Product Number WP 2000-3
June 30, 2000

From the
Office of Tax Policy Research

WORKING PAPER SERIES

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by

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June 2000

I owe thanks to participants of the public finance seminar at The University of Michigan and the Brookings conference on "Rethinking Estate and Gift Taxation," including D. Holtz-Eakin, J. Slemrod, and W. Gale, for a number of helpful comments and suggestions on an earlier version of this paper.

SIMULATING THE EFFECTS ON INEQUALITY AND WEALTH ACCUMULATION OF ELIMINATING THE FEDERAL GIFT AND ESTATE TAX

John Laitner

ABSTRACT

This paper employs a neoclassical general equilibrium model to study the effect on steady-state aggregate wealth accumulation and the cross-sectional distribution of wealth of eliminating the U.S. gift and estate tax. In the model, overlapping generations of families each live multiple periods, have life cycles of earnings and retirement, and accumulation/decumulate wealth according to the life-cycle model of saving behavior. Some, or all, households are altruistic in the sense of caring about the utility of their descendants. There is an exogenous distribution of earning abilities within every birth cohort. An altruistic household with high earnings may choose to leave an estate. Total wealth accumulation determines the economy wide interest rate. The earnings distribution and bequest behavior, determine a long-run cross-sectional distribution of wealth.

This paper calibrates the model's parameters from 1995 U.S. data and simulates steady-state equilibria with and without estate taxes. The analysis offers two possible calibrations. In one, all households are altruistic. Average bequest amounts then seem roughly consistent with data, but the simulated distribution of wealth is much less concentrated than the empirical U.S. distribution. In the second, only 5-10 percent of family lines are altruistic. The simulated wealth distribution is then quite concentrated, but the average bequest of altruistic households seems larger than data show.

Under the first calibration, eliminating the U.S. gift and estate tax leaves the steady-state equilibrium aggregate capital stock virtually unchanged. The degree of inequality in the cross-sectional distribution of wealth rises slightly. Under the second calibration, the same tax change raises the steady-state capital-to-output ratio of the economy by 2-6 percent. Wealth inequality rises even more substantially, however, with the share of the top 1 percent of wealth holders expanding by 20-45 percent.

Simulating the Effects on Inequality and Wealth Accumulation of Eliminating the Federal Gift and Estate Tax

John Laitner

Recent political debates include proposals to reduce or eliminate the Federal unified gift and estate tax. This paper attempts to analyze the possible long–run consequences of such a change, focusing in particular on (i) national wealth accumulation and (ii) the degree of inequality in the cross–sectional distribution of net worth among households.

This paper works with a structural model. Economists have proposed a number of theories of intergenerational transfer behavior (e.g., Laitner [1997]), including theories in which transfers arise inadvertently from incomplete annuitization, theories in which they constitute repayment for services (such as care for an elderly donor), and theories in which they arise intentionally as donors seek to augment their descendants' resources. Since an array of exemptions and credits imply the Federal tax only affects large gifts and estates, we concentrate on intentional transfers. Among theories for the latter, some stress a donor's joy of giving, and others a donor's concern for his heirs' utility. The former do not necessarily have clear tax implications — as a donor might derive joy in proportion either to his gross or net–of–tax estate. The latter, so–called "altruistic" models, avoid this potential problem and have the added benefit of consistency both with the "representative agent" paradigm which macroeconomic theorists employ widely and with the casual empirical observation that very prosperous families are the ones most likely to leave estates (e.g., Modigliani [1986]). Our analysis adopts the altruistic framework.

This paper constructs an intertemporal general equilibrium model with heterogeneous households, a simple government sector, and an aggregate production function. Households have differing earning abilities, and they may care about their grown children to different degrees. A household lives for a number of periods, and life–cycle saving is important. Since households may care about the utility of their descendants, there can also be intergenerational transfers in the form of *inter vivos* gifts or bequests. Altruistic households with high earning abilities relative to their children are, for example, likely to make intergenerational transfers. Expectations are fully rational. The complexity of the framework limits our analysis to long–run, steady–state equilibria. The model generates a stationary distribution of wealth. We compare it with the actual distribution and study the consequences for it of changes in the gift and estate tax. We also consider the long–run effects of the tax on aggregative national wealth.

The organization of this paper is as follows. Section I provides an overview, including a summary of results. Section II presents the model in more detail. To derive quantitative results, Sections III–IV turn to numerical analysis. Section III calibrates the model's parameters from a variety of data sources; Section IV presents policy simulations. Section V concludes.

I. Overview

This paper constructs an intertemporal general equilibrium model. The model's parameters characterize household preference orderings and aspects of the production technology; they are invariant with respect to tax changes. If we alter gift and estate taxes, the model enables us to follow the consequences for the aggregate capital stock in a context in which other taxes adjust to preserve the government's budget constraint, and in which the interest rate moves to a new equilibrium level. Since the model, after trend corrections, determines a stationary equilibrium distribution of wealth, we can also study how wealth inequality changes subsequent to modification of the tax system. Although Section II references propositions about existence and provides a diagram which summarizes several aspects of the analysis, our quantitative results stem from numerical solutions of the model.

The model has life–cycle saving for all families. This part of the framework includes children, retirement, income taxes, and social security taxes and benefits. Labor supply is inelastic. Annuity and life insurance markets exist and function. There is an exogenous distribution of family earning abilities. Each household learns its lifetime earning ability early in adulthood, and earning abilities are heritable to a degree within family lines. A fraction λ of family lines is dynastic; the remaining fraction, $1-\lambda$, are not. Non–dynastic families care only about their own lifetime consumption, including the consumption of minor children living with them. They do not make *inter vivos* gifts or bequests to their grown children.

Dynastic, or "altruistic," families care as well about the consumption of their adult children, grandchildren, etc. Dynastic families have earning ability draws from the same distribution as households in general, and their life cycles are analogous to those of other families. The descendants of dynastic families are also dynastic. Dynastic families may choose to make intergenerational transfers, although the latter must be nonnegative. Parents with high earnings and/or a large inheritance are likely candidates to make transfers, especially if their children have lower earning abilities than they do. Life–cycle saving, private intergenerational transfers, and the overall distribution of earnings determine wealth holdings. The analysis in this paper considers only long–run, steady–state equilibria.

Section III calibrates the model. There are four key parameters. One determines the slope with respect to age of life–cycle consumption profiles. We set this parameter from survey data on consumer expenditures. A second parameter determines the weight altruistic parents assign to descendants' well–being relative to their own. We calibrate the second parameter so that our numerical solutions replicate the empirical aggregate stock of wealth. The third key parameter, γ, jointly sets risk aversion and willingness to substitute consumption over different ages. The fourth parameter is λ, the fraction of dynastic households in the economy. Section III jointly calibrates γ and λ to match the empirical degree of wealth inequality and Federal gift and estate tax revenues.

A surprising result is that when $\lambda = 1$, so that all families are dynastic, private intergenerational transfers contribute rather modestly to overall wealth inequality. In fact, when $\lambda = 1$, the model falls short of explaining the degree of inequality of the empirical distribution of wealth. In terms of consistency with the empirical distribution of bequests and estate tax collections, on the other hand, the model seems reasonably satisfactory.

When only a fraction of households are altruistic, the model can match the actual distribution of wealth more closely. A value of λ of about .05 seems to yield good results. In other words, bequests and inheritances can explain a high degree of wealth inequality when only a small minority of households are altruistic. With a low λ, however, the simulated distribution of bequests deviates from the empirical distribution: in the simulations nearly all altruistic households leave multi–million dollar estates, whereas data from tax returns implies that estates of this magnitude are very rare.

At this point, the model then offers either (i) a plausible distribution of bequests but an overly equal distribution of wealth or (ii) a reasonably good match with the empirical distribution of wealth but a less than entirely satisfactory distribution of bequests.

Section IV studies the long–run consequences of eliminating the Federal gift and estate tax. After eliminating the tax, we calculate a new steady–state equilibrium interest rate, adjusting income taxes to maintain the former ratio of government spending to output. For the best calibration with $\lambda = 1$, eliminating the estate tax has almost no effect on the economy's long–run capital intensivity. The steady–state distribution of wealth becomes moderately less equal: its Gini coefficient rises slightly, although the fraction of wealth held by the top 1 percent increases by 16%. For the best calibration with $\lambda = .05$, on the other hand, eliminating the estate tax causes the aggregative capital to output ratio to increase about 2.5% in the long run, with the gross of tax interest rate falling as much as 60 basis points. In view of the relatively small revenues of the gift and estate tax, these effects are quite impressive. Wealth inequality rises more sharply than before, however, with the fraction of wealth of the top 1 percent expanding 32%.

With either choice of calibration, the analysis suggests that reducing the Federal gift and estate tax is likely to raise the concentration of the cross–sectional distribution of wealth. If one's primary goal is to increase the aggregative capital–to–output ratio, perhaps policies such as paying down the national debt deserve careful consideration as alternative options.

II. The Model

The model is neoclassical. Parts are conventional. Technological change is exogenous, and there is an aggregate production function. As in standard overlapping generations frameworks, households have finite lives. However, the model has three distinctive features. First, households may be "altruistic" in the sense of caring about the utility of their grown–up descendants.[1] Second, within each birth cohort there is an exogenous distribution of earning abilities. Third, households face borrowing constraints: because of bankruptcy laws, creditors will not extend loans without collateral; hence, households cannot have negative net worth. The first two features lead to a distribution of intergenerational transfers: a high–earning–ability, altruistic parent with a low–earning–ability child will want to make an *inter vivos* gift or a bequest, but a low–earning–ability parent with a high–earning–ability child, or a non–altruistic parent, will not. The third feature creates another reason for intergenerational transfers, in particular, *inter vivos* gifts: even parents who do not intend to make bequests at death may want to make lifetime transfers to their grown children if the children are liquidity constrained, say, when they are in their twenties.

There is a longstanding controversy within the economics profession over the relative importance for national wealth accumulation of life–cycle saving and estate building (e.g.,

[1] In this paper, parents may care about their grown children, but children, by assumption, do not reciprocally care about their aged parents.

Kotlikoff and Summers [1981], Modigliani [1988], Kotlikoff [1988]). Following the lead of Blinder [1974] and Davies [1982], this paper incorporates both motives for wealth accumulation; Section III's calibrations determine their relative roles. If we had included only bequest–motivated saving, our analysis might overstate the significance of estate taxation for overall wealth accumulation. Furthermore, a model without life–cycle saving compels inheritance to explain wealth inequality entirely — again risking exaggeration of the effects of estate–tax reform.

In contrast to Blinder [1974], parents in this paper's model determine their bequests by balancing their own resources and needs against their adult children's earning abilities and needs. The model is more analogous to Davies [1982], although our computations proceed all the way to a long–run equilibrium with a stationary distribution of inheritances and wealth. The basic framework is similar to Laitner [1992], although the present paper incorporates estate taxes, assumes that earning abilities are heritable within family lines, and allows limited altruism in the sense that a parent caring about his grown children may, in his calculations, weight the children's lifetime utility less heavily than his own. Further — and this turns out to be significant in the calibrations — this paper allows a fraction of households to be altruistic, while the remainder are not.

Other comparisons to the existing literature are as follows. In contrast to Becker and Tomes [1979], Loury [1981], and many others, the present paper omits special consideration of human capital. In contrast to Davies [1981], Friedman and Warshawsky [1990], Abel [1985], Gokhale *et al.* [1999], and others, the present paper assumes that households purchase actuarially fair annuities to offset fully mortality risk; consequently, all bequests are intentional. In contrast to Bernheim and Bagwell [1988], this paper assumes perfectly assortative mating — adopting the interpretation of Laitner [1991], who shows that a model of one parent households, each having one child, can mimic the outcomes of a framework in which each set of parents has two children and mating is endogenous.

In contrast to Blinder [1974], Auerbach and Kotlikoff [1987], and others, the present paper assumes that households supply labor inelastically. Similarly, each surviving household retires at age 66. Presupposing an inelastic labor supply eliminates, of course, potentially interesting implications about the work incentives of heirs (see, for example, Holtz–Eakin *et al.* [1993]). This ultimately may lead to an understatement of the importance of intergenerational transfers: in practice, a parent having an exceptionally high earning ability may decide, on the basis of the principle of comparative advantage, to work long hours and to build a very large estate, letting his descendants enjoy both higher consumption than they could otherwise afford and more leisure than the donor takes for himself.

Finally, this paper's model does not explore possible strategic behavior on the part of heirs (e.g., Gale and Perozek [2000]). For example, the child of a high earning ability parent might intentionally save nothing in youth in order to extract a larger bequest.

<u>Framework</u>. In the analysis, time is discrete and the population is stationary. Think of each household as having a single parent and single offspring (see the reference to assortative mating above). The parent is age 22 when a household begins. The parent is 26 when his child is born. When the parent is 48, the child is 22. At that point, the child leaves home to form his own household. The parent works from age 22 through 65 and then retires. No one lives beyond age 87. There is no child mortality. In fact, for

simplicity we assume all parents live at least through age 48. Between 49 and 87, the age of death is uncertain.

Because of experiential human capital, each household's earnings rise naturally with age. There is also labor–augmenting technological progress at a constant rate, affecting all households equally. Finally, each adult has an individual earning ability. There is an intergenerational stochastic process for abilities, such that each adult's ability is geometric average of his father's ability and random sampling from an exogenous distribution. The intergenerational correlation of abilities follows estimates from Solon [1992]. The exogenous shock comes from a noncentral T–distribution — allowing thicker tails than the more traditional choice of a normal distribution. The stochastic process assigns an ability to each adult at age 22. The ability remains fixed throughout the adult's life, and it is public knowledge (visible, in particular, to the adult's parents). A household's earnings at a given age are the product of its human capital, its ability, the state of overall technology, and the wage rate. Our analysis is limited to steady–state equilibria in which the wage rate, the interest rate, the income tax rate, and the social security tax rate are constant over time.

Utility is isoelastic, so that preferences are homothetic. This allows a steady–state equilibrium despite technological progress. As explained, we think of each household as having a single adult and raising a single child. An adult's life has two phases. The first begins at age 22 and closes after age 47. At 22, the adult learns his earning ability and the present value of all transfers that he will receive from his parent. He chooses a terminal net worth level (for age 47), and then he solves a life–cycle problem for ages 22–47. He must pay a proportional income tax and a proportional social security tax up to the latter's statutory earnings maximum. Other than paying taxes and saving to meet his terminal goal, the adult allocates consumption between his minor child and himself to maximize private utility. He does face, however, a nonnegativity constraint on net worth at every age. In choosing his net worth for the close of his first phase of life, an adult seeks to maximize his subsequent expected utility.

This paper assumes that parents part with their transfers to their adult children as late as they can. This enables them to limit the potential strategic behavior of their children, and it seems consistent with donors' apparent reluctance to distribute their estates through gifts instead of bequests (e.g., Pechman [1987, tab.8.2] and Poterba [1998, tab.4]). Thus, in the first phase of life, until his parent dies an adult will actually receive in any given year only the portion of his inheritance needed to lift his current liquidity constraints. The remaining estate arrives, of course, at his parent's death. For simplicity, we assume that if the parent remains alive at age 74 (when the child is 48), the remaining transfer takes place then — and is called a "bequest."[2] The model has no generation skipping transfers from parents to grandchildren.

The second phase of life runs from age 48 to 88. At age 48 an adult's inheritance is

[2] The reason for the arbitrary age limit of 74 for transfers is as follows. After age 74, the grandchild's earning ability is revealed. While the additional information would affect the parent's planning in theory, in practice it seems unlikely that surviving 75 year olds alter their consumption and wills appreciably in view of their grandchildren's early success in the labor market.

complete, and his child has become an adult. He learns his child's earning ability, and sets his transfer. As above, he implements the transfer through *inter vivos* gifts over years in which his child is liquidity constrained, and through a bequest at death or age 74. The parent annuitizes the remainder of his assets, and he uses the assets plus his remaining earnings and social security benefits for his own life–cycle consumption.

To determine a household's asset goal for the close of age 47 and its desired intergenerational transfer to its adult child, we must solve a pair of so–called Bellman equations. Appendix A provides the details of these equations and of the life–cycle calculations outlined above.

The remainder of the economy is more straightforward. There is a Cobb–Douglas aggregate production function through which the economy's aggregate physical capital stock and total effective labor supply determine the current GDP. (The model omits government capital and consumer durables.) Setting the price of units of GDP to 1 and assuming perfect competition, the marginal products of effective labor and physical capital determine the wage and interest rate.

The model has government debt — the empirical government debt seems too large to overlook in the calibrations of Section III. We assume that the ratio of debt to total GDP is constant through time; that the ratio of social security retirement benefits to GDP is constant; that the social security system is unfunded, so that current social security tax revenues just equal current benefits; and, that government spending on goods and services is an unchanging fraction of GDP. Section III describes the gift and estate tax, which is the most elaborately specified tax in the model. Finally, there is a proportional tax on interest and wage income. Each simulation solves for the income–tax rate necessary to preserve balance in the government's budget constraint.

The economy is closed. Thus, Walras law implies that equilibrium requires two conditions. First, the sum of the current effective labor from all households provides the aggregate supply of labor, and the production sector provides the aggregate demand. For (our neoclassical) equilibrium, we need the total labor supply to equal the labor input of the aggregate production function. Second, the sum of the current net worth of all households provides the economy's supply of financing. The demand for financing is the sum of next period's government debt and next period's physical capital stock. Again, equilibrium requires equality of supply and demand. Put another way, to calculate an equilibrium for the model one must find an income tax rate and an aggregative capital–to–labor ratio such that (a) the implied net–of–tax wage and interest rates from the aggregate production function induce household wealth accumulation just sufficient to finance the given capital–to–labor ratio, and (b) implied tax collections are just sufficient to finance current government spending and debt service net of steady–state debt growth. In fact, this paper focuses exclusively on steady–state equilibria in which factor payments and tax rates are indefinitely constant and capital, effective labor, and GDP grow at the rate of technological progress. Appendix A presents details of the framework.

Computation of Equilibrium. Figure 1 summarizes the sectoral components of our model.

Figure 1 here

Figure 1: The steady–state equilibrium demand and supply of financing

On the vertical axis we have potential steady-state gross–of–tax interest rates. Letting W be the steady–state gross–of–tax wage rate corresponding to a given r, E_t the aggregate effective labor supply, K_{t+1} the physical capital stock ready for use at the start of the next period, and D_{t+1} national debt which private–sector creditors must carry from t to $t+1$, the horizontal axis gives the amount of credit at time t supplied by the household sector and used by government and business. Our Cobb–Douglas aggregate production function implies a constant ratio of factor shares, leading to a hyperbolic relation of r and $K_t/(W \cdot E_t)$ — hence, given a steady state, of r and $K_{t+1}/(W \cdot E_t)$. Our assumptions about government debt make $D_{t+1}/(W \cdot E_t)$ constant. Thus, uses of credit determine the demand curve in Figure 1. (Appendix A provides details.)

For any interest rate, household behavior and the government budget constraint determine a long–run supply of credit (relative to the wage bill). For given any r, we can jointly solve for the household sector's supply of credit and the income tax rate satisfying the government's budget constraint. This determines the supply curve in Figure 1. Straightforward amendments of Propositions 1–3 in Laitner [1992] establish that the supply curve has an asymptote at r^U specified in Appendix A. An intersection in Figure 1 determines a steady–state equilibrium for the model. There are no steady states above the asymptote (household net worth is infinite in that range). Although multiple intersections are theoretically possible in Figure 1, they do not arise in the numerical computations below.

Appendix A lays out a series of numerical steps which generate points on the curves in Figure 1, enabling one to compute their intersection.

Digressing for a moment, the shape of the supply curve in Figure 1 has great potential interest. The supply of credit must become extremely interest elastic near its asymptote. If our steady–state equilibrium occurs in that range, for example, near point B, we have an implication reminiscent of Barro [1974]: a larger national debt, sliding the demand curve to the right, will barely change the equilibrium interest rate at all. We might label this the "Ricardian region" of the supply curve. At a point such as A, in contrast, an increase in government debt affects the economy as in the familiar overlapping generations model without bequests of Diamond [1965].

III. Calibration

The model has 15 parameters. Using 1995 as our base year, we set them to match data on the U.S. economy as closely as possible. With the parameters fixed, Section IV changes the Federal gift and estate tax and computes new long–run equilibria.

We calibrate most of the parameters from familiar sources. Appendix B provides details of the steps. Since the parameters setting the shape of life–cycle consumption profiles and the degree of altruism are more subtle, we discuss them separately. Likewise, we devote extra attention to the distribution of earnings, since the model proves to be sensitive to it. This section also reviews the model's treatment of the existing Federal gift and estate tax. Finally, we turn to the two most difficult parameters to calibrate.

Lifetime consumption and the degree of altruism. Our specification of lifetime utility has a subjective discount factor β. This parameter specifies how heavily a household weights next–year's lifetime marginal utility relative to this year's. Although economists often surmise that $0 < \beta < 1$ because people are impatient, recent work by Barsky *et. al.* [1997] finds some support for $\beta > 1$ from survey evidence. We estimate β indirectly. The time path of life–cycle consumption for a liquidity constrained household must follow the household's flow of resources. For unconstrained households, however, the age profile of consumption per adult equivalent depends on the interest rate, the intertemporal rate of substitution, and the subjective discount factor. Given values for the first two, we set β so that lifetime consumption growth follows 1984–97 data from the *U.S. Consumer Expenditure Survey*. The survey enables us to track the consumption of different age cohorts over time. We pick 30–39 year olds as the least likely to have family composition changes or binding liquidity constraints. We find consumption per adult growing at about 2.5 percent per year. Appendix B provides details.

In their calculations of total utility, altruistic adults in our model weight their children's lifetime utility relative to their own with parameter ξ. We certainly expect $0 \leq \xi \leq 1$. The closer ξ is to 1, the closer parents are to valuing their grown children's utility as highly as their own; the closer it is to 0, the weaker altruism is. Lacking direct evidence, we set ξ so that at the 1995 empirical interest rate, our steady–state equilibrium intersection in Figure 1 has a ratio of wealth to labor income matching aggregative U.S. data.

Early simulations showed that the steady–state distribution of wealth was quite sensitive to the underlying distribution of earnings — in other words, to the distribution of earning abilities. The first column of Table 1 presents empirical characterizations of the U.S. earnings distribution from Huggett [1996]. Following Solon [1992], the present paper assumes that earning abilities evolve according to a log–linear equation, with a child's earning ability related to his father's with an intergenerational correlation of .45. The equation also has a random component. Choosing a distribution and variance for the random component, the equation determines a stationary distribution. We adjust the variance of the random component so that the stationary distribution roughly matches U.S. Census data (see Appendix B). With a normal distribution for the random component (in an equation determining the evolution of the log of ability), Table 1 shows we obtain a distribution of earnings similar to Huggett's. Column 3 shows that a T–distribution with 9 degrees of freedom matches Huggett almost as closely. The T–distribution does allow a slightly larger share of total earnings for the top 1 percent of earners, however, and that leads to a noticeable improvement relative to empirical evidence in the simulated wealth distributions below. All of the simulations in this paper use the T–distribution.

Table 1 here

Estate taxes. Our discussion of the taxation of intergenerational transfers is limited to the Federal gift and estate tax.[3] Recall that when a parent is age 48, his child leaves home and both the parent and child learn the latter's earning ability. At that point, the parent determines the present value of his total intergenerational transfer. Data show that although most wealthy decedents made gifts during their lives, actual taxable estates are an order of magnitude larger than taxable gifts (Pechman [1987, tab. 8.2] and Poterba [1998, tab.4]). Thus, in terms of tax liability, this paper assumes that all private transfers are taxed as estates. Table 2 presents 1995 marginal estate tax rates.[4] In 1995, donors had a lifetime credit of $192,800, bequests to spouses were tax free, and each parent could make a tax–exempt annual transfer of $10,000 per child. Elementary steps that a couple with two children could take to reduce their tax liability included using $40,000 of exemptions each year (a gift of $10,000 from each parent to each child), and transferring half of the ultimate bequest to children at each spouse's death. To capture these steps, our tax algorithm exempts $40,000 for each year of a child's life up to the date of the estate, it splits the remaining estate in half and applies Table 2's rate schedule and the $192,800 credit to each half, then it combines the tax liabilities for both halves as the parent household's full estate–tax liability.[5] Specifically, for any prospective transfer amount, the algorithm computes the tax liability for each possible (parent) age of death (up to 74), then it derives

[3] However, many states now set their estate taxes merely to pick up the credit which the Federal tax allows to states. Therefore, since for calibration purposes below we adjust our assessment of Federal estate tax collections to incorporate this credit, our treatment does, in effect, include most state death taxes.

[4] In practice, there was an eighteenth bracket with marginal rate .60, and a nineteenth bracket with rate .55 — emerging from the phase–out of lower infra–marginal rates. The simulations ignore the .60 bracket.

[5] As stated above, to capture the effect of assortative mating, our model has one adult

the expected value of the liability with mortality–table weights. A parent's estate pays taxes equaling the expected value amount (and the parent fully anticipates this). The model assumes that a parent who anticipates the possibility of a taxable estate can begin making tax–exempt $40,000 gifts before learning his child's earning ability, and that the parent has sufficient liquidity to do so. Think of gifts of this description to minor children as funding trust accounts — counted as part of parental net worth in our distributional analysis below. In fact, we have argued that parents act as though they want to control their net worth as long as possible; thus, in computing parental net worth, we deduct only such transfers as occur between parent ages 48–74, do not exceed the parent's eventual estate, and are necessary to lift a child's liquidity constraints. In practice, the latter may exceed or fall short of tax–exempt gifts needed for maximal tax avoidance.[6]

Table 2 here

Fraction of altruists and intertemporal elasticity of substitution. In our model, the fraction of family lines which are altruistic is λ. For the flow of utility at any age, the elasticity of utility with respect to consumption is γ. Selecting values for λ and γ is the remaining calibration task. We want to pick values so that the simulated distribution of wealth resembles the empirical distribution and so that simulated estate tax revenues resemble actual tax collections.

Table 3 presents empirical information on the cross–sectional distribution of net worth among U.S. households. The first column, from Wolff [1996], uses the 1983 *Survey of Consumer Finances*, aligned to national (Flow of Funds) totals. Net worth includes government bonds, real estate, corporate stock, cash, the surrender value of life insurance, etc., less debts. The data exclude most consumer durables, although not vehicles. The

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and one child per household. Nevertheless, our tax assessments reflect empirical households with two adults and two children.

[6] For example, for a very large estate gifts to lift liquidity constraints will exceed cumulative $40,000 exemptions, the parent in question would pay a gift tax in practice, and estate tax payments which our model computes will be correspondingly overstated. For a moderately large estate, in contrast, cumulative $40,000 exemptions may exceed the lifetime transfers we compute. Then for some ages, our computations will understate *inter vivos* transfers, overstate the wealth of the parent, and understate the wealth of the child.

figures include defined contribution pension accounts, but they omit the value of defined benefit pension rights. Likewise, future social security benefits are not part of net worth. The second column comes from Hurst *et al.* [1998] and is based on *The Panel Study of Income Dynamics* 1989, augmented with information on the highest wealth holders from *Forbes* magazine and other sources. The definition of net worth is similar to column 1. In both cases it seems likely that omission of defined–benefit pensions and consumer durables biases the concentration of wealth upward.

Table 3 here

The distribution of wealth clearly is much more concentrated than the distribution of earnings — recall Table 1. Net worth concentration may arise in part from the life–cycle pattern of wealth accumulation: households near retirement tend to have higher net worth than very young or very old families. Table 4 simulates a purely life–cycle model at a steady–state interest rate of .069 and an income tax rate $\tau = .2402$ (the latter is consistent with our model's government budget without estate tax revenues). Life–cycle accumulation explains 63% of the empirical ratio $(K_{t+1} + B_{t+1})/(W \cdot E_t)$. Recall that Kotlikoff and Summers [1981] suggest that life–cycle saving explains 20% or less of U.S. national net worth, while Modigliani [1988] argues that it accounts for 70–80%. Our results are in between, although closer to Modigliani. The Gini coefficient for the steady–state cross–sectional distribution of net worth generated from the life–cycle model is .69, and the shares of net worth for the top 1, 5, 10, and 20 percent of households are, respectively, 15, 36, 51, and 70%. Evidently the life–cycle model can account for part of the difference between the empirical earnings and wealth distributions; nevertheless, it falls short of explaining the wealth distribution's upper tail.

Table 4 here

The *Economic Report of the President* [1999] shows 1995 Federal revenues from the gift and estate tax of \$14.8 billion. Surrounding years suggest 1995 revenues were atypically low: tax revenues were \$15.2 billion in 1994, \$17.2 billion in 1996, \$19.8 billion in 1997, and \$24.1 billion in 1998. Further, Eller [1997, tab.1d] shows the Federal credit for state death duties was \$3.0 billion. Since money transferred to state governments does not alleviate the tax burden of individuals, a revenue figure of \$18–19 billion seems an appropriate calibration target.

Table 5 presents simulation results with different combinations of λ and γ. In every case, the government budget constraint holds (with the proportional income tax rate adjusting for different estate–tax revenues), β is set so that lifetime consumption grows at the empirical rate, and ξ is set so that private net worth matches the empirical combination of physical capital plus government debt. Because in the model many "bequests" occur at age 74 — rather than at death — we calculate cross–sectional wealth statistics in the simulations for ages 22–73.

Table 5 here

The parameter λ measures the fraction of family lines which are dynastic. To the extent that life–cycle saving fails to explain total national wealth, dynastic families must on average have higher net worth than nondynastic households. When λ is small, the equilibrium average amount of extra wealth that dynastic families carry must be larger, and the corresponding degree of inequality in the distribution of net worth will tend to be greater.

The role of γ is more complicated. Gamma determines both risk aversion and the (lifetime) intertemporal elasticity of substitution. A low γ denotes rigid preferences with regard to both risk and consumption variation over time. The second characteristic means that a parent who has a low γ, who is altruistic, and who has high resources relative to his child's earning ability will want to make a very substantial bequest. Accordingly, to maintain equality with the empirical capital–to–wage bill ratio, the simulations tend to require a lower ξ for a more negative γ. When both parameters are low, we end up with few, very large estates. In other words, a low γ tends to lead to high wealth inequality. Because of the progressive marginal rates in the estate tax, a more concentrated wealth distribution tends, in turn, to generate higher estate–tax revenues.

From Table 5 we select two combinations of λ and γ as plausible matches with 1995 U.S. data.

The first candidate occurs in the rows with $\lambda = 1$, where all households are altruistic. Then column 2 produces rough agreement with 1995 empirical estate–tax revenues. Intergenerational transfers make the distribution of wealth somewhat more unequal than Table 4's purely life–cycle economy: the Gini coefficient for the wealth distribution rises from .69 for the purely life–cycle economy to .73 in column 2; the fraction of wealth held by the top 1 percent of wealth holders rises from .15 to .19; and, the fraction held by the top 5 percent rises from .36 to .42. Nevertheless, comparison with Table 3 shows that simulated inequality remains below its empirical counterpart.

In the simulation with $\lambda = 1$ and $\gamma = -1$, 32 percent of all households receive an inheritance. Laitner and Ohlsson [2000] find that about 40 percent of households in the *Panel Study of Income Dynamics* eventually inherit. Other simulation output shows that *inter vivos* gifts make up 54–55% of private transfers in present value terms, and the average bequest is $91,000. Although the latter exceeds the average inheritance of $23,000 (in present value at age 50) which Laitner and Ohlsson report for the PSID, they measure the average inheritance per capita whereas this paper's $91,000 figure measures what an average couple would receive, this paper's simulation corresponds to 1995 whereas the PSID data come from 1984 (when the nominal GDP was only 54% as large as in 1995), heirs seem to have a general tendency to understate their inheritances in surveys (e.g., Cox [1987]), and wealthy households are underrepresented in the PSID (e.g., Hurst *et al.* [1998]). In terms of the distribution of estates, Johnson [2000] and Eller 1997] show that about 1.4 percent of U.S. decendents in 1995 had taxable estates, and Eller shows that about .8 percent had taxable estates over $1 million.[7] In the simulation with $\lambda = 1$

[7] Although in 1995 about 3.4 percent of decedents left estates over the $600,000 minimum for filing an estate tax form, spousal and charitable deductions rendered many of these estates nontaxable. Our model's bequests exclude transfers to spouses, and our model treats charitable bequests as part of the lifetime consumption of the decedent; hence, our simulated distribution of bequests seems most comparable to data on taxable estates. Of course, tax avoidance (e.g., Schmalback [2000]) presumably creates a downward bias in the data.

and $\gamma = -1$, the stationary distribution of bequests for 1995 has roughly 3.5 percent of households leaving estates over $600,000 and about 1.5 percent leaving $1 million or more. Since estate tax data refer to individuals, for comparability we need to divide simulated household bequests in half. Then less than 1 percent of decedents have estates over $1 million, and 1–1.5 percent have estates over $600,000.

A second candidate for a match has $\lambda = .05$ and $\gamma = -4$. The character of the long–run equilibrium is quite different from the first candidate. As stated, life–cycle saving alone accounts for about 63 percent of the economy's stock of wealth. When $\lambda = 1$ and $\gamma = -1$, all households are altruistic and about 32 percent leave an estate at death. When $\lambda = .05$ and $\gamma = -4$, only 5 percent of households are altruistic and slightly over 4.5 percent leave an estate. To generate the 37 percent of national wealth due to intergenerational transfers, the bequests of the tiny fraction of altruistic families must be huge in the second case. In the first case, households with exceptionally high earnings share their good luck through moderate transfers to their descendants, and traces of the original fortune will tend to die out rather quickly. In the second case, a small group of families have great inherited wealth, and they perpetuate their dynasties' fortunes with large estates — bequests only dip to 0 for altruistic dynasties suffering through a long sequence of generations with low earnings.

When $\lambda = .05$ and $\gamma = -4$, intergenerational transfers substantially contribute to overall wealth inequality. The Gini coefficient for the simulated distribution of wealth is .80, the empirical level reported in Table 3 being .78. The fractions of wealth for the top 1, 5, 10, and 20% of households are .25, .57, .69, and .81, respectively, compared to .25–.33, .47–.55, .61, and .80, respectively, in Table 3. Estate–tax revenues roughly match their actual 1995 value.

The problem with a very low λ comes from the bequest numbers themselves. With $\lambda = .05$ and $\gamma = -4$, although the average bequest is $119,000, the average bequest among altruistic households is $2.4 million. Virtually all altruistic households leave bequests, with well over 80 percent, in other words, over 4 percent of the total population of households, leaving over $1 million. In terms of individual decedents, slightly more than 3 percent have estates this large. One might rationalize the small fraction of households leaving an estate at all — slightly under 5 percent — in the simulations relative to the PSID (see above) by arguing that many of the PSID estates are small, perhaps being accidental transfers stemming from incomplete annuitization. However, the simulated distribution of bequests does not seem to resemble Eller's tax–return frequencies (as reported above) at all.

In the end, if one believes that all households have the same preferences, the top section of Table 5 implies that intergenerational transfer do not entirely explain the observable degree of wealth concentration. One might then want to investigate other theoretical frameworks to feel fully confident about the consequences of tax reform for inequality. Alternatively, if one believes that private intergenerational transfers are a major source of wealth disparity, Table 5's best calibrations have $\lambda = .05$ and $\gamma = -4$. A problem then is that the very high bequests of many dynastic households in the simulations seem difficult to square with empirical evidence.

Table 6 presents derived values of β and ξ. Recall that ξ is the weight a parent places on his marginal utility relative to his child's at the same date, and $\beta^{26} \cdot \xi$ is the weight a parent puts on his own marginal utility at age 22 relative to his child's marginal utility at age 22. For $\lambda = 1$ and $\gamma = -1$, $\xi = .168$ and the age–corrected weight is .166; for $\lambda = .05$ and $\gamma = -4$, $\xi = .119$ and the age–corrected weight is .847. Evidently, parents favor their own utility over their adult children's by a considerable degree in the simulations.

Table 6 here

Finally, note that Auerbach and Kotlikoff [1987] choose $\gamma = -3$ for their base case simulations. More recently, Barsky *et al.* [1997] estimate $\gamma = -4$ on the basis of survey questions about intertemporal substitution, and $\gamma = -3$ to -11 from questions about risk aversion. These estimates seem roughly consistent with calibrations in Table 5 of $\gamma = -1$ to -4.

IV. Tax Changes

This section performs the comparative static exercise of eliminating the Federal gift and estate tax. The analysis fixes parameters (including β and ξ) as in Table 5, and then simulates without estate taxes. We adjust the proportional income tax rate so that the government's budget constraint holds despite lost estate–tax revenues, assuming that ratios of government spending to GDP and government debt to GDP remain as before. We are particularly interested in (i) what happens to private net worth and (ii) what happens to the degree of equality in the cross–sectional distribution of wealth. Table 7 presents results.

Table 7 here

Since increases in the income tax offset decreases in estate taxes, we cannot be sure whether the economy's capital intensivity will rise or fall after our policy change. Because of general equilibrium changes in factor prices, we cannot even know ahead of time whether wealth equality will rise or fall. Indeed, the table shows changes in either direction are possible for either capital intensivity or wealth inequality.

When $\lambda = 1$, our most interesting simulation has $\gamma = -1$. Compare Tables 5 and 7 in this case. Eliminating the estate tax leads to a very slight increase in the economy's steady–state capital intensivity: the aggregative wealth–to–wage bill ratio, and hence the wealth–to–GDP ratio, rises about .25%, and the gross interest rate essentially remains unchanged. The Gini coefficient of the distribution of wealth rises from .73 to .74. The fraction of wealth owned by the top 1 percent shows the biggest effect: it rises from .19 to .22, an increase of 16%.

When $\lambda = .05$ and $\gamma = -4$, the steady–state aggregative wealth to GDP ratio increases 2.6% after the elimination of the estate tax. The gross of tax interest rate falls from 6.9 to 6.3 percent per year. Again, the Gini coefficient of the wealth distribution does not change much — from .80 to .81. However, the share of the top 1 percent of wealth holders increases substantially — rising from .25 to .33, an increase of 32%.

In sum, according to the model eliminating the estate tax has small effects on the economy's overall capital intensivity in the preferred calibrations with $\lambda = 1$. While the effect on the Gini coefficient of the cross–sectional wealth distribution is also small, the top of the distribution becomes more concentrated: the fraction of wealth held by the top 1 percent rises 16%. In the case with $\lambda = .05$ and $\gamma = -4$, the steady–state wealth–to–GDP ratio increases over 2 percent, a fairly impressive change given the small revenues of the estate tax. Again, wealth inequality rises as well, especially at the very top of the distribution, with the share of the wealthiest 1 percent of asset holders increasing 32%.

V. Conclusion

This paper develops a neoclassical, general equilibrium model of the steady–state distribution of wealth. Calibration outcomes seem to leave two choices: either one can assume all households are altruistic, or one can assume that a small fraction are altruistic and the remainder are not.

In the first case, the model does not explain the high degree of concentration evident in the U.S. distribution of wealth, though average simulated bequest amounts seem plausible, as does their distribution. In this case, the model predicts that eliminating the U.S. gift and estate tax would have very modest consequences for overall wealth accumulation and would moderately increase inequality in the long–run wealth distribution.

Alternatively, if we assume that only about 5 percent of all households are altruistic, the simulations are more consistent with the existing U.S. distribution of wealth. Unfortunately, the new simulations generate seemingly unrealistically large average bequests for altruistic households. In this case, eliminating the estate tax causes quite large increases in the steady–state capital intensity of the economy (especially relative to the small magnitude of gift and estate tax revenues). Increases in long–run wealth inequality are also substantial, however — with simulated increases in the share of wealth of the wealthiest 1 percent of families of 32% in the favored case. In view of the possible consequences for inequality, if the objective of estate tax reform is to increase national wealth accumulation, our results suggest that one might want carefully to consider other options, such as lowering the national debt or strengthening the social security trust fund (e.g., Laitner [2000]).

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Appendix A

This appendix presents the paper's model in mathematical detail.

An adult who was born at time t and who has earning ability z supplies $e_s \cdot z \cdot g^{t+s}$ "effective" labor units at each age $s \geq 22$. If z' is the earning ability of the adult's child, following Solon [1992],

$$\ln(z') = \rho \cdot \ln(z) + \eta, \tag{1}$$

where $\rho \in (0,1)$ is a parameter and η is a random variable. Solon assumes η has a normal distribution. In order to allow thicker tails on the earnings distribution, this paper assumes η has a noncentral T distribution. The latter has density

$$\frac{\Gamma(\frac{n+1}{2})}{\sigma_\eta \cdot \Gamma(\frac{n}{2}) \cdot \sqrt{\pi \cdot n}} \cdot \frac{1}{(1 + (\frac{\eta - \mu_\eta}{\sigma_\eta})^2/n)^{(n+1)/2}}\,, \tag{2}$$

where n is number of degrees of freedom.

This paper focuses on steady–state equilibria in which the wage per effective labor unit, W, the interest rate, r, the income tax rate, τ, and the social security tax rate, τ^{ss}, are constant. The fraction of adults remaining alive at age s is q_s. One plus the net–of–tax interest factor on annuities for an adult of age s is

$$R_s = \frac{1 + r \cdot (1 - \tau)}{q_{s+1}/q_s}\,. \tag{3}$$

If an adult has consumption c at age s, his household derives utility flow $u(c,s)$. If his minor child has consumption c^k, the adult's household derives, at age s, an additional utility flow $u^k(c^k,s)$. Our analysis sets

$$u(c,s) = \begin{cases} \frac{c^\gamma}{\gamma}, & \text{if } s \leq 65, \\ v^{1-\gamma} \cdot \frac{c^\gamma}{\gamma}, & \text{if } s > 65, \end{cases}$$

$$u^k(c,s) = \begin{cases} \omega^{1-\gamma} \cdot \frac{c^\gamma}{\gamma}, & \text{if } 26 \leq s < 48, \\ 0, & \text{if } s \geq 48, \end{cases}$$

with $\gamma < 1$. Appendix B discusses the relative weights for retirement consumption, v, and minor children, ω.

Consider a parent aged 48. Let t be the year he was born. Let his utility from remaining lifetime consumption be $U^{old}(A', z, t)$, where his earning ability is z, and his assets for remaining lifetime consumption are A'. Then

$$U^{old}(A',z,t) = \max_{c_s} \sum_{s=48}^{88} q_s \cdot \beta^{s-48} \cdot u(c_s,s), \tag{4}$$

subject to: $A_{s+1} = R_{s-1} \cdot A_s + e_s \cdot z \cdot g^{t+s} \cdot W \cdot (1-\tau-\tau_{ss}) + ssb(s,z,t) \cdot (1-\frac{\tau}{2}) - c_s,$

$$A_{44} = A' \quad \text{and} \quad A_{89} \geq 0,$$

where $u(.)$ and q_s and R_s are as above, $\beta \geq 0$ is the lifetime subjective discount factor, A_s stands for the net worth the parent carried to age s, and $ssb(s,z,t)$ specifies social security benefits at age s.

The utility over ages 22–47 for a parent born in year t is $U^{young}(A,A',z,t)$ if he carries assets A into age 22, carries assets A' out of age 47, and has earning ability z. We have

$$U^{young}(A,A',z,t) = \max_{c_s} \sum_{s=22}^{47} q_s \cdot \beta^{s-22} \cdot [u(c_s,s) + u^k(c_s^k,s)], \tag{5}$$

subject to: $A_{s+1} = R_{s-1} \cdot A_s + e_s \cdot z \cdot g^{t+s} \cdot W \cdot (1-\tau-\tau_{ss}) - c_s - c_s^k,$

$$A_{22} = A \quad \text{and} \quad A_{48} \geq A',$$

$$A_s \geq 0 \quad \text{all} \quad s = 22, ..., 48.$$

We assume bankruptcy laws prevent households from borrowing without collateral, giving us the last inequality constraint in (5) — but, for the sake of simplicity, that such constraints do not bind for older households, making them superfluous in (4).

A nonaltruistic household solves

$$max_{A' \geq 0} \; \{U^{young}(0,A',z,t) + \beta^{26} \cdot U^{old}(A',z,t)\}. \tag{6}$$

To incorporate altruism, let $V^{young}(A,z,t)$ be the total utility — combining utility from lifetime consumption and from the lifetime utility of descendants — of a 22–year old altruistic household carrying initial assets A to age 22, having earning ability z, and born at time t. Let $V^{old}(A',z,z',t)$ be the total utility of a 48–year old altruistic household which begins age 48 with assets A', and has just learned that its grown child has earning ability z'. Then letting $E[.]$ be the expected value operator and $\xi > 0$ the intergenerational subjective discount factor, we have a pair of Bellman equations

$$V^{young}(A,z,t) = \max_{A' \geq 0} \{U^{young}(A,A',z,t) + \beta^{26} \cdot E_{z'|z}[V^{old}(A',z,z',t)]\},$$

$$V^{old}(A', z, z', t) = \max_{B \geq 0} \{U^{old}(A' - B, z, t) + \xi \cdot V^{young}(T(B,t), z', t+26)\},$$

where B is the parent's intergenerational transfer and $T(B,t)$ the net–of–transfer–tax inheritance of the child. We require $B \geq 0$, implying that parents cannot compel reverse transfers from their children.

Because utility is isoelastic,

$$U^{young}(A, A', z, t) = g^{\gamma \cdot t} \cdot U^{young}(A/g^t, A'/g^t, z, 0),$$

and, assuming social security benefits rise with growth factor g between cohorts,

$$U^{old}(A', z, t) = g^{\gamma \cdot t} \cdot U^{old}(A'/g^t, z, 0).$$

Similarly, provided estate–tax exemptions, credits, and brackets grow over time with factor g, one can deduce

$$V^{young}(A, z, t) = g^{\gamma \cdot t} \cdot V^{young}(A/g^t, z, 0),$$

$$V^{old}(A', z, z', t) = g^{\gamma \cdot t} \cdot V^{old}(A'/g^t, z, z', 0).$$

Substituting a for A/g^t and b for B/g^t, one can, therefore, rewrite the Bellman equations as

$$V^{young}(a, z, 0) = \max_{a' \geq 0} \{U^{young}(a, a', z, 0) + \beta^{26} \cdot E_{z'|z}[V^{old}(a', z, z', 0)]\}, \qquad (7)$$

$$V^{old}(a', z, z', 0) = \max_{b \geq 0} \{U^{old}(a' - b, z, 0) + \xi \cdot g^{\gamma \cdot 26} \cdot V^{young}(T(b, 0)/g^{26}, z', 0)\}. \qquad (8)$$

If $\phi(s, t, z)$ is the net worth of a family of age s, ability z, and birthdate t, homotheticity also implies

$$\phi(s, t, z) = g^t \cdot \phi(s, 0, z). \qquad (9)$$

This paper assumes all families have identical v, ω, and β. At first all households have a common ξ as well. Later, however, we allow two values of ξ: a fraction λ of family lines have $\xi > 0$, but a fraction $1 - \lambda$ have $\xi = 0$.

Turning to the production and government sectors, the aggregate production function is

$$Q_t = [K_t]^{\alpha} \cdot [E_t]^{1-\alpha}, \quad \alpha \in (0, 1), \qquad (10)$$

where Q_t is GDP, K_t is the aggregate stock of physical capital, and E_t is the effective labor force. K_t depreciates at rate $\delta \in (0,1)$. The price of output is always 1. Perfect competition implies

$$W_t = (1-\alpha)\cdot\frac{Q_t}{E_t} \quad \text{and} \quad r_t = \alpha\cdot\frac{Q_t}{K_t} - \delta. \tag{11}$$

The government issues D_t one–period bonds with price 1 at time t. We assume

$$D_t/Q_t = \text{constant}. \tag{12}$$

Letting SSB_t be aggregate social security benefits, we assume

$$SSB_t/Q_t = \text{constant}. \tag{13}$$

The social security system is unfunded, so

$$SSB_t = \tau^{ss}\cdot W_t \cdot E_t. \tag{14}$$

If G_t is government spending on goods and services, assume

$$G_t/Q_t = \text{constant}. \tag{15}$$

Leaving out the social security system, in which benefits and taxes contemporaneously balance, the government budget constraint is

$$G_t + r_t\cdot D_t = \tau\cdot[W_t\cdot E_t + r_t\cdot K_t + r_t\cdot D_t] + D_{t+1} - D_t + ET_t, \tag{16}$$

where ET_t is estate–tax revenues. Assume public–good consumption does not affect marginal rates of substitution for private consumption.

Normalizing the size of the time–0 birth cohort to 1 and employing the law of large numbers,

$$E_t = \sum_{s=22}^{65} g^t \cdot q_s \cdot e_s. \tag{17}$$

Households finance all of the physical capital stock and government debt. Letting $f(.)$ be the density for z, and NW_t be the aggregate net worth held which the household sector carries from time t to $t+1$, the economy's supply and demand for credit balance, using the law of large numbers again, if and only if

$$\frac{K_{t+1}+D_{t+1}}{E_t} = \frac{NW_t}{E_t} \equiv \frac{\sum_{s=22}^{87} q_s \cdot \int_{-\infty}^{\infty} \phi(s,t-s,z)\cdot f(z)\,dz}{E_t}. \tag{18}$$

Alternatively, suppose a fraction of households λ are altruistic and the remainder are not. As stated in the text, dynasties permanently fall into one group or the other: descendants of altruistic households are themselves altruistic, whereas descendants of non–altruistic households are non–altruistic. Non–altruistic households, or "purely life–cycle households," solve (6) alone. Let such a household's net worth be $\phi^{LC}(s,t,z)$. (Recall that nondynastic and dynastic family lines have the same ρ and distribution for η.) Then in place of (18), one needs

$$\frac{K_{t+1}+D_{t+1}}{E_t}=\frac{NW_t}{E_t}\equiv$$
$$\frac{\sum_{s=22}^{87} q_s \cdot \int_{-\infty}^{\infty} [\lambda \cdot \phi(s,t-s,z)+(1-\lambda)\cdot \phi^{LC}(s,t-s,z)] \cdot f(z)\,dz}{E_t}. \qquad (18')$$

This paper treats λ as a parameter.[1]

In "equilibrium" all households maximize their utility and (1)–(18) hold. A "steady–state equilibrium (SSE)" is an equilibrium in which r_t and W_t are constant all t and in which Q, K, and E grow geometrically with factor g.

Proceeding to Figure 1 of the text, note that perfectly competitive behavior on the part of firms and the aggregate production function yield

$$\frac{(r+\delta)\cdot K_t}{W \cdot E_t}=\frac{\alpha}{1-\alpha},$$

where K_t/E_t is stationary in a steady state. Equations (10)–(12) show D_t divided by $W \cdot E_t$ is stationary. Combining the two uses of credit,

$$\frac{K_{t+1}+D_{t+1}}{W \cdot E_t}=g\cdot[\frac{\alpha}{1-\alpha}\cdot\frac{1}{r+\delta}+\frac{D_t}{W\cdot E_t}]\,. \qquad (19)$$

This yields the demand curve of Figure 1, where $r^L \equiv -\delta$.

Define $\bar{r}$ from

$$(1+\bar{r})^{26}\cdot(1-\tau^{beq})\cdot\xi\cdot\beta^{26}\cdot g^{(\gamma-1)\cdot 26}=1, \qquad (20)$$

where τ^{beq} is the maximal marginal tax rate on bequests. For any r with $r\cdot(1-\tau)<\bar{r}$, we can solve our Bellman equations using successive approximations: set $V^{old,1}(.)=0$; substitute this for $V^{old}(.)$ on the right–hand side of (7), and solve for $V^{young,1}(.)$; substitute the latter on the right–hand side of (8), and solve for $V^{old,2}(.)$; etc. This yields convergence at a geometric rate: as $j\to\infty$,

$$V^{young,j}(.)\to V^{young}(.) \quad \text{and} \quad V^{old,j}(.)\to V^{old}(.).$$

This paper's grid size for numerical calculations along these lines is 250 for net worth and 25 for earnings. The grids are evenly spaced in logarithms — except for even division in natural numbers for the lowest wealth values.

Turning to the distribution of inheritances and wealth, let the policy functions from (7)–(8) be

[1] See, however, Stark [1999].

$$a_{48} = a(a_{22}, z) \quad \text{and} \quad b = b(a_{48}, z, z').$$

Composing them we have a mapping from initial assets in one generation, a_{22}, to initial assets in the next, a'_{22}:

$$a'_{22} = b(a(a_{22}, z), z, z'). \tag{21}$$

Lines (1)–(2) imply

$$z' = [z]^{\rho} \cdot e^{\eta}, \tag{22}$$

where η has a known distribution. Together (21)–(22) determine a Markov process from Borel sets of points (a_{22}, z) to sets of tuples (a'_{22}, z') a generation later. We truncate the distribution of η so that its support is compact. Then as in Laitner [1992], there are bounded intervals $\mathcal{A}$ and $\mathcal{Z}$ with $\mathcal{A} \times \mathcal{Z}$ an invariant set for the Markov process, and there is a unique stationary distribution for the process in this set. In terms of distribution functions $F : \mathcal{A} \times \mathcal{Z} \to [0, 1]$, the Markov process induces a mapping ψ with

$$F^{t+26} = \psi(F^t), \tag{23}$$

where F^t is the distribution of intergenerational transfers at time t. Iterating (23) from any starting distribution on $\mathcal{A} \times \mathcal{Z}$, we have convergence to the unique stationary distribution. Again, our numerical grid in practice is 250×25. The stationary distribution and lifetime behavior yield expected net worth per household normalized by average current earnings. Using the law of large numbers, we treat the latter ratio, $NW_t/(W \cdot E_t)$, as nonstochastic. This generates the supply curve in Figure 1. Laitner's [1992] propositions show the ratio $NW_t/(W \cdot E_t)$ varies continuously with r and has an asymptote at $r^U \equiv \bar{r}/(1 - \tau)$.

Appendix B

Our model has parameters α, δ, μ_η, σ_η, n, ρ, v, ω, τ^{ss}, g, τ, β, ξ, λ, and γ. We calibrate the first 13 from sources described in this appendix. The text discusses the last two.

Letting 1995 wages and salaries from *The Economic Report of the President* [1999] be c_1, proprietor's incomes be c_2, and national income be c_3, labor's share of output, $1 - \alpha$, solves

$$1 - \alpha = \frac{c_1 + (1 - \alpha) \cdot c_2}{c_3} \, .$$

This generates our estimate $\alpha = .3251$. Using the 1995 GDP and stock of business inventories from *The Economic Report of the President* [1999], and combining the latter with the 1995 fixed private capital stock from *U.S. Department of Commerce* [1997, p.38], we have $K_t/Q_t = 2.3386$. This implies an interest rate $r = .069$, closely resembling Auerbach and Kotlikoff's [1987] .067 and Cooley and Prescott's [1995] .072, if we set $\delta = .07$. The latter is our choice of depreciation rate.

There is no population growth in our simulations. We simply set our technological progress factor g to 1.01.

We set a proportional tax τ^{ss} on earnings up to the 1995 social security limit ($61,200) so that taxes exactly cover 1995 retirement benefits ($287.0 bil.). Within each birth cohort, social security benefits are progressive: for each cohort, we allocate benefits across our 25 earning groups according to the benefit formula and maximum in *U.S. Social Security Administration* [1998].

Using 1995 Federal, state, and local expenditures on goods and services, $G_t/(W \cdot E_t) = .2765$. Taking the 1995 ratio of Federal debt to $1-\alpha$ times GDP, $B_t/(W \cdot E_t) = .6716$. Similarly, using K_t/Q_t from above, the empirical ratio $(K_t + B_t)/(W \cdot E_t)$ is 4.1367 for 1995.

Table A1 here

We assume no child mortality and no adult mortality until age 48. Table A1 presents our figures for q_s, which reflect average 1995 mortality rates for U.S. men and women. The implied average life span is 77 years. Markets offer actuarially fair annuities and life insurance, and households fully annuitize their life–cycle consumption streams and insure their earnings.

Labor supply, by assumption, is inelastic. Column 2 of Table A1 presents our age profile for experiential human capital, taken from median money incomes of 1995 households. In (1), we set $\rho = .45$ on the basis of Solon [1992]. We set μ_η so that the unconditional average z is 1; we truncate our distribution of η so that the minimum z is .2 and the maximum is 10,000; and, we set σ_η so that the unconditional variance of log earnings matches Dooley and Gottschalk's [1984] U.S. Census figure of .4510. Finally, we set the degrees of freedom of our T distribution (see (2)) to 9, so that our unconditional earnings distribution resembles Huggett [1996] — see Table 1 and the text.

First–order conditions for lifetime optimization imply that an adult will choose υ times as much consumption after retirement, *cet. par.*, as before, and that he will allocate ω times as much consumption to his minor child as to himself. People tend to have lower consumption needs after retirement: a recent TIAA–CREF brochure suggests, for example, that "you'll need 60–90 percent of your current income in retirement, adjusted for inflation, to maintain your standard of living when you retire;" and, a recent *Reader's Digest* article on retirement planning writes, "Many financial planners say it will take 70 to 80 percent of your current income to maintain your standard of living when you retire." Using the midpoint of these limits, we set $\upsilon = .75$. Mariger [1986] estimates that children consume 30% as much as adults. Similarly, Burkhauser *et al.* [1996] estimate that consumption needs of 4–person relative to 2–person families have a ratio of 1.34–1.42. We set $\omega = .3$.

Lifetime first–order conditions for adult consumption at different ages imply

$$q_s \cdot [c_s]^{\gamma-1} \geq q_{s+1}\beta \cdot R_s \cdot [c_{s+1}]^{\gamma-1} \iff [\beta \cdot (1 + r \cdot (1-\tau))]^{1/(1-\gamma)} \cdot c_s \leq c_{s+1},$$

with equality when the nonnegativity constraint on household net worth does not bind. Tables from the 1984–97 *U.S. Consumer Expenditure Survey* present consumption data for households of different ages.[2] We adjust the treatment of service flows from owner occupied houses.[3] Then we compute the average ratio of consumption at age $s+1$ to that at age s for households aged 30–39 — attempting to avoid ages at which liquidity constraints bind, at which children leave home, and at which retirement begins. The average ratio is 1.0257; hence, we require

$$[\beta \cdot (1 + r \cdot (1-\tau))]^{1/(1-\gamma)} = 1.0257. \tag{24}$$

Table A2 here

Table A2 summarizes the data so far. We fix our first ten parameters to the values in the table. For a particular λ and γ, we then adjust τ, β, and ξ until in the simulation the government budget constraint holds, consumption growth condition (24) holds for unconstrained ages, and the empirical capital stock plus government debt to earnings ratio matches the right–hand side of (18) or (18'). In these calculations, a higher ξ will lead to higher intergenerational transfers, always shifting Figure 1's supply curve to the right.

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[2] See http://stats.bls.gov.csxhome.htm.

[3] The adjustment is as follows. We subtract mortgage payments and repairs to owner occupied houses and scale remaining consumption to NIPA levels for aggregate consumption less housing flows. Then we distribute NIPA housing service flows across ages using proportional housing values given in the survey. See Laitner [2000].

Table A1. Survival Rates and Experiential Human Capital

Age	q_s	e_s	Age	q_s	e_s
22	1.0000	33006	55	.9678	59922
23	1.0000	34910	56	.9608	58532
24	1.0000	36815	57	.9533	57141
25	1.0000	38720	58	.9451	55751
26	1.0000	40625	59	.9362	54361
27	1.0000	42529	60	.9264	52971
28	1.0000	44434	61	.9158	51580
29	1.0000	46339	62	.9042	50190
30	1.0000	48243	63	.8918	48800
31	1.0000	49467	64	.8785	47409
32	1.0000	50690	65	.8643	46019
33	1.0000	51914	66	.8493	
34	1.0000	53137	67	.8333	
35	1.0000	54361	68	.8163	
36	1.0000	55584	69	.7982	
37	1.0000	56808	70	.7789	
38	1.0000	58031	71	.7585	
39	1.0000	59255	72	.7370	
40	1.0000	60478	73	.7143	
41	1.0000	61118	74	.6904	
42	1.0000	61757	75	.6654	
43	1.0000	62397	76	.6393	
44	1.0000	63036	77	.6120	
45	1.0000	63676	78	.5835	
46	1.0000	64315	79	.5539	
47	1.0000	64955	80	.5233	
48	1.0000	65594	81	.4918	
49	1.0000	66234	82	.4476	
50	.9957	66874	83	.3875	
51	.9909	65483	84	.3098	
52	.9858	64093	85	.2169	
53	.9803	62703	86	.1197	
54	.9743	61312	87	.0396	

Sources: Column 1 from average death rates 1900, *Statistical Abstract of the United States* [1997,p.89]. Column2 extrapolated from 1995 money income of households, *Statistical Abstract of the United States* [1997,p.466].

Table A2. Parameter Values and Empirical Ratios

Name	Value
Parameters	
α	.3251
δ	.0700
g	1.0100
τ^{ss}	.0607
μ_η	-.1964
σ_η	.5930
n	9
ρ	.45
υ	.7500
ω	.3000
Ratios	
$G_t/(W \cdot E_t)$	.2765
$(K_t + B_t)/(W \cdot E_t)$	4.1367
$[\beta \cdot (1 + r \cdot (1 - \tau))]^{\frac{1}{1-\gamma}}$	1.0257

Source: see text.

Table 1. Simulated Distributions of Earnings

	Huggett	Simulated from Eq. (1) with Random Shock which is: normal	T–distribution
Gini	.42	.39	.41
Share Top 1%	6%	6%	8%
Share Top 5%	19%	19%	21%
Share Top 10%	31%	30%	32%
Share Top 20%	47%	46%	47%

Source: See text.

Table 2. Federal Estate Tax Rates 1995

Tax Bracket ($ thousands)	Marginal Tax Rate (percent)
0 – 10	18
10 – 20	20
20 – 40	22
40 – 60	24
60 – 80	26
80 – 100	28
100 – 150	30
150 – 250	32
250 – 500	34
500 – 750	37
750 – 1000	39
1000 – 1250	41
1250 – 1500	43
1500 – 2000	45
2000 – 2500	49
2500 – 3000	53
3000 – 10000	55

Source: Poterba [1998]. See text.

Table 3. U.S. Distribution of Net Worth		
	Data from 1983 SCF	Data from 1989 PSID
Gini	.78	
Share Top 1%	33%	25.6%
Share Top 5%	55%	47.3%
Share Top 10%		61.2%
Share Top 20%	80%	
Share Top 25%		82.9%

Source: column 1 from Wolff [1996, tab. 4]; column 2 from Hurst *et al.* [1998, tab. 5].

Table 4. Simulated Distribution of Wealth with Life Cycle Saving Alone

	Life Cycle Net Worth
Gini	.69
Share Top 1%	15%
Share Top 5%	36%
Share Top 10%	51%
Share Top 20%	70%

Source: See text.

Table 5. Calibrated Simulations of the Distribution of Wealth for Different Combinations of λ and γ

Statistic[a]	Value of γ: 0	-1	-2	-4	-8
$\lambda = 1.00$					
Gini	.73	.73	.73	.73	.73
Share Top 1	18%	19%	20%	21%	21%
Share Top 5%	41%	42%	42%	43%	43%
Share Top 10%	56%	57%	57%	57%	57%
Share Top 20%	74%	74%	74%	74%	74%
Fraction 0 Bequest	.62	.68	.73	.74	.77
Estate Tax Revenue (bil.)	$9.9	$22.6	$30.2	$36.8	$39.3
$\lambda = 0.10$					
Gini	.78	.78	.78	.78	.78
Share Top 1	21%	21%	22%	22%	23%
Share Top 5%	52%	52%	52%	52%	52%
Share Top 10%	66%	66%	66%	66%	66%
Share Top 20%	81%	81%	81%	81%	81%
Fraction 0 Bequest	.91	.91	.91	.91	.91
Estate Tax Revenue (bil.)	$3.5	$9.9	$16.0	$25.4	$33.9
$\lambda = 0.05$					
Gini	.80	.80	.80	.80	.80
Share Top 1	23%	23%	24%	25%	26%
Share Top 5%	57%	57%	57%	57%	57%
Share Top 10%	69%	69%	69%	69%	69%
Share Top 20%	82%	82%	82%	81%	81%
Fraction 0 Bequest	.95	.95	.95	.95	.95
Estate Tax Revenue (bil.)	$3.0	$7.3	$13.1	$23.2	$36.9

a. Statistics refer to distribution over ages 22–73. See text.

Table 6. Calibrated Simulations of Intertemporal and Intergenerational Preference Weights

Parameter	Value of γ: 0	-1	-2	-4	-8
$\lambda = 1.00$					
β	.975	1.000	1.025	1.078	1.193
ξ	.422	.168	.064	.009	.000
$\beta^{26} \cdot \xi$	.216	.166	.122	.062	.012
$\lambda = 0.10$					
β	.975	1.000	1.025	1.078	1.194
ξ	.641	.402	.246	.087	.009
$\beta^{26} \cdot \xi$	.328	.397	.469	.620	.943
$\lambda = 0.05$					
β	.975	1.000	1.025	1.078	1.194
ξ	.673	.447	.290	.119	.017
$\beta^{26} \cdot \xi$	.344	.442	.554	.847	1.735

Source: see text.

Table 7. Steady States with New Equilibrium Interest Rates, after Elimination of the Estate Tax

Statistic[a]	Value of γ: 0	-1	-2	-4	-8
$\lambda = 1.00$					
Gini	.74	.74	.73	.73	.72
Share Top 1%	22%	22%	21%	21%	20%
Share Top 5%	44%	44%	43%	43%	42%
Share Top 10%	59%	58%	58%	57%	57%
Share Top 20%	76%	75%	75%	74%	74%
Gross Interest Rate	.068	.069	.069	.070	.073
New Ratio $g \cdot \frac{K+B}{W \cdot E}$	4.19	4.19	4.18	4.15	4.08
Pre–Reform $g \cdot \frac{K+B}{W \cdot E}$	4.18	4.18	4.18	4.18	4.18
New Average Bequest	$104,000	$99,000	$94,000	$88,000	$78,000
Pre–Reform Average Bequest	$96,000	$91,000	$87,000	$74,000	$76,000
$\lambda = 0.10$					
Gini	.81	.81	.80	.79	.79
Share Top 1%	30%	29%	28%	26%	24%
Share Top 5%	57%	56%	56%	54%	53%
Share Top 10%	70%	69%	68%	68%	67%
Share Top 20%	83%	82%	82%	81%	81%
Gross Interest Rate	.068	.067	.067	.066	.067
New Ratio $g \cdot \frac{K+B}{W \cdot E}$	4.21	4.23	4.24	4.25	4.23
Pre–Reform $g \cdot \frac{K+B}{W \cdot E}$	4.18	4.18	4.18	4.18	4.18
New Average Bequest	$135,000	$134,000	$132,000	$128,000	$123,000
Pre–Reform Average Bequest	$120,000	$119,000	$118,000	$115,000	$113,000
$\lambda = 0.05$					
Gini	.83	.83	.82	.81	.80
Share Top 1%	37%	36%	35%	33%	30%
Share Top 5%	62%	62%	61%	60%	59%
Share Top 10%	72%	72%	72%	71%	70%
Share Top 20%	84%	84%	84%	83%	82%
Gross Interest Rate	.067	.066	.065	.063	.063
New Ratio $g \cdot \frac{K+B}{W \cdot E}$	4.22	4.27	4.29	4.33	4.34
Pre–Reform $g \cdot \frac{K+B}{W \cdot E}$	4.18	4.18	4.18	4.18	4.18
New Average Bequest	$143,000	$144,000	$142,000	$141,000	$135,000
Pre–Reform Average Bequest	$121,000	$122,000	$121,000	$119,000	$117,000

(a) First 5 statistics refer to distribution over ages 22–73. See text.

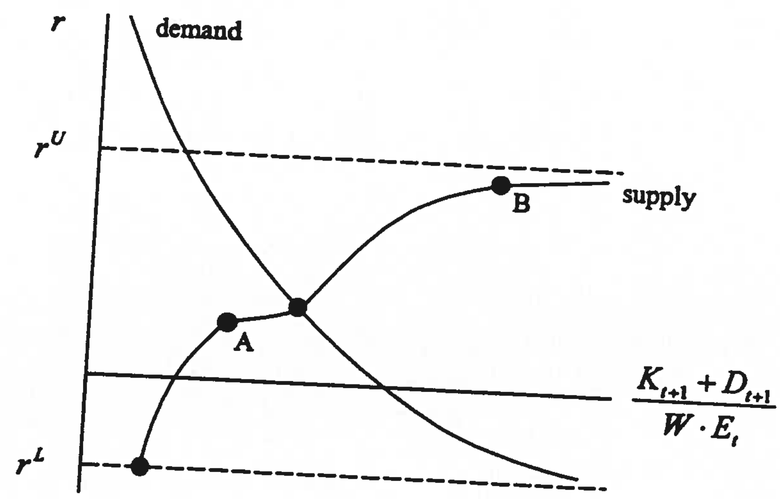

Figure 1