6, we report the fraction of the total revenue from a given tax that is paid by the wealthiest in a given group. Table 6 shows that the wealthiest 1% of people are on average 64.3 years old, hence many of them are retired, and that they pay 35.8% of the total amount of capital income taxes in the economy. Given their age, they only pay 7.7% of the total labor income taxes. Given the high estate taxation threshold that we calibrate, they pay 98.8% of the estate taxes and, finally, they pay 15.7% of the total taxes in our economy.

These numbers are interesting also because they indicate that, should we reduce estate taxation and raise earnings taxes to make up for the lost revenue, very little of the earnings tax increase would come from the pockets of the wealthiest. Since some households can become richer because of large labor earnings, as in Castañeda at al. (and in the data), this is not a foregone conclusion.

The second line of data in this table reports the corresponding figures for households who belong to the wealthiest 1-5%. The households in this group are slightly younger, they pay a much lower, but still large fraction of total capital taxes (18.1%), a very similar fraction of labor income tax, but close to none of the estate taxes because they are younger and less likely to die but also because they are more likely to leave estates smaller than the estate exemption level. The top 5-10% wealthiest households are quite similar to the latter group in terms of the tax burden.

Table 7 looks at the tax burden from a different angle and reports the average amount of a given tax paid by a group, as a fraction of average income in our economy. The first line of data in this table shows that the wealthiest 1%, every year, on average pay an amount of capital income taxes that corresponds to 1.7 times average income, they also pay 1.3 times the average income in labor income taxes and their estates pay, on average, 0.4 times average income in estate taxes. Scrolling down to the wealthiest 1-5%, we find that their average tax burden is much lower across the board and totals 0.5 times average income in the economy. The wealthiest 5-10% pay 0.4 times average income in total taxes every year. The last line of data in the table shows the average tax burden of taxation in our benchmark economy. The average person is 51 years old and pays 0.1 times average income in capital taxes, 0.2 times average income in labor taxes, almost no estate taxes, and faces an average tax burden of 21% of average income in the economy.

These numbers also confirm and quantify the expectation that the burden of the labor income tax is more evenly distributed than the capital income tax, while the burden of the estate tax is the most unevenly distributed, with the top 1% paying 99% of the total taxes.

7 Reforming Estate Taxation

We study two key margins of estate taxation: the threshold above which estates start being taxed, and the marginal tax rate above which estates are taxed above the exemption threshold. Modifying the estate taxation exemption levels affects both the size of the estates that are hit by estate taxes and the burden of estate taxation. For example, reducing the exemption level implies that smaller estates start being taxed, but also that the previously taxed estates pay more taxes, because their exemption level is smaller. In contrast, changing the estate tax rate for a given exemption level just increases or decreases the burden of estate taxes on estates of the same size.

Changing estate taxation also has an effect on the estate distribution. This can happen for two reasons. First, if the people leaving estates care about the estate net of bequest taxes (a more altruistic form of bequest motive), they will change their saving behavior and desired bequest when estate taxation changes. This effect will be missing in the case of gross bequests in the utility function. Second, people might receive different amounts of bequests net of taxes, which will affect their saving behavior and desired bequests in turn, because the model with realistically calibrated bequest motives generates a non-homoteticity of savings in income and wealth.

We now turn to presenting the effects of various estate taxation policy reforms on the aggregates, on inequality, on the importance of parental background, the tax burden, and welfare, in the cases of adjusting either the capital income (Table 8) or the labor income tax (Table 9) to re-establish government budget balance. In some instances, to better discuss the various effects, we also report results for fixed prices and thus partial equilibrium.

7.1 Aggregate Effects

Comparing Tables 8 and 9 allows us to highlight the differences and similarities of using either the capital income or labor income tax to re-establish government budget balance when the estate tax is reformed.

Changing the tax on capital income to re-establish budget balance changes the incentives to save by affecting the net rate of return on capital. Changing labor income taxation to re-establish government budget balance does not distort labor supply decisions (for tractability we assume exogenous labor supply), but affects net lifetime income, and hence the importance of human capital inheritance across generations. In fact, raising the tax on labor earnings reduces the advantage of being born to more able parents and having a higher expected lifetime income. Finally, due to borrowing constraints, changes in the labor income tax also affects the ability to consume at younger ages.

In both tables, the top panel shows the aggregate effects of changing the estate tax rate, while the second panel reports the results for changes in the estate tax exemption level. The third panel changes both the estate tax rate and its exemption level at the same time. The line in bold refers to our benchmark economy. The bottom two panels reproduce some of the analysis for the case of utility from bequests gross of taxes.

The top panels of these two tables show that **lowering the estate tax rate** (τ_b) below our calibrated level of 21% increases the return to leaving a bequest for people who are rich enough to have an active bequest motive but requires an increase in another tax instrument to re-establish budget balance. Increasing the tax rate on capital income decreases the incentive to save for everyone, and especially for those who are not actively saving to leave a bequest. The net effect for the richest in our framework is that the increased return from leaving a bequest is larger than the disincentive coming from the lower interest rate. In addition, in the aggregate, the increased savings of the richest are large enough to counterbalance the decreased savings of everyone else and, on net, aggregate capital and income go up as the estate tax is lowered.

When the labor income tax is used to balance the government budget constraints (Table 9), for given prices, reducing estate taxation does not reduce the rate of return to savings for anyone in the population and still increases the return to leaving a bequest for the rich. As a result, aggregate capital goes up by more (which tends to reduce the interest rate by more in general equilibrium) and so does aggregate output. This is not very surprising because not only does taxing labor not discourage savings as taxing capital income does, but in our economy labor supply is fixed, and therefore there is no disincentive of labor supply coming from increasing the labor tax.

Increasing the tax rate on estates displays an interesting nonlinearity, but only in the model with net bequests in the utility function. Up to a tax rate on estates of about 50%, raising the estate tax rate reduces both aggregate capital and output due to the fact that the return to leaving a bequest goes down when the estate tax goes up, and the saving rate of the rich goes down by more than the increased savings of everyone else (now facing higher returns due to a lower tax rate on capital and higher equilibrium interest rates and thus saving more). However, around a tax rate on estates of about 60%, bequests net of the estate tax become smaller and smaller and the richest keep up their saving to avoid a large reduction in net bequests. The rest of the population faces a lower capital income tax and desire to save more, and aggregate capital and income go up. In the model with gross bequest motives, the rich do not adjust savings up to avoid a large reduction in net estates, as the tax rate on estates keeps going up and this nonlinearity is absent.

Table 9 shows that this non-linearity is still present but is smaller when we keep increasing the estate tax while lowering the tax rate on labor. In this case, the rich keep getting less rich due to smaller net bequests as we increase the estate tax, but the effect of increasing the returns to savings due to lower capital income taxes is no longer present across the whole population. However, most of the population experiences a positive wealth effect due to lower labor income taxes, and thus saves a little more as a result.

The second panels of Tables 8 and 9 show the effects of **changing the estate exemption level**. Lowering the exemption level has two effects. First, it introduces estate taxes for smaller estates that were not taxed previously; and second, it taxes more heavily the estates that were already taxed previously. When the exemption level is lowered, aggregate capital and income decrease. When it is increased, the effects go in the opposite direction but are very small. This holds regardless of whether the capital income or the labor income tax is adjusted.

Finally, **we change the structure of estate taxation to the statutory one in place in the year 2000**, when the exemption level was $675,000 and the marginal tax rate was 55%. This change in the exemption levels implies that 2.44% of estates are now taxed, compared with 1.92% in our benchmark. As Tables 8 and 9 show, this tax policy minimizes aggregate capital and income among all of the tax configurations that we consider and thus does not seem particularly desirable under this respect. Under this taxation scheme, gross bequests go up because people care about the utility of leaving bequests net of taxes and thus keep more assets to transfer to their descendants, but this increase is not enough to compensate for the increased estate tax burden.

The two bottom panels of Table 8 and the bottom panel of 9 report results for the **model in which people derive utility from bequests gross of taxes**, rather than net of taxes. Here, when the estate tax rate goes down, people do not decrease their desired gross bequests and capital and, as a result, output goes up by a little more than the case of net bequests in the utility function. In contrast, when the estate tax rate goes up, people do not save more to leave larger bequests net of taxes to their children. As a result, aggregate capital and income drop slightly more than in the model with utility from bequests net of taxes. Interestingly however, both the calibrated models with net and gross bequests in the utility function imply a drop in aggregate capital and income when estate taxation is raised; and the differences in the effects generated by these two models are quite small, once the two models are calibrated to match the same facts in their respective benchmark calibrations.

7.2 Distributional Effects

Tables 10 and 11 report the effects of various reforms on measures of wealth inequality. The main conclusions to be drawn from these experiments are the following. First, the share of wealth held by the richest is monotonically decreasing in the estate tax rate. For instance, eliminating estate taxation would increase the share of total net worth held by the richest 1% of people from 35% to 37%, while increasing it to 50% would reduce their share of net worth to 33%. Second, the effects of changing estate taxation on inequality are similar when we use the labor or the capital income tax to balance the budget. Third, the decrease in wealth inequality as the tax rate on estates is increased is slightly larger when the capital income tax is used to balance the budget than when the labor income tax is used. Fourth, changing the exemption level of estate taxation in the range of $200,000 to $1,000,000 has little effect on wealth inequality for an estate tax rate of 21%, while the effects are a bit larger with a higher estate tax rate of the order of 55% (results available from the authors).

Hence, putting together the aggregate and distributional effects of these reforms, we find that reducing estate taxation increases aggregate output and capital but increases wealth inequality, while increasing the estate tax rate has the opposite effect.

7.3 Importance of Parental Background Effects

In order to assess to what extent estate tax reforms can affect the lifetime value of being born to a family with a different parental earnings level, or parental background, we show in Table 12 the one-time asset compensation corresponding to moving a child being born to a family with a given parent's earnings to another one, expressed as a fraction of average yearly income. We report these compensations for our benchmark economy and for an economy with a 55% tax rate on estates, an estate exemption level of $\$675,000$, and either a lower capital income or labor income tax. We also report results for the model with gross bequests in the utility function.

These comparisons yield several findings. First, the value of being born to a family with the highest parental background is significantly reduced when estate taxes are increased. For instance, the compensation requested for moving from the top to the bottom of parental background is 35.7 times average income in the benchmark economy, while it goes down to 33.7 times when estate taxation is increased, regardless of whether the capital income or the labor income tax is adjusted. Second, these compensations are very similar regardless of which tax is used to balance the government budget, and this indicates that it is the reduction in the net bequests received that dominates the effects of this reform, rather than the tax used to balance the government budget constraint. Third, the effects of the importance of parental background and its changes are very similar both for net and gross bequests in the utility function, with only a slightly bigger reduction for the case of gross bequests in the utility function. Fourth, the importance of parental background to determine one's lot in life is basically unchanged for all other people who are not born in a super-rich family, first reflecting the very high progressivity of estate taxation both before and after the reform, and second, reflecting the fact that only a small fraction of the population receives a very large bequest.

7.4 Distribution of the Tax Burden Effects

We now report the tax burdens in the economy with a 55% tax rate on estates, an estate exemption level of $675,000 (which corresponds to the the levels of statutory taxation in place in 2000), and a decreased capital income or labor income tax. All results are reported for the model with bequests net of taxes in the utility function. The tax burdens for the case of gross bequests in the utility function are very similar.

Table 13 reports the average amount of tax paid by a group in this economy with higher estate taxation and can be compared to Table 7, which refers to our benchmark economy. The biggest effect is that, due to a higher estate tax rate and a lower exemption level, the estate tax revenue on the estates left by the decedents in the richest 1% increases from 0.4 to 1.0 times average income, almost tripling. In contrast, the estate tax burden of everyone below the richest 1%, despite the lower estate tax exemption level, changes very little, due to the fact that very few people below the top 1% leave estates of taxable size, even with the lower exemption level. The second noticeable feature is that when the capital income tax is lowered, the average capital income tax for the richest 1% goes down from 1.7 to 1.4 times average income. Lastly, for this reform, despite the break coming from reduced capital income taxation, the average tax burden for the richest 1% is 3.4 times average income in the benchmark economy, but goes up to 3.7 times average income when the capital income tax is lowered and up to 3.8 times when labor income taxation is lowered, due to the fact that the richest save more and thus benefit more from reduced capital income taxation.

7.5 Welfare Effects

Table 14 reports one-time welfare compensations and the fraction of people gaining from a reform. The welfare compensation computes the amount of assets that we need to give agents in the economy before a reform, so that each agent is indifferent between living in the economy before and after a reform. For simplicity, we then switch the signs so that a positive number means a welfare gain of switching from the benchmark economy to the economy with higher estate taxation. To isolate the general equilibrium effects, we present, in the top panel, the partial equilibrium results in which we fix the prices as in the model before the reform and set taxes as in the general equilibrium model after the reform.

The column "All" refers to the ex-ante welfare measure computed under the veil of ignorance. The columns labeled "Initial Earnings" condition on the newborn workers' initial earnings draw, while the last three columns report, respectively, the fraction of households benefiting from the reform, the average gains of those who gain, and losses of those who lose.

A few things are worth noticing. **For fixed prices**, first the vast majority of the population gains from switching to the year 2000 statutory estate taxation. The fraction is highest when the labor income tax is lowered to balance the government budget, because many people save little and thus do not benefit from a tax break on capital income. Second, the fraction of people gaining from a raise in estate taxation is very similar regardless of whether net or gross bequests enter one's utility function. Third, the first three columns of the table report the average gain or loss conditional on one's initial earnings draw upon entering the labor market. Conditioning on this reveals that the average gains conditional of being born in a given productivity level are always positive with the exception of the largest earnings realization. Conditional on being in that state, the utility loss from increased estate taxation is very large, especially in the case in which net bequests enter the utility function because households in that case lose utility, both because they get lower net estates (which happens with both utility functions) and because they receive smaller utility from gross bequests due to increased estate taxation (an effect present only with net bequests in the utility function). Interestingly, however, the difference in the welfare losses of the super-rich in the case of utility from net and gross bequests is smaller than the loss due to the receipt of smaller bequests. Hence, the results make intuitive sense, but are quantitatively surprisingly close.

For endogenous prices, things change. First, the interest rate goes up, but the wage rate goes down, regardless of whether capital or labor income tax is lowered. A higher interest rate increases the rate of return to savings and thus tends to improve the welfare of the savers. A reduction in the wage rate, in contrast, decreases the earnings of all workers, thus generating a welfare loss. The negative wage effect dominates, thus resulting in a much smaller fraction of people benefiting from an increase in estate taxes than for fixed prices. Second, in the case the labor income tax is lowered due to the increased revenue from estate taxation, the welfare loss from lower wages is partly offset in wages net of taxes, thus generating a larger fraction of people gaining from the reform. Third, the welfare gains can be nonlinear as a function of one's initial earnings because wages go down but the interest rate goes up. As a result, low earners who do not save much lose due to lower wages. As we move up the earnings distribution, savings increase and people start to gain due to the higher return to saving. This holds true until we get to the highest earnings level, at which leaving and receiving bequests become very important, hence the welfare of people in this state is hurt by higher estate taxes.

Lastly, for almost all reforms, with the exception of the one with gross bequests in the utility function, in which the capital income tax is adjusted and prices adjust (which implies an even larger drop in wages), increasing estate taxation results in an ex-ante welfare gain from the standpoint of the unborn person who is under the veil of ignorance.

8 Comparing Our Results With those in the Previous Literature

The literature studying the effects of estate taxation in quantitatively calibrated models that match the observed wealth inequality includes Cagetti and De Nardi [9] and Castañeda et al. [11].

Both papers use a simplified life cycle structure and altruistic households, but Cagetti and De Nardi do so in a model with entrepreneurial choice in which entrepreneurs are potentially very productive and credit constrained, while in Castañeda et al. the households face high earnings risk once they become super-rich (a mechanism that we also include in our analysis). Compared with these two papers, we model the life cycle structure and two types of intergenerational links carefully.

Both Cagetti and De Nardi and Castañeda et al. only study the case of abolishing estate taxation. Interestingly, both papers find, as we do, that abolishing estate taxation would generate small increases in aggregate capital and output. More specifically, for instance, all three papers generate increases in the range of $0.7-1.5\%$ for aggregate capital, $0.1-0.6\%$ of aggregate output, and 1.0-1.7 percentage point increases in the share of wealth held by the richest 1%. Cagetti and De Nardi also compute welfare gains and losses and find that abolishing estate taxation would generate large welfare losses for a large fraction of the population, a finding that is also broadly consistent with ours.

While it is reassuring that the results are quite similar for the specific case of abolishing estate taxation, we study a much broader range of estate tax reforms and we flesh out the effects of these reforms on many important outcomes, including the importance of parental background. In addition, we also study the robustness of our results to two different types of voluntary bequest motives that match important aspects of the observed estate distribution.

9 Conclusions and Directions for Future Research

We study wealth inequality, the importance of parental background, and the effects of reforming estate taxation in a framework with both voluntary and accidental bequests and transmission of ability (or human capital) across generations and earnings risks. Our model fits key aspects of the data very well and is quite rich, but makes some important assumptions.

First, we limit ourselves to steady state analysis. This is due to both computational costs and to the fact that we see understanding steady state inequality as a necessary step that comes before studying the transitions and evolution of inequality over time.

Second, for tractability, we assume exogenous labor supply, and we thus abstract from labor supply distortions coming from taxation. It would be interesting to study this channel, both in stationary environments with different taxation structures (see, for example, De Nardi et al [20] for a discussion of the effects of government policies on income across countries) and in the context of the observed rise in wage inequality in the United States (see Heathcote et al. [32] for a discussion of the macroeconomic effects of these changes).

Third, we assume an exogenous transmission of ability, or human capital, across generations, thus not modelling this interesting channel, its formation, and its reaction to policy reforms. For examples of frameworks modeling these important interactions, including parental investment and the effects of family structure on income, see Aiyagari et al. [2], Greenwood et al. [30], Scholz and Seshadri [50], Lee et al. [46], and Lee and Seshadri [47].

Lastly, we abstract from some additional, and potentially important reasons to save, such as medical expense risks after retirement and heterogenity in life expectancy. See De Nardi et al. [18], [17], [19], and French et al. [23] for discussions about the importance of heterogenous longevity and medical expenses risk in the data and their impact on saving motives.

10 Appendix

10.1 Earnings and Earnings Persistence Calibration

The transition matrix for Q_y is:

$$\begin{bmatrix} 0.8239 & 0.1733 & 0.0027 & 0.000070 \\ 0.2171 & 0.6399 & 0.1428 & 0.000196 \\ 0.0067 & 0.2599 & 0.7332 & 0.000198 \\ 0.1117 & 0.0000 & 0.0794 & 0.808958 \end{bmatrix}.$$

The transition matrix for Q_{yh} is

$$\begin{bmatrix} 0.8272 & 0.1704 & 0.0024 & 0.0000000000 \\ 0.5748 & 0.4056 & 0.0196 & 0.0000000000 \\ 0.2890 & 0.6173 & 0.0937 & 0.0000000005 \\ 0.0001 & 0.0387 & 0.9599 & 0.0012647506 \end{bmatrix}.$$

The transition matrices induce an initial distribution of earnings with probability masses over the respective earnings levels, given by [64.76% 32.80 % 2.44% 0.00006595%].

The high persistence of the income of the super-rich that is implied by our calibration is consistent with work by DeBacker et al. [15], which reports that the persistence of both labor and business income at the top of labor and business income distributions is high and that, in particular, the probability of staying there both after one year and five years (the latter results are available from the authors on request) is around 80%. Despite the fact that they use a large sample of U.S. income tax returns from the Treasury Department, their sample size is not large enough to look finely at the earnings of people above the top 0.01%; but the findings still imply high earnings persistence in the upper tail of earnings.

10.2 Interpreting the Size of the Bequest Motive

To get a sense of the size of the bequest motive, consider a person who starts the period with cash on hand x and dies for sure next period. The budget constraint for such a person is given by $a' = (x - c)$, where a' is savings. The estate net of taxes b is given by

$b = a'$ if $a' < x_b$

$b = (1 - \tau_b)(a' - x_b) + x_b$, if $a' \geq x_b$.

The first-order condition for an interior solution implies that the marginal utility of consumption today equals the appropriately discounted marginal utility of bequests and solves the following problem.

For the case of net bequests in the utility function, the following maximization problem applies

$\max \frac{c^{1-\gamma}-1}{1-\gamma} + \phi_1 \left[(b + \phi_2)^{1-\gamma} - 1 \right]$ with

$b = a'$ if $a' < x_b$ and

$b = (1 - \tau_b)(a' - x_b) + x_b$ if $a' \geq x_b$; which we can solve for b. First, consider the case in which $a' < x_b$, or in case of gross bequests in the utility function, then we have

$b = \frac{x - f\phi_2}{1+f}$

with $f = \left(\phi_1 (1 - \gamma) \right)^{-\frac{1}{\gamma}}$.

Then consider the case in which $a' \geq x_b$ and bequests are net in the utility function to obtain

$b = \frac{(1-\tau_b)(x - x_b - f\phi_2) + x_b}{1 + f(1-\tau_b)}$.

Since bequests cannot be negative, the expression for b reveals that x has to be large before the person will leave any bequests. If x is not sufficiently large, then $c = x$ and the solutions just derived do not apply. Assuming that x is in fact large enough, the marginal propensity to bequeath out of an extra dollar today is

$\frac{\partial}{\partial x}(b) = \frac{1}{1+f}$ when the estate is below the exemption level, and is

$\frac{\partial}{\partial x}(b) = \frac{(1-\tau_b)}{1+f(1-\tau_b)}$.

For the case in which gross bequests enter the utility function, the following maximization problem applies

$\max \frac{c^{1-\gamma}-1}{1-\gamma} + \phi_1 \left[(x - c + \phi_2)^{1-\gamma} - 1 \right]$.

Hence, we have

$a' = \frac{x - f\phi_2}{1+f}$

with $f = \left(\phi_1(1-\gamma)\right)^{-\frac{1}{\gamma}}$.

In a dynamic model, where the odds of dying in any given period are low, x should be interpreted not as the total stock of wealth, but as its annuity or consumption value.

Regarding the point at which the bequest motive kicks in, take ϕ_2, divide it it by the income normalization (which is now 0.2 yearly), and multiply it by $57,135 to express it in year 2000 dollars.

References

[1] Henry J. Aaron and Alicia H. Munnell. Reassessing the role for wealth transfer taxes. *National Tax Journal*, 45(2):119–143, 1992.

[2] Rao S. Aiyagari, Jeremy Greenwood, and Ananth Seshadri. Efficient investment in children. *Journal of Economic Theory*, 102:290–321, 2002.

[3] Joseph G. Altonji, Fumio Hayashi, and Larry Kotlikoff. Parental altruism and intervivos transfers: Theory and evidence. *Journal of Political Economy*, 6(105):1121–1166, 1997.

[4] Gary S. Becker and Nigel Tomes. Human capital and the rise and fall of families. *Journal of Labor Economics*, 4(3):1–39, 1986.

[5] Barry P. Bosworth and Sarah Anders. Saving and wealth accumulation in the psid, 1984-2005. NBER Working Paper 17689, 2011.

[6] Santiago Budría Rodríguez, Javier Díaz-Giménez, Vincenzo Quadrini, and José-Víctor Ríos-Rull. Updated facts on the U.S. distributions of earnings, income and wealth. *Federal Reserve Bank of Minneapolis Quarterly Review*, 26(3):2–35, 2002.

[7] Marco Cagetti and Mariacristina De Nardi. Entrepreneurship, frictions and wealth. *Journal of Political Economy*, 114(5):835–870, 2006.

[8] Marco Cagetti and Mariacristina De Nardi. Wealth inequality: data and models. *Macroeconomic Dynamics*, 12:285–313, 2008.

[9] Marco Cagetti and Mariacristina De Nardi. Estate taxation, entrepreneurship, and wealth. *The American Economic Review*, 99(1):85–111, 2009.

[10] Christopher D. Carroll. Why do the rich save so much? NBER Working Paper 6549, 1998.

[11] Ana Castañeda, Javier Díaz-Giménez, and José-Víctor Ríos-Rull. Accounting for u.s. earnings and wealth inequality. *Journal of Political Economy*, 111(4):818–857, 2003.

[12] Juan Carlos Conesa, Sagiri Kitao, and Dirk Krueger. Taxing capital? not a bad idea after all! *American Economic Review*, 99:25–48, 2009.

[13] Council of Economic Advisors. *Economic Report of the President*. United States Government Printing Office, Washington, 1998.

[14] Helmuth Cremer and Pierre Pestieau. Wealth transfer taxation: A survey. CESifo Working Paper Series No. 1061, 2003.

[15] Jason DeBacker, Bradley Heim, Vasia Panousi, Shanthi Ramnath, and Ivan Vifangos. The properties of income risk in privately held businesses. Federal Reserve Board Working Paper 2012-69, 2012.

[16] Mariacristina De Nardi. Wealth inequality and intergenerational links. *Review of Economic Studies*, 71(3):743–768, 2004.

[17] Mariacristina De Nardi, Eric French, and John B. Jones. Life expectancy and old age savings. *American Economic Review: Papers and Proceedings*, 99(2):110–115, 2009.

[18] Mariacristina De Nardi, Eric French, and John B. Jones. Why do the elderly save? The role of medical expenses. *Journal of Political Economy*, 118(1):39–75, 2010.

[19] Mariacristina De Nardi, Eric French, and John B. Jones. Medicaid insurance in old age. Working Paper 19151, National Bureau of Economic Research, 2013.

[20] Mariacristina De Nardi, Liqian Ren, and Chao Wei. Income inequality and redistribution in five countries. *Federal Reserve Bank of Chicago Economic Perspectives*, 24(2):2–20, 2000.

[21] Mariacristina De Nardi and Fang Yang. Bequests and heterogeneity in retirement wealth. *European Economic Review*, 72:182–196, 2014.

[22] Emanuel Farhi and Ivan Werning. Progressive estate taxation. *The Quarterly Journal of Economics*, 125:635–673, 2010.

[23] Eric French, Mariacristina De Nardi, John B. Jones, Olyesa Baker, and Phil Doctor. Right before the end: Asset decumulation at the end of life. *Economic Perspectives*, 30(3):2–13, 2006.

[24] William G. Gale and Henry J. Aaron. *Economic Effects of Fundamental Tax Reform*. Brookings Institution Press, 1996.

[25] William G. Gale and Slemrod Joel. Rethinking the estate and gift tax: Overview. Working Paper 8205, National Bureau of Economic Research, 2001.

[26] William G. Gale, James R. Hines Jr., and Joel Slemrod, editors. *Rethinking Estate and Gift Taxation*. Brookings Institution Press, 2011.

[27] William G. Gale and Maria G. Perozek. Do estate taxes reduce saving? In John Shoven, editor, *Rethinking Estate and Gift Taxation*. Brookings Institution Press, 2001.

[28] William G. Gale and John Karl Scholz. Intergenerational transfers and the accumulation of wealth. *Journal of Economic Perspectives*, 8(4):145–160, 1994.

[29] William G. Gale and Joel Slemrod. Overview. In Gale et al. [26], pages 1–64.

[30] Jeremy Greenwood, Nezih Guner, and John A. Knowles. More on marriage, fertility, and the distribution of income. *International Economic Review*, 44(3):827–862, 2003.

[31] Gary D. Hansen. The cyclical and secular behaviour of labour input: Comparing efficiency units and hours worked. *Journal of Applied Econometrics*, 8(1):71–80, 1993.

[32] Jonathan Heathcote, Kjeil Storesletten, and Gianluca Violante. The macroeconomic implications of rising wage inequality in the United States. *Journal of Political Economy*, 118:681–722, 2010.

[33] James R. Hines. Income and substitution effects of estate taxation. *The American Economic Review*, 103:484–88, 2013.

[34] Mark Huggett. Wealth distribution in life-cycle economies. *Journal of Monetary Economics*, 38(3):469–494, 1996.

[35] Mark Huggett, Gustavo Ventura, and Amir Yaron. Sources of lifetime inequality. *American Economic Review*, 101(7):2923–54, 2011.

[36] Michael D. Hurd and James P. Smith. Anticipated and actual bequests. Working Paper 7380, National Bureau of Economic Research, 1999.

[37] Michael P. Keane and Kenneth I. Wolpin. The career decisions of young man. *Journal of Political Economy*, 105:473–522, 1997.

[38] Wojciech Kopczuk. Economics of estate taxation: A brief review of theory and evidence. *Tax Law Review*, 63:139–157, 2000.

[39] Wojciech Kopczuk. Incentive effects of inheritances and optimal estate taxation. *American Economic Review: Papers and Proceedings*, 103:472–77, 2013.

[40] Wojciech Kopczuk. Taxation of intergenerational transfers and wealth. In Martin Feldstein Alan Auerbach, Raj Chetty and Emmanuel Saez, editors, *Handbook of Public Economics, volume V*. Elsevier, 2013.

[41] Wojciech Kopczuk and Joseph Lupton. To leave or not to leave: The distribution of bequest motives. *Review of Economic Studies*, 74:207–235, 2007.

[42] Wojciech Kopczuk and Joel Slemrod. The impact of the estate tax on wealth accumulation and avoidance behavior. In Gale et al. [26], pages 299–349.

[43] Laurence J. Kotlikoff and Lawrence H. Summers. The role of intergenerational transfers in aggregate capital accumulation. *Journal of Political Economy*, 89(4):706–732, 1981.

[44] Moritz Kuhn. Trends in income and wealth inequality. Mimeo, 2014.

[45] John Laitner and Thomas F. Juster. New evidence on altruism, a study of tiaa-cref retirees. *The American Economic Review*, 86(4):893–908, 1996.

[46] Sang Yoon Lee, Nicholas Roy, and Ananth Seshadri. The causal effect of parent's education on children's earnings. Mimeo, 2015.

[47] Sang Yoon Lee and Ananth Seshadri. Economic policy and equality of opportunity. Mimeo, 2014.

[48] Pierre Pestieau and Motohiro Sato. Estate taxation with both accidental and planned bequests. CESifo Working Paper Series 1799, 2006.

[49] Richard Schmalbeck. Avoiding federal wealth transfer taxes. In Gale et al. [26], pages 113–158.

[50] John Karl Scholz and Ananth Seshadri. Health and wealth in a lifecycle model. Mimeo, 2012.

[51] George Tauchen. Finite state markov-chain approximations to univariate and vector autoregressions. *Economic Letters*, 20(2):177–181, 1986.

[52] Fang Yang. Social security reform with impure intergenerational altruism. *Journal of Economic Dynamics and Control*, 37:52–67, 2013.

τ_b	ex_b	r	wage	τ_a	K	Y	B	K/Y	B/Y
Net bequest model, changing the estate tax rate									
0.00	–	5.580	0.490	0.216	3.122	1.003	0.00876	3.114	0.873
0.10	756K	5.598	0.490	0.208	3.112	1.001	0.00884	3.108	0.882
0.21	**756K**	**5.622**	**0.489**	**0.200**	**3.100**	**1.000**	**0.00880**	**3.102**	**0.880**
0.30	756K	5.634	0.489	0.194	3.094	0.999	0.00894	3.096	0.895
0.40	756K	5.658	0.488	0.187	3.082	0.998	0.00896	3.088	0.898
0.50	756K	5.669	0.488	0.179	3.076	0.997	0.00902	3.085	0.904
0.60	756K	5.654	0.488	0.170	3.084	0.998	0.00909	3.090	0.911
0.70	756K	5.624	0.489	0.160	3.099	1.000	0.00921	3.099	0.921
0.80	756K	5.440	0.495	0.122	3.197	1.011	0.01088	3.162	1.076
0.90	756K	5.439	0.495	0.107	3.197	1.011	0.01118	3.162	1.105
Net bequest model, changing the estate tax exemption level									
0.21	219K	5.638	0.489	0.195	3.092	0.999	0.00891	3.095	0.892
0.21	**756K**	**5.622**	**0.489**	**0.200**	**3.100**	**1.000**	**0.00880**	**3.102**	**0.880**
0.21	1095K	5.619	0.489	0.201	3.101	1.000	0.00879	3.101	0.879
Net bequest model, changing both the estate tax rate and the exemption level									
0.55	675K	5.667	0.488	0.174	3.077	0.997	0.00905	3.085	0.907
Gross bequest model, changing the estate tax rate									
0.00	–	5.560	0.491	0.215	3.133	1.004	0.00890	3.121	0.886
0.10	786K	5.593	0.490	0.208	3.115	1.002	0.00884	3.110	0.883
0.21	**786K**	**5.622**	**0.489**	**0.200**	**3.100**	**1.000**	**0.00882**	**3.103**	**0.882**
0.30	786K	5.641	0.489	0.194	3.090	0.999	0.00885	3.094	0.886
0.40	786K	5.669	0.488	0.188	3.076	0.997	0.00881	3.085	0.883
0.50	786K	5.702	0.487	0.183	3.059	0.995	0.00875	3.074	0.879
0.60	786K	5.727	0.486	0.177	3.046	0.994	0.00869	3.066	0.875
0.70	786K	5.752	0.485	0.172	3.034	0.992	0.00864	3.057	0.871
0.80	786K	5.779	0.485	0.168	3.020	0.991	0.00859	3.049	0.867
0.90	786K	5.809	0.484	0.164	3.005	0.989	0.00853	3.039	0.863
Gross bequest model, changing the estate tax rate and exemption level									
0.55	675K	5.717	0.486	0.179	3.051	0.994	0.00872	3.069	0.877

Table 8: Aggregate effects of changing the estate tax rate or exemption level, adjusting the capital income tax.

τ_b	ex_b	r	wage	τ_l	K	Y	B	K/Y	B/Y
Net bequest model, changing the estate tax rate									
0.00	–	5.531	0.492	0.196	3.148	1.006	0.00887	3.130	0.882
0.10	756K	5.580	0.490	0.194	3.122	1.003	0.00886	3.114	0.884
0.21	**756K**	**5.622**	**0.489**	**0.192**	**3.100**	**1.000**	**0.00880**	**3.102**	**0.880**
0.25	756K	5.626	0.489	0.191	3.098	1.000	0.00891	3.099	0.892
0.30	756K	5.649	0.488	0.190	3.086	0.998	0.00892	3.091	0.894
0.40	756K	5.697	0.487	0.189	3.061	0.996	0.00887	3.075	0.891
0.50	756K	5.732	0.486	0.187	3.044	0.993	0.00895	3.064	0.901
0.60	756K	5.741	0.486	0.185	3.039	0.993	0.00899	3.061	0.905
0.70	756K	5.742	0.486	0.183	3.039	0.993	0.00904	3.061	0.910
0.80	756K	5.683	0.487	0.177	3.069	0.996	0.00993	3.080	0.997
0.90	756K	5.611	0.489	0.169	3.106	1.001	0.01096	3.104	1.096
Net bequest model, changing the estate tax exemption level									
0.21	219K	5.651	0.488	0.191	3.085	0.998	0.00888	3.090	0.890
0.21	**756K**	**5.622**	**0.489**	**0.192**	**3.100**	**1.000**	**0.00880**	**3.102**	**0.880**
0.21	1095K	5.617	0.489	0.192	3.103	1.000	0.00879	3.102	0.879
Net bequest model, changing both the estate tax rate and the exemption level									
0.55	675K	5.739	0.486	0.186	3.040	0.993	0.00897	3.061	0.903
Gross bequest model, changing the estate tax rate and exemption level									
0.55	675K	5.774	0.485	0.187	3.023	0.991	0.00868	3.050	0.876

Table 9: Aggregate effects of changing the estate tax rate or exemption level, adjusting the labor income tax.

τ_b	ex_b	τ_a	Gini	Percentile (%)			
				1	5	20	40
Net bequest model, change the estate tax rate							
0.00	–	0.216	0.811	36.91	53.34	67.28	83.61
0.10	756K	0.208	0.808	36.12	52.70	66.77	83.31
0.21	**756K**	**0.200**	**0.804**	**35.15**	**51.90**	**66.09**	**82.89**
0.30	756K	0.194	0.802	34.62	51.44	65.71	82.66
0.40	756K	0.187	0.798	33.78	50.71	65.10	82.27
0.50	756K	0.179	0.795	33.12	50.12	64.58	81.89
0.60	756K	0.170	0.793	32.83	49.82	64.27	81.67
0.70	756K	0.160	0.792	32.74	49.69	64.10	81.53
0.80	756K	0.122	0.793	33.63	50.27	64.38	81.57
0.90	756K	0.107	0.789	32.89	49.59	63.79	81.13
Net bequest model, change the estate tax exemption level							
0.21	219K	0.195	0.805	35.52	52.23	66.37	82.90
0.21	**756K**	**0.200**	**0.804**	**35.15**	**51.90**	**66.09**	**82.89**
0.21	1095K	0.201	0.804	35.11	51.87	66.10	82.92
Net bequest model, change estate tax rate and exemption level							
0.55	675K	0.174	0.794	32.99	49.98	64.43	81.74
Gross bequest model, change estate tax rate and exemption level							
0.55	675K	0.179	0.792	32.39	49.57	64.15	81.59

Table 10: Distribution effects of changing the estate tax rate or exemption level, adjusting the capital income tax.

				Percentile (%)			
τ_b	ex_b	τ_a	Gini	1	5	20	40
Net bequest model, change the estate tax rate							
0.00	–	0.196	0.811	36.92	53.32	67.22	83.54
0.10	756K	0.194	0.807	36.04	52.60	66.65	83.22
0.21	**756K**	**0.192**	**0.804**	**35.15**	**51.90**	**66.09**	**82.89**
0.30	756K	0.190	0.802	34.66	51.50	65.78	82.72
0.40	756K	0.189	0.799	33.79	50.78	65.20	82.36
0.50	756K	0.187	0.796	33.17	50.25	64.78	82.11
0.90	756K	0.169	0.799	34.22	51.03	65.33	82.36
Net bequest model, change the estate tax exemption level							
0.21	219K	0.191	0.805	35.51	52.24	66.39	82.92
0.21	**756K**	**0.192**	**0.804**	**35.15**	**51.90**	**66.09**	**82.89**
0.21	1095K	0.192	0.804	35.11	51.87	66.09	82.91
Net bequest model, change estate tax rate and exemption level							
0.55	675K	0.186	0.795	33.02	50.11	64.64	81.99
Gross bequest model, change estate tax rate and exemption level							
0.55	675K	0.187	0.794	32.52	49.78	64.41	81.84

Table 11: Distribution effects of changing the estate tax rate or exemption level, adjusting the labor income tax.

Parent's earnings	Moving to parent's earnings 1st	2nd	3rd
Benchmark			
2nd	0.06	-	-
3rd	5.59	5.43	-
4th	35.71	35.50	28.41
Net bequest model, changing capital tax			
2nd	0.07	-	-
3rd	5.46	5.29	-
4th	33.70	33.52	26.73
Net bequest model, changing labor tax			
2nd	0.06	-	-
3rd	5.53	5.38	-
4th	34.15	33.98	27.12
Gross bequest model, changing capital tax			
2nd	0.07	-	-
3rd	5.43	5.27	-
4th	33.65	33.47	26.71
Gross bequest model, changing labor tax			
2nd	0.06	-	-
3rd	5.49	5.35	-
4th	34.05	33.88	27.05

Table 12: Importance of parental background effects of changing the estate tax rate and exemption level to the year 2000 statutory levels (the estate tax rate is raised to 55% and its exemption level is lowered to $\$675K$).

Wealth Percentile	Age	Capital tax	Labor tax	Estate tax	Total tax
Changing the capital income tax					
0-1%	64.52	1.39	1.25	1.034	3.67
1-5%	61.70	0.19	0.31	0.006	0.51
5-10%	60.20	0.13	0.28	0.000	0.40
average	50.70	0.04	0.16	0.011	0.21
Changing the labor income tax					
0-1%	64.36	1.60	1.21	1.020	3.83
1-5%	61.79	0.22	0.30	0.006	0.52
5-10%	59.67	0.15	0.28	0.000	0.42
average	50.70	0.05	0.16	0.010	0.21

Table 13: Tax burden effects of changing the estate tax rate and exemption level to the year 2000 statutory levels (the estate tax rate is raised to 55% and its exemption level is lowered to $\$675K$).

	Initial Earnings				Fraction	Winner's	Loser's
All	1st	2nd	3rd	4th	Gaining	Ave gain	Avg Loss
Partial equilibrium							
Net bequest motive, capital income tax							
0.015	0.004	0.027	0.134	-77.277	0.961	0.016	0.0261
Net bequest motive, labor income tax							
0.045	0.027	0.073	0.162	-89.250	0.990	0.046	0.0637
Gross bequest model, capital income tax							
0.012	0.003	0.022	0.109	-65.186	0.957	0.014	0.0235
Gross bequest model, capital income tax							
0.037	0.022	0.060	0.131	-78.028	0.997	0.038	0.1733
General equilibrium							
Net bequest motive, capital income tax							
0.005	-0.003	0.013	0.115	-75.100	0.384	0.022	0.0056
Net bequest motive, labor income tax							
0.005	-0.001	0.012	0.070	-67.214	0.457	0.016	0.0038
Gross bequest motive, capital income tax							
-0.008	-0.011	-0.008	0.070	-60.013	0.097	0.028	0.0121
Gross bequest motive, labor income tax							
0.005	-0.001	0.012	0.070	-67.207	0.457	0.016	0.0038

Table 14: Welfare effects of changing the estate tax rate or exemption level to the year 2000 statutory levels (the estate tax rate is raised to 55% and its exemption level is lowered to $\$675K$) when using the either the capital or labor income tax to balance the budget. In the first five columns, a positive number means a welfare gain of switching from the benchmark economy to the economy with statutory levels.