

# Wealth Inequality, Family Background, and Estate Taxation

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## **Abstract**

This paper provides two main contributions. First, it proposes a new theory of wealth inequality that merges two sources of inequality previously proposed: bequests motives and inheritance of ability of 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 and the effects of changing estate taxation on inequality, aggregate capital accumulation, intergenerational mobility, welfare, and on family background as a source of inequality. Our calibrated model generates realistically skewed distributions for wealth, earnings, and bequests, and a correlation of lifetime earnings and wealth at retirement that is close to that in the data and is thus a good laboratory to use to study these questions. We find that parental background is a crucial determinant of one's expected lifetime utility. We also find that increasing estate taxation from its effective levels observed over many years, to levels that are closer to the statutory ones observed in year 2000, would significantly reduce wealth concentration in the hands of the richest few and the role of parental background in determining one's lot in life. The implied welfare gains

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of such a policy would be positive for 71% of the population. For those experiencing losses, their loss would be a one-time cost of the order of 11% of average income.

**Keywords:** Wealth Inequality; Intergenerational Transmission of Inequality; Estate Taxation; Bequests; Earnings Shocks.

**JEL Classification:** E21; J14

# 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 proposes a new theory of wealth inequality that merges two sources of inequality previously proposed: bequests motives and inheritance of ability of 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 and the effects of changing estate taxation on inequality, aggregate capital accumulation, intergenerational mobility, welfare, and on family background as a source of inequality. Our calibrated model generates realistically skewed distributions for wealth, earnings, and bequests, and a correlation of lifetime earnings and wealth at retirement that is close to that in the data 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 set adopt a tractable “warm-glow” formulation which, appropriately calibrated, matches a number of key features of the data. 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”). In both of these cases, 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 generate a positive correlation of the saving rates across generations. In addition, more successful parents tend to have higher-earner offsprings, which makes for an even more concentrated distribution of wealth and higher correlation of savings across generations.

We calibrate our framework to match key moments of earnings inequality, aggregates savings, the fraction of wealth transmitted across generations, one moment of the observed bequest distribution, the fraction of estate taxes 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. [9] we employ an ex-ante welfare criterion (before ability is realized) which 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 family background, in addition to the 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 to also discuss the importance of parental background in influencing expected lifetime utility and the extent to which taxation can affect the importance of family background. Our calibrated model yields several findings worth mentioning right away.

First, our benchmark model implies that one's family background is an important determinant of one's expected lifetime utility. We allow for four types of family backgrounds: lower earnings, middle-earnings, high-earnings, and super-rich. Someone born with parents at the lowest earnings level would be willing to give up, respectively 20%, 50%, and 120%, as a percentage of average income, to be born in a family with the middle, high, and super-high earnings levels.

Second, changing estate taxation to levels of the order of the statutory ones that have been common for many years has large effects on wealth inequality and especially on the concentration of wealth in the hands of the richest 1%. In terms of ex-ante welfare gains, the implied welfare gains of such a policy would be positive for 71% of the population. For those experiencing losses, their loss would be a one-time cost of the order of 11% of average income. In addition, in this economy, the effect of parental background in influencing expected lifetime utility would be much lower and, more specifically the effect of moving a child from a lower income background to a middle income income will imply an asset compensation of the order of 14% of average income at the beginning of one's working life, compared to 19% in the benchmark. The corresponding numbers for moving a child from a low to upper, or super-rich earnings family backgrounds would imply compensations of 33% and 115% respectively, compared to 48% and 120% in the benchmark with much lower effective estate taxation.

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 taxes reforms. Section 8 concludes.

## 2 Related Literature

Our analysis builds on the model developed by De Nardi [12] (and further refined by De Nardi and Yang [13]) by introducing an earnings process calibration based on the one proposed by Castañeda et al. [8] and thus succeeding to match the observed wealth concentration in the hands of the richest few very well. 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 households' wealth in the aggregate economy (see Kotlikoff and Summers [33] and Gale and Scholz [19]), and of wealth and earnings ability over the household's life cycle (see Hurd and Smith [26] and Becker and Tomes [4]). As a result, they are also prime forces to include to study the effects of family 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 [27] for an earlier contribution and Huggett et al. [25] for a more recent one. We also study this dimension, as well as the effect of family background on lifetime utility and inequality.

The smaller literature studying the effects of estate taxation in quantitatively calibrated models that match the observed wealth inequality includes Cagetti and De Nardi [5] and Castañeda et al. [8]. While Cagetti and De Nardi do so in a model with entrepreneurial choice, Castañeda et al. does not, but 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 which also matches the observed distribution of bequests and generates a realistic increase of consumption dispersion over the life cycle.

Our analysis is also connected to the qualitative literature of the effects of estate taxation and the importance of the type of the assumed bequest motive in determining the effects of estate taxation (see for example Cremer and Pestieau [11], Pestieau and Sato [35], and Hines [23]). 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 formulation of bequest motives, that is, in our main formulation parents care about bequests net of estate taxes, which is closer to an altruistic formulation, but we also check what would happen if parents were to 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 [7]. Second, we

compare our findings to those of Cagetti and De Nardi [5] and Castañeda et al. [8], papers that assume perfectly altruistic dynasties.

There is also a literature testing the empirical implications of parental altruism, or trying to make inference on bequest motives using rich micro-level data sets. This branch of the literature has bearing on the choices that 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 about intergenerational risk sharing that have been rejected by Altonji et al. [3], among others. An interesting paper by Laitner and Juster [34] finds heterogeneity in bequest motives for the relatively affluent retirees in his sample. A contribution by Kopczuk [31] strived to estimate and uncover a specific bequest motive which 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, we also compare our results to those in papers that have used the fully altruistic model as a benchmark and have been analyzed by Castañeda et al. [8] and Cagetti and De Nardi [5].

Finally, our paper proposes a positive analysis of estate taxation, as opposed to a normative one (for a relative recent contribution of this kind see Farhi and Werning [14]).

### 3 Some Facts about Estate Taxation

Gale et al. [18], Aaron and Gale [15], Gale and Perozek [17], and Kopczuk ([29], [30] and [28]) provide interesting overviews of the history and issues concerning estate and gift taxation and their changes over time.

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. In the process of going from the gross estate to the net, taxable estate, these are some of the important steps. We focus here on the year 2000 tax code, as it represents more typical tax rates of the period for which we are calibrating our model. First, the allowed estate tax implied exemption level was \$675,000. Second, assets are typically evaluated at fair market value. Closely held business, however, are allowed to value real property assets at their "use value" rather than their highest alternative market-oriented value. The maximum allowed reduction in value was \$770,000. Third, in addition, it is often possible to substantially discount asset value when such assets are not readily marketable or the taxpayers' ownership does not correlate with control. Fourth, interests in certain qualified family businesses were also allowed an extra deduction of up to \$625,000 in 2000 for the value of the business being transferred. Finally, one can apply unlimited deductions for transfers to a surviving spouse.

After determining the net estate, that is, the gross estate appropriately valued less deductions, the statutory tax rate is applied. The "applicable credit amount" implied that in 2000 at least the first \$675,000 were not taxable. The marginal federal tax rate for a 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.

Just based on the scheme above, one can see that a rich couple could immediately double the standard exemption level just by leaving the children assets up to the deduction upon the death of the first decedent, and then

applying the deduction a second time upon death of the other spouse.

The estate taxation literature is clear about the fact that judicious application of valuation schemes and extra deduction for the presence of a family business further increase the exemption level and brings down the effective estate tax rate above the exemption level. Schmalbeck [37] describes many (legal) estate taxes avoidance schemes to reduce the estate tax burden and provides some measures of effective estate taxes after such schemes are implemented.

Gale and Slemrod [20] argue that simply by using legal valuation techniques, exemptions, and various deductions, a couple with a \$4 million dollar business could pass it to their heir without paying any estate taxes, and without having to engage in any complicated tax avoidance scheme. They also argue that this threshold can be increased even further using other legal schemes. Aaron and Munnell [1] and Kopczuk et al. [32] also argue that there are many ways to reduce effective estate taxation.

Although many experts agree that effective estate taxation can be substantially reduced by appropriate estate management and valuation (this can be done, in part, even after the death of the decedent), there is considerable uncertainty about how much people can and do reduce the estate tax burden by using both legal and illegal ways. Wolff [38] and Poterba [36] study this by comparing tax revenues and the distribution of estates reported in tax forms with the hypothetical one that would be implied by the Survey of Consumer Finances using mortality probabilities and many other assumptions. While Wolf argues that the estate tax captures only about 25% of the potential tax base, Poterba concludes that it catches most of it. Similarly, there is uncertainty about the effective progressivity of the estate tax and on its exact exemption level. Some argue that it is easier to decrease the tax burden for smaller estates (which are also less likely to be audited). Others argue that given the economies of scale for tax avoidance and evasion the tax burden might actually be lower for larger estates.

There is, in contrast, no dispute about the observed revenues from the estate and gift tax, and about the fraction of estates that do pay estate taxes.

In terms of revenue, only about 2% of the estates of adult decedents do pay any estate taxes, and their revenue is about 0.3% of US output (See for example Gale and Slemrod [20]).

In the process of calibrating our model, as in [6] we assume a simple form for estate taxation that allows for an exemption level and a constant tax rate above such 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,  $P(\tilde{y})$ , are linked to one's realized average annual earnings  $\tilde{y}$  and are financed through a labor income tax ( $\tau_s$ ). The government also taxes capital at rate  $\tau_a$ , labor income and Social Security pay-outs at rate  $\tau_l$ , and estates at rate  $\tau_b$  above the exemption level  $x_b$ , to finance government spending. The two government budget constraints 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 be either consumed or invested into physical capital which depreciates at rate  $\delta$ .

### 4.3 Demographics and Labor Productivity

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.<sup>1</sup> 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.

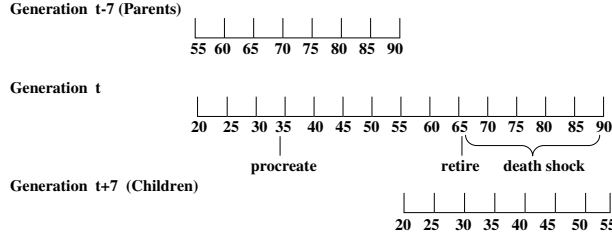


Figure 1: Model Demographics.

Total labor productivity of worker  $i$  at age  $t$  is given by  $y_t^i = e^{z_t^i + \epsilon_t}$ , in which  $\epsilon_t$  is the deterministic age-efficiency profile. The process for the stochastic productivity 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  $\beta$ . 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 assets turn into bequests upon death. This form of ‘impure’ bequest motive implies that an

<sup>1</sup>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

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

The term  $\phi_1$  measures the strength of bequest motives, while  $\phi_2$  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.

Our formulation is more flexible than in De Nardi [12] and De Nardi and Yang [13] because we allow for two kind 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.

An even more general formulation could allow  $\phi_2$  to be a function of some measure of parental income, or lifetime productivity, as in  $\phi_2(\tilde{y})$ . The rationale behind this alternative choice is that more productive parents turn out to have more productive children and hence need to be richer before actively saving to share their wealth with their descendants. This formulation is closer to the implications of a purely altruistic model. It should be noted that the implications of the purely altruistic model in terms of inter-generational risk sharing have been rejected by numerous papers, hence this formulation could be more realistic than the completely altruistic model. For now, we focus on the more restricted case in which  $\phi_2(\tilde{y}) = \phi_2$ .

#### 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

$x = (t, a, z, \tilde{y}, S_p)$ , where  $t$  is household age (notice that in 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 productivity shock,  $\tilde{y}$  stands for accumulated earnings, and  $S_p$  stands for parental state variables other than age and, more precisely, is given by  $S_p = (a_p, z_p, \tilde{y}_p)$ . It thus includes parental assets, current productivity, and accumulated earnings. When one's parent retires,  $z_p$ , or current parental productivity, 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  $V_w(t, a, z, \tilde{y}, S_p)$  and  $V_w^I(t, a, z, \tilde{y})$  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 of inheritances in per-capita terms. That is,

$$(1) \quad V_w(t, a, z, \tilde{y}, S_p) = \max_{c, a'} \left\{ U(c) + \beta p_{t+7} E[V_w(t+1, a', z', \tilde{y}', S'_p)] \right. \\ \left. + \beta(1 - p_{t+7}) E[V_w^I(t+1, a' + a'_p/N, z', \tilde{y}')] \right\},$$

subject to

$$(2) \quad c + a' = (1 - \tau_l - \tau_s)wy + [1 + r(1 - \tau_a)]a,$$

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

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

$$(5) \quad \tilde{y}'_p = \begin{cases} [(t+6)\tilde{y}_p + wy_p/5]/(t+7) & \text{if } t < 3 \\ \tilde{y}_p & \text{otherwise} \end{cases}$$

$$(6) \quad a'_p = a'_p(S_p),$$

where  $N$  is the average number of kids 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  $a$ .

To compute Social Security payments, we keep track of yearly lifetime average labor income  $\tilde{y}$ . Since current income  $y$  refers to a five-year period, current income is divided by five when the yearly lifetime average labor income ( $\tilde{y}$ ) is updated. Average yearly earnings for children and parents thus evolve according to equations (4) and (5), respectively. 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

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

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. He also faces a positive probability of dying, in which case he derives utility from bequeathing the remaining assets.

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

subject to (3) and

$$(9) \quad c + a' = [1 + r(1 - \tau_a)]a + (1 - \tau_l)P(\tilde{y}).$$

#### 4.6 Definition of Equilibrium

We focus on an equilibrium concept where factor prices and age-wealth distribution are constant over time. Each agent's state is denoted by  $x$ . An equilibrium is described as follows.

**Definition 1** *A stationary equilibrium is given by government tax rates, transfers, and spending  $(\tau_l, \tau_s, \tau_a, \tau_b, x_b, P(\tilde{y}), G)$ ; 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 a state  $x$ .

(ii)  $m^*$  is the invariant distribution of households over the state variables for this economy.<sup>2</sup>

(iii) All markets clear.

$$C = \int cm^*(dx), \quad K = \int am^*(dx), \quad L = \int \epsilon ym^*(dx)$$

$$C + (1+n)K - (1-\delta)K + G = F(K; L)$$

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

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

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

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

$$\int I_{t>9} P(\tilde{y}) m^*(dx) = \tau_s w L$$

## 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, namely, the tax rate on Social Security, due to the assumption of exogenous labor supply and retirement decisions, only depends on the earnings shocks and the population demographics, which are exogenous to the 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 [10]. The  $p_t$ 's are the vectors of conditional survival probabilities for people older than

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<sup>2</sup>I normalize  $m^*$  so that  $m^*(X) = 1$ , which implies that  $m^*(\chi)$  is the fraction of people alive that are in a state  $\chi$ .

|                    | Parameters     |                                          | Value    |
|--------------------|----------------|------------------------------------------|----------|
| Demographics       | $n$            | annual population growth                 | 1.2%     |
|                    | $p_t$          | survival probability                     | see text |
| Preference         | $\gamma$       | risk aversion coefficient                | 1.5      |
|                    | $\omega$       | risk aversion coefficient on bequests    | 1.5      |
| Labor productivity | $\epsilon_t$   | age-efficiency profile                   | see text |
|                    | $y$            | labor earnings levels                    | see text |
|                    | $Q_y$          | labor earnings transition matrix         | see text |
|                    | $\rho_h$       | AR(1) coef. of prod. inheritance process | 0.40     |
|                    | $\sigma_h^2$   | innovation of prod. inheritance process  | 0.37     |
| Production         | $\alpha$       | capital income share                     | 0.36     |
|                    | $\delta$       | depreciation                             | 6.0%     |
| Government policy  | $\tau_a$       | capital income tax                       | 20%      |
|                    | $P(\tilde{y})$ | Social Security benefit                  | see text |
|                    | $\tau_s$       | Social Security tax                      | 9.42%    |

Table 1: Exogenous parameters used in the benchmark model.

65 and are set to the survival probabilities for people born in 1965 (Bell et al. (1992)). We take the risk aversion coefficient,  $\gamma$ , to be 1.5 and  $\omega$ , to be 1.5.

The deterministic age-profile of labor productivity  $\epsilon_t$  has been estimated by Hansen (1993). Since we impose mandatory retirement at the age of 65, we set  $\epsilon_t = 0$  for  $t > 9$ . To calibrate the labor earnings process, we build on its calibration by Castañeda et al. [8], who choose its parameters to match moments of the earnings and wealth distribution jointly, but have a much more simplified life cycle structure than we do. More specifically, we use their relative endowments of productivity levels for earnings and transition matrix, but we pick the highest level of earnings to match the percentage of earnings earned at the top 1 percentile as a fraction of total earnings (which is 14.76% in the 1992 Survey of Consumer Finances (SCF)). The resulting grid points for the productivity process  $y$  are [ 1, 3.15, 9.78, 1118.7] and the transition matrix for  $Q_y$  is:

$$\begin{bmatrix} 0.9843 & 0.0117 & 0.0040 & 0.0001 \\ 0.0314 & 0.9648 & 0.0038 & 0.0000 \\ 0.0153 & 0.0044 & 0.9801 & 0.0002 \\ 0.1090 & 0.0050 & 0.0625 & 0.8235 \end{bmatrix}.$$

We take the persistence  $\rho_h$  of the productivity inheritance process from Zimmerman (1992) and Solon (1992) and the variance  $\sigma_h^2$  from De Nardi (2004). We then discretize the productivity inheritance process as proposed by Tauchen (1986). The resulting transition matrix for  $Q_{yh}$  is

$$\begin{bmatrix} 0.8272 & 0.1704 & 0.0024 & 0.0000000000000010 \\ 0.5748 & 0.4056 & 0.0196 & 0.00000000000002784 \\ 0.2890 & 0.6173 & 0.0937 & 0.0000000000399192 \\ 0.0001 & 0.0359 & 0.9627 & 0.001228854774278 \end{bmatrix}.$$

The transition matrices induce an initial distribution of earnings with probability masses over the respective earnings levels which is given by  $[0.7472, 0.2429, 0.0099, 0.00000003]$ .

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

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

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

In this formula, the bend points are expressed in terms of average earnings and 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  $\tau_s$  is set at 9.42% to balance the Social Security budget.

| Moment                           |                         | Data       | Benchmark | No Bequest Motives |
|----------------------------------|-------------------------|------------|-----------|--------------------|
| Wealth-output ratio              |                         | 3.0        | 3.0       | 3.0                |
| Bequest-wealth ratio             |                         | 0.88-1.18% | 0.88%     | 0.64%              |
| 90th perc. bequest distribution  |                         | 4.34       | 4.72      | 5.1572             |
| Fraction of estates paying taxes |                         | 2.0%       | 1.9%      | 1.6%               |
| Revenue from estate tax/output   |                         | 0.33%      | 0.33%     | 0.33%              |
| Government spending/output       |                         | 18%        | 18%       | 18%                |
| Parameters                       |                         |            |           |                    |
| $\beta$                          | discount factor         |            | 0.9596    | 0.9629             |
| $\phi_1$                         | bequest utility         |            | -4.6695   | 0.0                |
| $\phi_2$                         | bequest utility shifter |            | 14.2402   | 0.0                |
| $\tau_b$                         | tax on estates          |            | 23.97%    | 67.03%             |
| $x_b$                            | estate exemption level  |            | 15.0718   | 15.9823            |
| $\tau_l$                         | tax on labor income     |            | 19.48%    | 19.51%             |

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 the parameters  $\beta$ ,  $\phi_1$ , and  $\phi_2$  to match the capital output ratio, the bequest-wealth ratio (Gale and Scholz [19]), and the 90th percentile of bequest distribution normalized by income (Hurd and Smith (2002)). Regarding the bequest-wealth ratio, it comes in at 0.88% including only bequests, while it raises to 1.18% if inter-vivos transfers and college expenses are included. 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 is 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 saving and average wealth in the economy.

The term  $\phi_1$  measures the strength of bequest motives, thus we choose the aggregate bequest as a moment. The term  $\phi_2$  reflects the extent to which bequests are luxury goods, affecting the bequest distribution, especially the high end of it. Our calibration implies that, during the last period of life, when the individual knows that it will die for sure next period, the marginal propensity to bequeath out of an additional dollar is 66%, while the threshold

above which the person wants to start bequeathing is 3.4\$ million (normalized using \$40K as average income in 2000).

We choose the tax parameters  $\tau_b$ ,  $x_b$ , and  $\tau_l$  to match the fraction of estate tax revenue to output (0.33% Gale, Hines, and Slemrod [18] and [16]), the fraction of estates that pay estate taxes (2.0%, Gale, Hines, and Slemrod [18] and [16]), and to the ratio of government spending to output (18%) (Council of Economic Advisors [10]).

In the model without bequest motives, we choose the parameters  $\beta$ ,  $\tau_b$ ,  $x_b$ , and  $\tau_l$  to match the capital output ratio, the fraction of estate tax revenue to output, the fraction of estates that pay estate taxes, and to the ratio of government spending to output.

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 (calculated from Castañeda et al. [8] Table 7 on page 845). The model earnings process produces a cross-sectional earning distribution that is very close to that from the SCF data.

|            | Gini | Percentile (%) |       |       |       |       |     |
|------------|------|----------------|-------|-------|-------|-------|-----|
|            |      | 1              | 5     | 20    | 40    | 60    | 80  |
| SCF        | 0.63 | 14.76          | 31.13 | 61.39 | 84.72 | 97.21 | 100 |
| All models | 0.54 | 14.93          | 27.57 | 59.59 | 75.43 | 89.55 | 100 |

Table 3: Percentage of earnings in the top percentiles.

## 6 Numerical Results

**All of the results are very preliminary and incomplete, and will be subject to further refinements of the calibration and to robustness checks.**

We present our numerical results as follows. First, we discuss the benchmark model and its implications, how some of these implications compare with

the actual data, and how they differ from the implications of a version of the model with no voluntary bequests (re-calibrated as discussed in the calibration section). 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 and impose budget balance for the government and adjust prices to re-establish market clearing.

## 6.1 The Benchmark Model

|                      | Gini | Percentile (%) |       |       |       |       |       |
|----------------------|------|----------------|-------|-------|-------|-------|-------|
|                      |      | 1              | 5     | 20    | 40    | 60    | 80    |
| SCF                  | 0.78 | 29.55          | 53.50 | 66.12 | 79.49 | 92.92 | 98.64 |
| Benchmark model      | 0.75 | 33.49          | 48.95 | 61.88 | 77.92 | 90.90 | 97.59 |
| Gross bequests model |      |                |       |       |       |       |       |
| No bequest motives   | 0.71 | 24.34          | 40.90 | 55.32 | 73.33 | 88.80 | 96.78 |

Table 4: Percentage of total wealth held by households in the top percentiles. First line: 1992 SCF data, second line: Benchmark model with voluntary bequests in which net bequests are in the utility function, third line: Benchmark model with voluntary bequests in which gross bequests are in the utility function, fourth line: Model without voluntary bequests.

Table 6.1 reports values of the wealth distribution for the whole economy. The first line refers to data from the 1992 SCF taken from Castañeda et al. [8] and shows that, in the data, wealth is highly unevenly distributed. The richest 1% of people hold 30% of total retirement wealth, while the richest 5% hold 54% of total net worth. These numbers can actually be even higher than those in 1992 in some periods. 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 model succeeds in generating a Gini coefficient of wealth concentration that is very close to the one in the data and a skewed retirement wealth distribution that is also comparable with the one in the data. (To be done.) The third line of data reports the corresponding numbers for the benchmark

model with intergenerational links and bequest motives, and bequests gross of taxes entering the utility function. (To be done.)

The fourth line of data reports results on the wealth distribution when the voluntary bequest motive is shut down (and the model is re-calibrated as discussed in the calibration section). This comparison highlights the role of the bequest motive, calibrated as a luxury good, in generating more 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 motives raises the saving rate of the rich, which thus leave larger estates to their children, who in turn also save more, thus increasing wealth concentration.

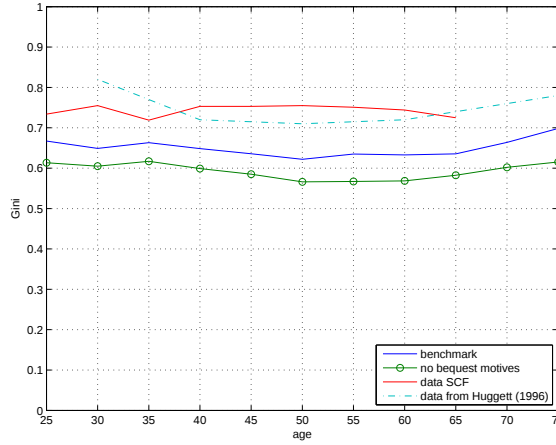


Figure 2: Gini coefficient of wealth by age.

Figure 2 displays a measure of wealth concentration, the Gini coefficient by age. We report two different series for the data. The first one is the one used by Huggett [24], while the second one comes from Castañeda et al. [8]. The first one displays more of a U-Shaped form by age, while the second one is flatter. Both lines, however, imply high concentration of wealth at all ages. All of our model are a bit below the observed concentration in wealth as measured by the Gini index, and both versions of the model (with and without voluntary bequests) display a U-shaped pattern that is closer to the one reported by Huggett. A comparison of the model with and without voluntary bequests

reveals that the one with voluntary bequests is closer to the observed Gini at all ages compared to the one without voluntary bequests.

TO DO:

1. Discuss consumption over the life cycle and consumption inequality: Model-data comparison.

2. Evolution of household earnings and equivalized consumption (mean and variance of the logs) over the life cycle of the cohort that is 25-29 years old in 1980.

### **6.1.1 The Effects of Parental Background and of One's Initial Earnings.**

In this subsection, we first use our framework to evaluate the importance of parental background. Then, we study the role of one's initial earnings in affecting lifetime utility.

We start by discussing the value of being born to a family with a different earnings level (and hence different expected child's initial productivity and expected bequests) to evaluate how important this element is in our framework, and later on assess to what extent the tax reforms that we consider can affect the luck (or lack thereof) of being born in a certain family background rather than another.

In our calibration, earnings can assume four values, which we think of as low-earnings, middle-earning, high-earnings, and super-high earnings. We perform our calculations of the value of being born in a certain parental socioeconomic class as follows. For each parental earnings (or productivity) level when the child is 20, that is just before his labor market entry, we find the median value for all of the other parental state variables (that is parental assets and lifetime earnings so far), and child's initial productivity, conditional on the parent's productivity. For all of these state variables, and conditional on parental productivity, we can thus compute the child's lifetime expected utility. Given this expected value, we compare it with the one for the same state variables, except for a different parental earning level just before labor market entry of the child. Finally, we compute the one-time asset compen-

sation requested to make the newborn indifferent to being born to a family with higher parent’s productivity, everything else fixed at the medial level of his original state variables. One way of interpreting this comparison is that is 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, to the value of the same state variables, except for a shift in parental socio-economic status.

| Parent’s productivity | Moving to parent’s productivity |        |        |
|-----------------------|---------------------------------|--------|--------|
|                       | 2nd                             | 3rd    | 4th    |
| 1st                   | -0.191                          | -0.475 | -1.188 |
| 2nd                   | -                               | -0.244 | -1.140 |
| 3rd                   | -                               | -      | -3.660 |

Table 5: Asset compensation to moving to a family with certain parent’s productivity to another one, as a fraction of average yearly income.

The first row in Table 5 shows that newborn workers whose parents are at the lowest productivity at age 55 are willing to give up assets corresponding to, respectively, 19.1%, 47.5%, and 120% of average income to be moved to a family with the 2nd, 3rd, and parental productivity level. These calculations indicate that the value of being born into a family with a higher socio-economic background is very large, and thus indicate that parental background is an important determinant of one’s lifetime utility.

Section to be completed.

### 6.1.2 Tax Incidence

| Wealth Percentile | Age   | Capital tax | Labor tax | Estate Tax | Total tax |
|-------------------|-------|-------------|-----------|------------|-----------|
| 0-1%              | 65.41 | 33.48       | 7.43      | 98.81      | 14.91     |
| 1-5%              | 64.66 | 15.46       | 6.92      | 1.19       | 8.72      |
| 5-10%             | 63.31 | 12.93       | 7.58      | 0.00       | 8.63      |

Table 6: Fraction of taxes paid at selected wealth percentile from the top.

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

| Wealth Percentile | Age   | Capital tax | Labor tax | Estate tax | Total tax |
|-------------------|-------|-------------|-----------|------------|-----------|
| 0-1%              | 65.41 | 1.33        | 1.00      | 0.322      | 2.65      |
| 1-5%              | 64.66 | 0.15        | 0.23      | 0.001      | 0.39      |
| 5-10%             | 63.31 | 0.10        | 0.20      | 0.000      | 0.31      |
| average           | 50.70 | 0.04        | 0.13      | 0.003      | 0.18      |

Table 7: Average tax burden at selected wealth percentile from the top

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 is an important variable affecting earnings, capital accumulation and, hence looking at average age helps 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 65.4 years old, hence many of them are retired, and that they pay 34% of the total amount of capital income taxes in the economy. Given their age, they only pay 7% of the total labor income taxes. Given the high estate taxation threshold that we calibrate, they pay 99% of the estate taxes, and, finally, they pay 15% of the total taxes from all sources that are generated by 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. It should be noted that, since some households can become richer because of large labor earnings as in Castañeda (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 (15%), a very similar fraction of labor income tax, but close to none of the estate taxes. The top 5-10% wealthiest of the households are quite similar to the latter group in terms of the tax burden.

Table 7 looks at the tax burden under a different angle and reports the average amount of capital income tax in 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 1.3 times average income, they also pay the average income in income taxes and 1/3 of it in estate taxes. Overall, their average tax burden corresponds to 2.7 times average income. Scrolling down to the wealthiest 1-5%, we find that their average tax burden is much lower across the board and totals 0.4 times average income in the economy. The wealthiest 5-10% are quite similar in their average tax burden. The last line of data in the table shows the average tax burden of taxation in our benchmark economy. The average person pays 0.04 times average income in capital taxes, 0.13 times in labor taxes, almost no estate taxes, and faces an average tax burden of 18% 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 total tax.

## 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 given exemption level just increases or decreases the burden of estate taxes on estates of the same size. Of course, 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 varies. Second, people might receive different amounts of bequests, which will affect

their saving behavior and desired bequests in turn, because the model with realistically calibrated bequest motives generates strong non-homoteticity of savings in income and wealth.

We turn now to presenting the effects of various estate taxation policy reforms on the aggregates, on inequality, on intergenerational mobility, on the importance of parental background, and on welfare.

## **7.1 Reforming Estate Taxation and Adjusting the Capital Income Tax**

In this section, we change the capital income tax to re-establish government budget balance when the estate tax is reformed. The top panel of Table 8 shows the aggregate and distributional effects of changing the estate tax rate, while the bottom panel reports the results for changes in the estate tax exemption level. The line in bold refers to our benchmark economy.

When the estate tax rate is increased, a lower tax rate on capital is needed to generate the same amount of tax revenue, and this tends to benefit people to more assets. However, due to the highly progressive nature of the estate tax system, a higher estate tax rate leads to less wealth concentration and, more specifically, to less wealth holding in the hands of the richest few. (The changes in the equilibrium interest and wage rate and in the capital-output ratio are fairly small.) The bottom panel of Table 8 shows the effects of changing the estate exemption level. Lowering the exemption level has similar but smaller effects to raising the estate tax rate. 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 (which corresponds to 16 times the average income), and the marginal tax rate was 55%. As a result of this policy, the equilibrium tax rate on assets drops from 20% to 16% to generate the same amount of tax revenue. This configuration of estate taxation hits the richest more heavily, thus substantially reducing the wealth holdings of the richest.

Note: we will also compute the cases in which the estate tax exemption level is lowered to 5, 2, and 1.

Table 9 shows the corresponding one-time welfare compensations. We cal-

| $\tau_b$                                                  | $ex_b$      | r            | wage         | $\tau_a$     | K/Y          | B/Y          | Gini         | Percentile (%) |             |             |             |
|-----------------------------------------------------------|-------------|--------------|--------------|--------------|--------------|--------------|--------------|----------------|-------------|-------------|-------------|
|                                                           |             |              |              |              |              |              |              | 1              | 5           | 20          | 40          |
| Changing the estate tax rate                              |             |              |              |              |              |              |              |                |             |             |             |
| 0.00                                                      | –           | 5.941        | 0.480        | 0.217        | 2.997        | 0.868        | 0.768        | 35.5           | 51.0        | 63.8        | 79.4        |
| 0.10                                                      | 15.1        | 5.951        | 0.480        | 0.210        | 2.994        | 0.877        | 0.763        | 34.7           | 50.2        | 63.1        | 79.0        |
| <b>0.24</b>                                               | <b>15.1</b> | <b>5.931</b> | <b>0.480</b> | <b>0.200</b> | <b>3.000</b> | <b>0.881</b> | <b>0.753</b> | <b>33.5</b>    | <b>49.0</b> | <b>61.9</b> | <b>77.9</b> |
| 0.30                                                      | 15.1        | 5.942        | 0.480        | 0.196        | 2.996        | 0.882        | 0.749        | 33.0           | 48.5        | 61.4        | 77.6        |
| 0.40                                                      | 15.1        | 5.968        | 0.479        | 0.191        | 2.989        | 0.888        | 0.745        | 32.2           | 47.8        | 60.8        | 77.2        |
| 0.50                                                      | 15.1        | 5.980        | 0.479        | 0.184        | 2.985        | 0.902        | 0.741        | 31.6           | 47.2        | 60.3        | 76.7        |
| 0.90                                                      | 15.1        | 5.910        | 0.481        | 0.145        | 3.007        | 0.979        | 0.724        | 29.2           | 44.8        | 58.1        | 74.8        |
| Changing the estate tax exemption level                   |             |              |              |              |              |              |              |                |             |             |             |
| 0.24                                                      | 10.0        | 5.933        | 0.480        | 0.198        | 3.000        | 0.883        | 0.753        | 33.6           | 49.0        | 61.9        | 77.9        |
| <b>0.24</b>                                               | <b>15.1</b> | <b>5.931</b> | <b>0.480</b> | <b>0.200</b> | <b>3.000</b> | <b>0.881</b> | <b>0.753</b> | <b>33.5</b>    | <b>49.0</b> | <b>61.9</b> | <b>77.9</b> |
| 0.24                                                      | 20.0        | 5.932        | 0.480        | 0.201        | 3.000        | 0.880        | 0.753        | 33.4           | 48.9        | 61.9        | 77.9        |
| Changing both the estate tax rate and the exemption level |             |              |              |              |              |              |              |                |             |             |             |
| 0.55                                                      | 2.7         | 5.925        | 0.480        | 0.159        | 3.002        | 0.916        | 0.729        | 31.43          | 46.47       | 59.54       | 75.40       |

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

culate the amount of assets to be given to agents in the economy before a reform so that each agent is indifferent between living in the economy before and after a reform. A negative number thus implies a welfare gain. The column "All" refers to the ex-ante welfare measure computed under the veil of ignorance. The columns labeled "Initial Productivity" condition on the newborn workers' initial productivity draw, while the last two columns report, respectively, the fraction of households benefiting from the reform, and the average loss of those who lose. As expected, reducing the estate tax rate benefits the super-rich, who leave and receive large bequests, and requires a higher capital tax rate for everyone. The fraction of newborns benefiting from abolishing estate taxation is less than 3%, and the average loss among the vast majority of the population is large, requiring an initial compensation amounting to 22% of average income. On the contrary, a higher estate tax rate benefits the poor and hurts the super-rich. The top panel of the table displays that increasing the estate tax rate from 30% to 90% increases the fraction of people benefiting from the tax change from 25% to 97% of the population. It also requires a lump-sum one-time compensation in assets worth from 5% to 32% of average

| $\tau_b$                                                  | $ex_b$ | All    | Initial Productivity |        |        |         | Fraction | Loser's  |
|-----------------------------------------------------------|--------|--------|----------------------|--------|--------|---------|----------|----------|
|                                                           |        |        | 1st                  | 2nd    | 3rd    | 4th     | Gaining  | Avg Loss |
| Changing the estate tax rate                              |        |        |                      |        |        |         |          |          |
| 0.00                                                      | –      | 0.0    | 0.021                | 0.068  | 0.163  | -64.685 | 0.028    | 0.2172   |
| 0.10                                                      | 15.1   | 0.025  | 0.016                | 0.047  | 0.112  | -39.855 | 0.026    | 0.0263   |
| 0.30                                                      | 15.1   | -0.001 | 0.000                | -0.006 | -0.018 | 19.377  | 0.252    | 0.0014   |
| 0.40                                                      | 15.1   | -0.002 | 0.002                | -0.013 | -0.036 | 57.849  | 0.269    | 0.0056   |
| 0.50                                                      | 15.1   | -0.010 | -0.002               | -0.032 | -0.078 | 99.027  | 0.548    | 0.0081   |
| 0.90                                                      | 15.1   | -0.086 | -0.051               | -0.184 | -0.322 | 483.827 | 0.972    | 0.3153   |
| Changing the estate tax exemption level                   |        |        |                      |        |        |         |          |          |
| 0.24                                                      | 10.0   | 0.002  | 0.001                | 0.005  | 0.011  | -3.005  | 0.741    | 0.0129   |
| 0.24                                                      | 20.0   | 0.000  | 0.000                | -0.000 | -0.009 | 1.765   | 0.062    | 0.0013   |
| Changing both the estate tax rate and the exemption level |        |        |                      |        |        |         |          |          |
| 0.55                                                      | 2.7    | -0.010 | -0.000               | -0.034 | -0.168 | 86.404  | 0.709    | 0.1066   |

Table 9: Welfare effects of changing the estate tax rate or exemption level, changing the capital income tax.

income.

The second panel of the table shows that, while lowering the estate taxation exemption level does not change much neither wealth inequality, nor aggregate capital accumulation, it does generate a welfare gain from 74% of the population, and a smaller welfare cost, corresponding to a one-time compensation of 1.3% of average income.

Finally, the last panel of the table shows that switching to the statutory tax code in place in year 2000, with a much lower exemption level and higher marginal tax rate, would benefit 71% of the population, but that the one-time welfare costs of the losers would be of the order of 11% of average income.

To better understand the implications of the reform that increases the estate tax rate and lowers its exemption level as stated in the year 2000 statutory provisions, we now present similar tables for the tax incidence that we

reported in Tables 6 and 7 for the benchmark economy. Table 10 reports the fraction of the total revenue from a given tax that is paid by the wealthiest in the corresponding group. The wealthiest 1% of people now pay 31.4% of the total amount of capital income taxes in the economy, compared with 33.8% before the reform in our benchmark economy. This reflects the fact that the wealthiest 1% of people hold less wealth and face a lower capital income tax rate after the reform. Due to the reduction of exemption level, the wealthiest 1% of people now pay 72% of the estate, a much smaller fraction compared with 99% before the reform. The wealthiest 1 – 5% of people now pay 15% of the estate, which is a much high fraction than in our benchmark economy and more generally, the estate tax now affects households in the top 15% of the wealth distribution.

| Wealth Percentile | Age   | Capital tax | Labor tax | Estate Tax | Total tax |
|-------------------|-------|-------------|-----------|------------|-----------|
| 0-1%              | 65.47 | 31.42       | 7.50      | 71.52      | 15.84     |
| 1-5%              | 65.65 | 15.05       | 6.89      | 14.51      | 8.82      |
| 5-10%             | 63.74 | 13.06       | 7.49      | 9.11       | 8.58      |

Table 10: Fraction of taxes paid at selected wealth percentile from the top, adjusting the capital income tax rate.

| Wealth Percentile | Age   | Capital tax | Labor tax | Estate tax | Total tax |
|-------------------|-------|-------------|-----------|------------|-----------|
| 0-1%              | 65.47 | 0.99        | 1.01      | 0.818      | 2.82      |
| 1-5%              | 65.65 | 0.12        | 0.23      | 0.042      | 0.39      |
| 5-10%             | 63.74 | 0.08        | 0.20      | 0.021      | 0.31      |
| average           | 50.70 | 0.03        | 0.14      | 0.011      | 0.18      |

Table 11: Average tax burden at selected wealth percentile from the top, adjusting the capital income tax rate.

Table 11 reports the average amount of a tax paid by a group, expressed as a fraction of average income in our economy. This table confirms that total tax revenue after the reform is kept the same as before. However, due to a higher estate tax rate and a lower exemption level, the estate tax revenue increases from 0.3% to 1.1% of average income. The reduction in the capital tax reduces the tax revenue from the capital income tax from 4% to 3% of average income,

with the savings in capital income taxes being concentrated in the wealthiest 20% of the population.

| Parent's productivity | Moving to parent's productivity |        |        |
|-----------------------|---------------------------------|--------|--------|
|                       | 2nd                             | 3rd    | 4th    |
| 1st                   | -0.148                          | -0.332 | -1.165 |
| 2nd                   | -                               | -0.174 | -1.133 |
| 3rd                   | -                               | -      | -3.613 |

Table 12: Asset compensation to moving to a family with certain parent's productivity to another one, as a fraction of average yearly income.

In order to assess to what extent the tax reforms that we consider can affect the value of being born to a family with a different earnings level, 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 productivity to another one, expressed as a fraction of average yearly income. The comparison of Table 5 and Table 12 indicates that the value of being born in a family with a higher socio-economic background is significantly reduced after the reform, and thus indicate that parental background becomes an less important determinant of one's lifetime utility. For instance, a child born to a family with a lowest earnings level is willing to give up 19% of average income as a one-time payment to be indifferent to begin born to a family with a middle-earnings level, while this amount drops to 15% of average income in the economy with higher estate taxes. This comparison shows that, even for given transmission of earnings ability, the effect of reforming the estate tax on the importance of parental background in determining one's lot in life is big.

## 7.2 Reforming Estate Taxation and Adjusting the Labor Income Tax

In this section, we change the labor income tax to re-establish government budget balance when the structure of estate taxation is reformed.

Comparing Tables 8 and 13 allows us to highlight the differences and similarities of the effects of taxation on the economy when we use either the tax on capital income or the tax rate on labor income to re-establish government

| $\tau_b$                                                  | $ex_b$      | r            | wage         | $\tau_l$     | K/Y          | B/Y          | Gini         | Percentile (%) |             |             |             |
|-----------------------------------------------------------|-------------|--------------|--------------|--------------|--------------|--------------|--------------|----------------|-------------|-------------|-------------|
|                                                           |             |              |              |              |              |              |              | 1              | 5           | 20          | 40          |
| Changing the estate tax rate                              |             |              |              |              |              |              |              |                |             |             |             |
| 0.00                                                      | —           | 5.879        | 0.482        | 0.199        | 3.016        | 0.874        | 0.765        | 35.3           | 50.7        | 63.5        | 79.1        |
| 0.10                                                      | 15.1        | 5.900        | 0.481        | 0.197        | 3.010        | 0.878        | 0.761        | 34.5           | 50.0        | 62.8        | 78.7        |
| <b>0.24</b>                                               | <b>15.1</b> | <b>5.931</b> | <b>0.480</b> | <b>0.195</b> | <b>3.000</b> | <b>0.881</b> | <b>0.753</b> | <b>33.5</b>    | <b>48.9</b> | <b>61.9</b> | <b>77.9</b> |
| 0.30                                                      | 15.1        | 5.958        | 0.479        | 0.194        | 2.992        | 0.883        | 0.751        | 33.1           | 48.6        | 61.6        | 77.7        |
| 0.40                                                      | 15.1        | 5.994        | 0.478        | 0.192        | 2.980        | 0.886        | 0.746        | 32.3           | 47.8        | 60.9        | 77.2        |
| 0.50                                                      | 15.1        | 6.032        | 0.477        | 0.191        | 2.969        | 0.895        | 0.743        | 31.7           | 47.2        | 60.4        | 76.9        |
| 0.90                                                      | 15.1        | 6.102        | 0.475        | 0.181        | 2.947        | 0.975        | 0.734        | 29.9           | 45.6        | 59.1        | 76.0        |
| Changing the estate tax exemption level                   |             |              |              |              |              |              |              |                |             |             |             |
| 0.24                                                      | 10.0        | 5.938        | 0.480        | 0.194        | 2.998        | 0.883        | 0.753        | 33.6           | 48.9        | 61.9        | 77.9        |
| <b>0.24</b>                                               | <b>15.1</b> | <b>5.931</b> | <b>0.480</b> | <b>0.195</b> | <b>3.000</b> | <b>0.881</b> | <b>0.753</b> | <b>33.5</b>    | <b>48.9</b> | <b>61.9</b> | <b>77.9</b> |
| 0.24                                                      | 20.0        | 5.929        | 0.480        | 0.195        | 3.001        | 0.880        | 0.753        | 33.4           | 49.0        | 61.9        | 77.9        |
| Changing both the estate tax rate and the exemption level |             |              |              |              |              |              |              |                |             |             |             |
| 0.55                                                      | 2.7         | 6.097        | 0.476        | 0.185        | 2.949        | 0.915        | 0.735        | 32.1           | 47.1        | 60.2        | 76.1        |

Table 13: Effects of changing estate tax, adjusting the labor income tax rate.

budget balance when reforming estate taxation. It should be noted that, as we have a large number of state variables and we need to preserve tractability, we assume exogenous labor supply. However, even in this case, changing proportional labor income taxation to re-establish government budget balance affects the importance of human capital inheritance across generations as, for example, raising the tax on labor earnings reduces the advantage of being born to more able parents and having a higher expected gross life-time income. In addition, it also has the standard, wealth effect by affecting the net present value of lifetime earnings and, due to borrowing constraints, it affects the ability to consume at younger ages. It also has general equilibrium effects on prices. Changing the tax on capital income to re-establish budget balance, in contrast, changes the incentives to save by affecting the net rate of return on capital.

First, we notice that the effects of changing estate taxation on inequality are very similar when we use the labor or the capital income tax to balance the budget. Second, we find that the interest rate monotonically increases with estate tax rate. This is because a higher estate tax rate discourages wealth

accumulation and as a result, a higher interest rate is needed to encourage saving. The monotonic increases of the interest rate leads to a monotonic decreasing in wage rate and a monotonic increase capital-output ratio. On the contrary, when the capital income tax is used to adjusted, there is no such monotonic response of the interest rate, wage rate and capital-output ratio. For example, after a raise in estate tax, a higher after-tax interest rate is needed to encourage saving. Since the tax rate on capital income decreases, the interest rate does not necessarily increase. Lastly, we compare the tax burdens resulting from changing the labor income tax, or the capital income tax, to implement the statutory estate taxation in place in year 2000. Table 10, shows that the resulting tax burdens are surprisingly similar, with the slight exception of the wealthiest 1%, who pay a slightly larger fraction of the capital income tax due to higher wealth holdings.

| Wealth Percentile | Age   | Capital tax | Labor tax | Estate Tax | Total tax |
|-------------------|-------|-------------|-----------|------------|-----------|
| 0-1%              | 65.59 | 32.05       | 7.47      | 72.47      | 17.03     |
| 1-5%              | 66.49 | 15.04       | 6.67      | 15.62      | 9.10      |
| 5-10%             | 62.42 | 13.11       | 7.90      | 7.12       | 9.02      |

Table 14: Fraction of taxes paid at selected wealth percentile from the top, adjusting the labor income tax rate.

| Wealth Percentile | Age   | Capital tax | Labor tax | Estate tax | Total tax |
|-------------------|-------|-------------|-----------|------------|-----------|
| 0-1%              | 65.59 | 1.28        | 0.95      | 0.805      | 3.03      |
| 1-5%              | 66.49 | 0.15        | 0.21      | 0.043      | 0.41      |
| 5-10%             | 62.42 | 0.10        | 0.20      | 0.016      | 0.32      |
| average           | 50.70 | 0.04        | 0.13      | 0.011      | 0.18      |

Table 15: Average tax burden at selected wealth percentile from the top, adjusting the labor income tax rate.

## 8 Conclusions

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 the 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 and in the context of the observed rise in wage inequality that took place in the United States (see Heathcote et al. [22] for a discussion of the macroeconomic effects of these changes.)

Thirdly, and importantly, we assume an exogenous transmission of ability, or human capital, across generations, thus not modelling this interesting channel 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] and Greenwood et al. [21].

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