working paper

9811

Simulating the Transmission of Wealth Inequality via Bequests

by Jagadeesh Gokhale,
Laurence J. Kotlikoff,
James Sefton, and
Martin Weale

FEDERAL RESERVE BANK OF CLEVELAND

Working Paper 9811

Simulating the Transmission of Wealth Inequality via Bequests

by Jagadeesh Gokhale, Laurence J. Kotlikoff, James Sefton, and Martin Weale

Jagadeesh Gokhale is at the Federal Reserve Bank of Cleveland; Laurence J. Kotlikoff is at Boston University and the National Bureau of Economic Research; James Sefton is at the National Institute for Economic and Social Research; and Martin Weale is at the National Institute for Economic and Social Research. The authors thank Steven Caldwell for providing fertility data from CORSIM, his detailed micro simulation model of the U.S. economy; they thank Pierre Pestieau and other participants in the May 1998 International Seminar in Public Economics Conference on Bequests and Inequality across Generations for very helpful comments.

September 1998

Simulating the Transmission of Wealth Inequality Via Bequests

by Jagadeesh Gokhale, Laurence J. Kotlikoff, James Sefton, and Martin Weale

How much wealth inequality arises from inheritance inequality? This is a fundamental, but unresolved question. Answering it empirically requires data that is unavailable and potentially uncollectable. An alternative approach initiated by Blinder (1974, 1976) and Davies (1982), and the one taken here, is to simulate the transmission of inequality via bequests. This paper constructs, calibrates to U.S. data, and simulates a dynamic 88-period overlapping generations model with the goal of determining how much bequests and other factors affect the intragenerational distribution of wealth. The model features random death, random fertility, assortative mating, heterogeneous human capital endowments, the inheritability of human capital, progressive income taxation, and the partial annuitization through Social Security of households' retirement savings.

All bequests in the model are undesired. They arise because households are not fully annuitized. The absence of altruism or some other motivation for bequests does not preclude our achieving a realistic wealth distribution. Indeed, our model is fully capable of generating a distribution of wealth that is just as unequal and just as skewed as the actual U.S. wealth distribution (as measured with the 1995 Survey of Consumer Finances).

The fact that intentional bequests are not a prerequisite for explaining wealth inequality is just one of our striking findings. We also find that inheritances play an important role in increasing wealth inequality, but only in the presence of Social Security. The reason is that Social Security annuitizes all of the retirement savings of the poor and most of the retirement savings of the middle class. In so doing it eliminates inheritances by children of the poor, dramatically reduces inheritances by children of the middle class, and leaves essentially unchanged inheritances by children of the rich. Absent Social Security, inheritances actually reduce wealth inequality, albeit to a small degree.

Although inheritances in the presence of social security play an important role in generating wealth inequality, the most important factors in this regard are human capital differences, assortative mating based on these differences, and the annuitization of retirement savings via social security. Interestingly, the fact that agents inherit their skills from their parents does not materially alter wealth inequality. Equally interesting is the affect of progressive income taxation on the wealth distribution. In Social Security's presence, progressive income taxation exacerbates wealth inequality, but it reduces wealth inequality in its absence.

Simulating the Transmission of Wealth Inequality via Bequests

by

Jagadeesh Gokhale
The Federal Reserve Bank of Cleveland

Laurence J. Kotlikoff
Boston University and the National Bureau of Economic Research

James Sefton
The National Institute for Economic and Social Research

and

Martin Weale
The National Institute for Economic and Social Research

August 1998

The opinions expressed here are those of the authors and not necessarily those of Boston University, the Federal Reserve Bank of Cleveland, the National Bureau of Economic Research, or the National Institute for Economic and Social Research. We thank Steven Caldwell for providing fertility data from CORSIM, his detailed micro simulation model of the U.S. economy. We thank Pierre Pestieau and other participants of the ISPE conference on Bequests and Inequality Across Generations for very helpful comments.

Abstract

How much wealth inequality arises from inheritance inequality? This is a fundamental, but unresolved question. Answering it empirically requires data that is unavailable and potentially uncollectable. An alternative approach initiated by Blinder (1974, 1976) and Davies (1982), and the one taken here, is to simulate the transmission of inequality via bequests. This paper constructs, calibrates to U.S. data, and simulates a dynamic 88-period overlapping generations model with the goal of determining how much bequests and other factors affect the intragenerational distribution of wealth. The model features random death, random fertility, assortative mating, heterogeneous human capital endowments, the inheritability of human capital, progressive income taxation, and the partial annuitization through Social Security of households' retirement savings.

All bequests in the model are undesired. They arise because households are not fully annuitized. The absence of altruism or some other motivation for bequests does not preclude our achieving a realistic wealth distribution. Indeed, our model is fully capable of generating a distribution of wealth that is just as unequal and just as skewed as the actual U.S. wealth distribution (as measured with the 1995 Survey of Consumer Finances).

The fact that intentional bequests are not a prerequisite for explaining wealth inequality is just one of our striking findings. We also find that inheritances play an important role in increasing wealth inequality, but only in the presence of Social Security. The reason is that Social Security annuitizes all of the retirement savings of the poor and most of the retirement savings of the middle class. In so doing it eliminates inheritances by children of the poor, dramatically reduces inheritances by children of the middle class, and leaves essentially unchanged inheritances by children of the rich. Absent Social Security, inheritances actually reduce wealth inequality, albeit to a small degree.

Although inheritances in the presence of social security play an important role in generating wealth inequality, the most important factors in this regard are human capital differences, assortative mating based on these differences, and the annuitization of retirement savings via social security. Interestingly, the fact that agents inherit their skills from their parents does not materially alter wealth inequality. Equally interesting is the affect of progressive income taxation on the wealth distribution. In Social Security's presence, progressive income taxation exacerbates wealth inequality, but it reduces wealth inequality in its absence.

I. Introduction

Does inequality in inherited wealth necessarily exacerbate wealth inequality? If so, by how much? These are two fundamental questions that remain unresolved. Although it may seem counterintuitive, inherited wealth may actually be more evenly distributed than non inherited wealth and may reduce overall wealth inequality. The reason is that the distribution of inheritances is governed, in large part, by the random nature of longevity. In contrast, the distribution of non inherited wealth is largely governed by the distribution of labor earnings.

Although theoretical research has clarified many of the channels through which inheritances influence wealth inequality, the relative importance of these channels remains unresolved. Empirical analysis of inheritances has been limited by the availability of reliable data. An alternative approach initiated by Blinder (1974, 1976) and Davies (1982), and the one taken here, is to simulate the transmission of inequality via bequests. Unlike previous simulation studies, however, our focus is on unintended inheritances arising from random dates of death and the dynamic impact of these inheritances on the distribution of wealth.

To study this process, we construct an overlapping generations model with uncertain lifespan. Each agent lives for at most 88 years – the first 22 years as a child, the second 22 years as a young adult who marries and has children, the third 22 years as a married, middle-aged adult who has no additional children, and the last 22 years as a married or widowed older adult facing lifespan uncertainty. Agents who die prior to reaching age 88 bequeath their wealth to their spouses. If their spouses are no longer living, they bequeath in equal amounts to their children, all of whom are alive given the model's timing. Agents have life-cycle preferences, meaning they have no bequest motive per se and leave bequests only because their resources are not fully annuitized. Our model follows the economy and its existing and new agents through time. This is a prerequisite to determining the impact of random inheritances on the long-run distribution of wealth.

The bequest/inheritance process is complicated. Other things equal, children whose parents die relatively early receive larger inheritances than children whose parents die relatively late. But how much one inherits depends both on the number of siblings with whom one must share bequests and the amount of non annuitized wealth one's parents accumulate prior to their deaths. Parents' wealth accumulation depends, in turn, on how much they themselves inherited (which depends on when their ancestors died), the level of their earnings out of which they saved, and the number of children they had to support. Hence, earnings inequality, the transmission of earnings inequality across generations, the number and spacing of children, assortative mating, the annuitization of retirement savings through Social Security, and the progressivity of the income tax system can all play important roles in influencing inequality in inheritances. Our model considers each of these factors and their interactions in trying to account, in a systematic fashion, for wealth inequality.

Our results suggest that whether inheritances dampen or exacerbate wealth inequality depends very strongly on social security's annuitization of retirement savings. Absent social security, inheritances reduce somewhat wealth inequality among members of the same birth cohort. In social security's presence, however, inheritances are an important force in increasing wealth inequality. In our model, differences in lifetime earnings abilities (skills), assortative mating based on skills, and social security's annuitization of retirement savings are, however, the other major factors that contribute to intragenerational wealth inequality. Interestingly, holding constant inequality in skills, the fact that agents inherit their skills from their parents does not materially alter wealth inequality. When all of the factors that influence wealth inequality are included, our model is fully capable of generating distributions of wealth that closely approximate the degree of inequality and skewness in the actual U.S. data as reported in the 1995 Survey of Consumer Finances.

The paper proceeds in Section II with a brief literature review. Section III presents our simulation model and its calibration. Section IV present results, and Section V summaries and concludes the paper.

II. Literature Review

Early studies of the link between inheritance and inequality focussed on the relationship between the value of the estates of fathers and those of their sons (Wedgwood, 1929, Harbury and Hitchens, 1979). Wedgwood found, looking at a sample of 99 people who left estates of at least £200,000 (just under $1,000,000) on death in 1924-5, 60 percent had a predecessor who died leaving at least £50,000, and that about 1/3 of the wealthy owed their position entirely to inheritance. Harbury and Hitchens found that in 1973, 58 percent of those men who died leaving at least £100,000 had fathers who had left at least £25,000 at 1973 prices and that 67 percent of the variance in a son's estate was explained by the variation in the father's estate.

Interesting as they are, these data do not demonstrate firmly that inherited wealth is a source of inequality. The data relate to the total value of the father's estate and not to the amount inherited by the son, which may have been much less if the estate was divided equally among a number of children. And they are perfectly consistent with the view that a wealthy father endowed his children with advantages in life that helped them become wealthy. Nevertheless they reinforced the widely-held view summarized by Meade (1976) that inheritance is a source of inequality in the distribution of wealth, a conclusion supported by the theoretical model of Wilhelm (1997). This view underlies support for estate taxation as a potential mechanism for redistributing wealth.

The idea that intergenerational transfers can be equalizing can be traced to Stiglitz (1969). In common with most of the growth literature of the day, he assumed that each individual's consumption was a linear function of her total income (labor earnings plus capital income). He demonstrated that a stable, egalitarian distribution of wealth would emerge if inheritances were distributed evenly among all of one's children.

Much subsequent work has focussed on the impact of inheritance on income inequality rather than wealth inequality. Stiglitz and Atkinson (1980) used the same model, but added earnings heterogeneity, to show that an increase in the size of inheritances, caused by an increase in the rate of savings, would decrease income inequality. In essence, inheritances act as insurance against the random receipt of lower than average labor income. If an agent's earnings end up below (above) the average for his cohort, chances are his parents' earnings were higher (lower), and their bequest will permit his parents to share with him their better (worse) luck. Stiglitz and Atkinson also pointed out that for inheritances to increase inequality in these linear models an additional mechanism needed to operate to offset this insurance effect. Stiglitz (1969) suggested primogeniture (the oldest son receives the entire estate). Blinder (1973) suggested class mating.

The model of Becker and Tomes (1979) and Tomes (1981) highlights the joint role that inheritances of financial wealth and earning power (human capital) play in determining whether intergenerational transfers are equalizing. Their condition for this outcome is that the propensity of parents to transfer financial and tangible resources to their children exceeds the *inheritability* of human capital -- the correlation coefficient between the parent's and the child's human capital. Deardon, Machin and Reed (1997) and Solon (1992) and Zimmerman (1992) have recently tried to estimate the inheritability of human capital in the United Kingdom and the United States, respectively. Their results suggest a coefficient of 0.5 for the correlation between a father's and a son's earnings. Although this is a large correlation, it's not clear whether it arises because of genetics or parents' human capital investment in their children.

Laitner (1979a and 1979b) constructs a utility-maximizing framework in which parents care about both their own and their children's consumption, bequests must be non-negative, and there is no inheritability of human capital. He shows that an equilibrium wealth distribution exists and that inheritances are equalizing if there is no assortative mating.

Theoretical work on taxation also provides grounds for doubting that inheritances are unequalizing. Becker and Tomes (1979) and Atkinson and Stiglitz (1980) show that inheritance taxation can increase income inequality. However if there are incomplete markets, such as the market for educational loans considered by Loury (1981), it is possible that the redistributive taxation of bequests can reduce intragenerational inequality.

The question of whether inheritances increase or decrease income inequality has also been studied empirically. Tomes (1981) examined this question directly and found evidence in support of an equalizing effect. Davies and Kuhn (1991) suggest that even though inheritances are equalizing in the long run, a rise in inheritance taxation will reduce inequality in the short run, but raise it in the long run.

Blinder (1974, 1976) conducts simulation studies with both intragenerational heterogeniety, and life-cycle accumulation to conclude that inheritances are unimportant in determining inequality of annual income, and that there was high intergenerational mobility in the distribution of inherited wealth. However, the impact of inheritances on current wealth is not studied.

In a very important paper, Davies (1982) conducts simulations based on a behavioral model of life cycle saving and bequests: Parents maximize lifetime utility over their own and their adult childrens’ consumption subject to their own and their childrens’ lifetime budget constraints. Optimal consumption is simulated over a fixed lifespan for 500 couples. Each parent couple is identical on all except the following dimensions: Parents’ own inheritances, earnings, rate of return, rate of time preference, intensity of altruism toward children, and parents’ age of first birth. Random draws of these variables from distributions calibrated to Canadian data are used for each couple before computing its optimal consumption path and desired bequest. Bequests occur when parents die, which, given there is no lifespan uncertainty occurs at a common age. Bequests are distributed among children equally or, alternatively, in a compensatory manner based on children's earnings. Assuming constant rates of income and population growth over time, a single simulation over 500 couples suffices to generate a cross-section distribution of wealth, income, and lifetime resources. The cross-section distributions of wealth and income generated in this manner match the 1970 Canadian distributions quite closely.

The Davies paper also attempts to explore the impact of the different sources of heterogeneity on inequality. Unfortunately, the multi-generation (dynamic) simulations required to explore the long-run level of bequests and inequality from resulting from removing, in turn, the heterogeneity in each of the variables was precluded by limits on computational capacity. Consequently, Davies was forced to consider these experiments assuming no bequests.

As indicated, Davies explored only the role of intentional bequests on inequality and in a static content; i.e., he did not consider how the receipt of inheritances by one generation would influence the receipt of inheritances by the next generation and so on. In contrast, the bequests in our model are purely unintentional. They are also random, and this randomness requires tracing their influence over successive generations; i.e., it necessitates a dynamic approach.

Other researchers have examined the motives underlying bequests. Laitner and Juster (1996) find some limited support for altruism. In contrast, Boskin and Kotlikoff (1985), Altonji, Hayashi and Kotlikoff (1992, 1997), Abel and Kotlikoff (1994), Hayashi, Altonji, and Kotlikoff (1996), Gokhale, Kotlikoff, and Sabelhaus (1996), and Wilhelm (1996) all find strong evidence against intergenerational altruism, suggesting that most bequests may be unintended or motivated by non altruisitic considerations.

Hurd (1992) examines the influence of children on saving by elderly people in the United States. He finds that old people with children do save more than those without children, but that the effect is statistically insignificant. Thus his findings are consistent with our model and with the underlying view that bequests are accidental. He presents simulations that show the impact of a strong bequest motive increasing his estimated value by one standard deviation, a factor of over 6. This change raises total bequests by just 17 per cent, suggesting that, the bequest motive he identifies is not only statistically insignificant but it is also small in absolute terms. His findings make it seem unlikely that a powerful bequest motive is needed to explain the pattern of inherited wealth. This may, of course be because, in a situation in which incomes are rising and children earn more than their parents, parents would generally feel little need to leave bequests to their children (Meade 1966) and would prefer a transfer in the other direction.

It is frequently observed that retired consumers save rather than dissave. *Prima facie* this might indicate a bequest motive in some form (Hurd, 1990). However Gokhale, Kotlikoff, and Sabelhaus (1996) and Miles (1997) point out that when wealth is calculated correctly to include the capitalized value of social security receipts, then it does indeed tend to fall throughout retirement. Hurd also comes to the conclusion that, looking carefully at panel and cross-section data, the evidence on wealth change is consistent with the life-cycle hypothesis and the view that bequests are accidental

Hugget (1996) develops a large-scale life-cycle simulation model with uncertain labor income that follows an autoregressive process and uncertain lifetimes. He compares the model’s age-wealth distribution to the actual U.S. distribution and finds a fairly close match except at the very upper tail. But unlike our analysis, which is focused on the impact that the distribution of inheritances has on wealth inequality, Hugget ignores this issue by assuming that all bequests are collected by the government and divided evenly across the population.

III. The Model

This section describes the model's demographic structure, its marital arrangements, its fertility patterns, its method of constructing an initial distribution of the population, its method of populating the model through time, its allocation of skills to the model's agents, its determination of bequests and inheritance, its time-zero wealth distribution, the length of its simulations, and its consumption and saving behavior.

Demographic Structure

As mentioned in the introduction, agents in the model can live for 88 periods. All economic and demographic events (like earnings, consumption, marriages, births, deaths, wealth transfers and so on) occur at the end of each period. Agents are children during the first 22 periods of life and consume as part of their parent's households at ages 1 through 22. (We assume that consumption occurs before births so that newborns don't consume.) Agents marry on their 22nd birthday. They give birth to children at ages 22 through 43, depending on their draw from a "birth matrix" (as explained below). They also enter the work force on their 22nd birthday (to receive their first paycheck at age 23), and work through age 66. They never die at or prior to age 66, but face probabilities of dying each year between ages 67 and 88. The probability of dying on their 88th birthday given that a person reached age 87 is set at unity. The probabilities of dying at ages 67 through 87 are taken from United States' mortality statistics.

The number, sexes, and timing of children born to each couple are determined randomly (as discussed below). This distribution is aligned to ensure that an equal number of males and females are born each year. There is no population growth, so total annual births remain fixed through time. There are two thousand males and two thousand females in each cohort.

Marriage

Agents are assigned their marriage partners at age 22, each on a random basis or on the basis of their earnings. In the later case of assortative mating, agents are married based on their skill rank, with the top skilled female marrying the top skilled male, the next most skilled female marrying the next most skilled male, and so on.

Fertility

An initial population (at time t=0) of 4000 thousand individuals (2000 males and 2000 females) is created for each age between 0 and 87. This is done as follows: First, a matrix of "birth ages" is derived from a fertility simulation of CORSIM – a dynamic microsimulation model of the U.S. economy described in Caldwell et al. (1998). This matrix considers only female ages of giving birth ranging between 22 and 43. For each female, the CORSIM birth matrix records a maximum of 10 birth ages, 5 for male and 5 for female births. Thus, the matrix has 40,434 rows and 10 columns. Table 1.1 shows the distribution of females in the CORSIM matrix by number and sex of births.

Since, computer memory limitations allow us to process only 4000 individuals in each year of birth, we need to pare down our birth matrix in such a way as to end up with a modified birth matrix that contains exactly 2000 male births and 2000 female births. We start by selecting 2000 rows from the birth matrix. The selection is done at random without replacement except that rows containing more than 5 births are excluded. The total number of births in the selected 2000-row matrix exceeds 4000. Hence, we randomly eliminate male and female births in the rows of this matrix for rows containing more than one birth to guarantee that the 2000 rows of the final birth matrix generate exactly 2000 female and 2000 male births. Table 1.2 shows the distribution of females by number and sex of births in the birth matrix used in the simulation.

Populating the Model at Time Zero

We start populating our model by creating 2000 male and 2000 female old-adults for each age between 67 and 88. These males and females are married to each other sequentially. Some of these oldsters will be treated as dead when we initiate the simulation. But we need to include their ghosts at this stage of our process of populating the model in order to establish complete family trees. Marriage is allowed only between people of the same age to be consistent with our assumption that marriage occurs at age 22 (i.e., that initial oldster males married initial oldster females when they were 22 and their wife was 22). Family relationships are established by exchanging id numbers. For example, marriage involves entering the spouse's id numbers in the spouse-id location of each person's record. Oldsters have no living parents or grandparents.

Drawing from the 2000 thousand rows of the birth matrix at random and without replacement, the middle-aged and young-adult children of the initial oldsters are created, ranging in age from 24 through 66. Take, for example, the initial 70-year olds. For each

70 year-old female (including the ghosts), we assigned a row of the birth matrix drawn at random without replacement. This row indicates how many children the female had and the ages at which she had them. We repeat this process of drawing at random without replacement from the birth matrix for each cohort of oldster females; i.e., we do it for 66 year-old oldster females, 67 year-old oldster females, and so on through 87 year-old oldster females. In this process, we are not permitting oldsters to bear children in their twilight years, rather we are retrospectively considering the births of the initial oldsters when they were in their child-bearing years. When each child is created, the parents' id numbers and years of birth are entered in the child's record, and the child's id number and year of birth is entered in each of the parent's record.

Given that females give birth between the ages of 22 and 43, oldsters aged 88 at the initiation of our simulation (t=0) have children who are aged 45 through 66; oldsters aged 87 at t=0 have children aged 44 through age 65; and so on, until we reach oldsters aged 67 at t=0 who would have children aged between 24 and 45. Thus, at this stage of our populating procedure, exactly 4000 (the full compliment of) 45 year-olds and less than 4000 thousand individuals at other ages between 24 and 66 have been created. The reason is that everyone (including oldster ghosts) who could have given birth to 45 year-olds have been considered, but not everyone who gave birth to those between ages 24 and 44 and those between ages 46 and 66 have been considered. For example, some of those aged 25 are children of the current middle aged rather than of the current oldsters (including the ghosts), and some of those aged 50 are children of ghosts who are older than the current oldsters.

Since at this stage there are fewer than 4000 middle-aged males and females at ages 46-66, additional middle-aged males and females are created such that they total 4000 for each of these age groups. Next, all middle-aged males and females (those aged 45 through 66) are married at random, making sure that siblings are not married to each other. Next, the children of middle-aged adults are created, again taking draws without replacement from the birth matrix for females of a given age and then doing the same for females of another age until all females age 45 through 66 have been considered. The children produced by this process range in age from 2 through 44.[1] Given that we've already created the children of the t=0 oldsters, the addition of these children leave us with exactly 2000 males and 2000 females aged 23 through 44—the young adults. The procedure just described is also used to marry the young adults.

The next step in the creation of the initial population is to create the children of the t=0 young adults that were born at t=–1 or earlier. Each young-adult female is assigned a row of the birth matrix at random without replacement, and children are created for all birth ages less than the age at t=0 of the female in question. For example, a 44 year-old female's children are created for birth ages between 22 and 43, but a 23 year-old's children are created only if her birth-row assignment contains a birth-age of 22. That is, children that will be born at t=0 or later are not created as yet. At the end of this process, exactly 2000 males and 2000 females have been created for each age between 1

[1] Sixty-six-year-olds have children aged between 23 and 44; 65 year-olds have children aged between 22 and 43; and so on through 45 year-olds who have children aged between 2 and 23.

and 88. The final step in creating the initial population is to kill off oldsters (make the ghosts disappear) according to their cumulative mortality probabilities.[2]

Each person-record contains id numbers and years of birth of the spouse, parents, grandparents, and children. Also recorded is the position of the birth-matrix row selected for each adult household, whether the person is alive or dead and, if dead, the year of death.

Populating the Model through Time

In populating the model through time we engage in the following steps in each year from t=0 onward. First, for t=0, we allocate at random and without replacement a row from the birth matrix to all 22 year-old females. Second, 22-year-olds males and females are married to each other (at random, or according to their skill ranks depending on the case being considered). Third, females age 22-43 will give birth as determined by their assigned birth matrix row thereby creating 2000 newborn (0-year-old) males and 2000 newborn (0 year-old) females. Fourth, oldsters are killed off at random according to the conditional probability of dying at their respective ages and the existing wealth of those who just died is transferred to the surviving spouse or children. Fourth, we age everyone, excluding those who died, by one year.

[2] The mortality probabilities are based on U.S. mortality tables. Conditional mortality probabilities below age 67 are set to zero and the conditional mortality probability at age 88 is set to unity. The probability of dying at age=a, d_a, is calculated as

$$d_a=(1-\sigma_a) \prod_{s=67}^{a-1} \sigma_s,$$

where σ_s is the conditional probability of surviving at age s.

Skill Endowments

In our simulations with no skill differences, all working agents are assigned a skill level of 1 and receive an annual wage of 1 because we normalize at unity the wage per unit of skill. In the case of skill differences but no assortative mating, we assign agents skill levels randomly when they reach age 23 (the time of receiving the first paycheck), which they keep throughout their working lives.

Specifically, we used the March 1998 Current Population Survey (including the population weights) to determine, separately for males and females, average earnings within each percentile of the earnings distribution, where earnings is defined as the sum of wages plus salaries plus self-employment income (when positive); i.e., we calculate average earnings of the poorest 1 percent of males, the next poorest 1 percent of males, etc., and the same for females.

Next, we construct earnings arrays for males and females with 2000 entries each. The first 20 entries for the males are assigned the average earnings in the lowest percentile of the male earnings distribution, the next 20 entries are assigned the average earnings in the second-from-lowest percentile of the male earnings distribution, and so on until all 2000 entries are assigned a value. The same procedure is followed in constructing the female earnings array. Each of the 2000 males (females) in a birth cohort is then assigned one of the 2000 male (female) entry values on a random basis. This assignment is done without replacement in order to ensure that each cohort that comes along has precisely the same distribution of labor earnings.

Given this assignment of wages, we compute the average value of wages over all males and females in the cohort and then divide each agent's wage by this average. The resulting value represents the agent's skill level, which he or she has throughout his or her working life. This normalization ensures that each cohort's skill level has an average value of 1. Figure 1 shows the normalized skill profiles by skill rank. The increase in skill level at each rank is very gradual for the first 95 ranks but skill levels increase quite sharply at the highest skill ranks.

In the case of assortative mating, we repeat the above assignment of skills, but then marry the highest skilled female with the highest skilled male, the second highest skilled female to the second highest skilled male, and so on. In the case of inherited skills, we assign to each male agent the skill level of his father and to each female agent the skill level of her mother. In the case of inherited skills and assortative mating, males and females inherit their father's and mother's skills, respectively, and assortative mating proceeds based on this skill distribution.

Bequests and Inheritances

When a married oldster dies, his or her spouse retains all the marital wealth; i.e., all bequests by married agents go to their spouses. When a widowed oldster dies or if both spouses in a married couple die at the same time, the decedent(s') wealth is evenly divided among the children.

Initial Wealth Endowments and Length of the Simulations

To initiate a simulation, we give all adults at t=0 an endowment of wealth of 1 unit. We then run the model for enough years into the future until the distribution of wealth of 67 year-olds as well as the total amount of wealth in the economy stabilizes.

Since the asymptotic wealth distribution as well as the total level of wealth are independent of the initial level and distribution of wealth, the fact that we start with this particular initial endowment of wealth doesn't alter our results. In practice, both the wealth distribution of 67 year-olds and the total level of wealth converge well before 150 years in each of our simulations. But to guarantee consistency across simulations, we ran each simulation out for 150 years.

Consumption and Saving Behavior

Agents' expected utility are time-separable isoelastic functions of their own current and future consumption as well as that of their children through age 22. Consider, as an example, the expected utility of a couple that is age 23 and that will have two children, one when the couple is age 25 and the other when it is 28:

$$(1) \qquad EU = \sum_{a=22}^{a=87} \beta^{a-22} (p_{ha} c_{ha}^{1-1/\sigma} + p_{wa} c_{wa}^{1-1/\sigma}) + \delta \sum_{a=25}^{a=46} \beta^{a-22} c_{k1a}^{1-1/\sigma} + \delta \sum_{a=28}^{a=49} \beta^{a-22} c_{k2a}^{1-1/\sigma}$$

In (1), the first summation considers the utility of each spouse from his or her own consumption at each possible age to which they could live. The second two summations consider the utility that the couple derives from the consumption of their two children. The terms c_{ha} , c_{wa} , c_{k1a} , and c_{k2a} refer, respectively, to the consumption of the husband, wife, first child, and second child when the couple is age a. The term β is the time-preference factor, σ is the intertemporal elasticity of substitution, and δ is a child-consumption weighting factor. In our simulations, we set the time preference rate (which equals $(1/\beta)-1$) equal to the interest rate. We also set δ equal to .4, and assume that σ is very close to zero.

As σ approaches zero, households become more and more reluctant (they become more and more concerned about) consuming smaller amounts in the future than they consume in the present. Since the inverse of σ is the household's coefficient of relative risk aversion, a value of σ close to zero translates into a coefficient of risk aversion close to infinity.

In our simulations, we assume that σ is very close to zero. Hall (1988) reports that there is "... no strong evidence that the elasticity of intertemporal substitution is positive. Earlier findings of substantial positive elasticities are reversed when appropriate estimation methods are used."

The assumption that σ is very close to zero simplifies enormously household consumption decisions. First this assumption in conjunction with the assumption of a time preference rate equal to the interest rate means that households seek to maintain the same level of consumption over time for each spouse. Households also seek to maintain a constant level of consumption for their children, when they are children. Given the value of δ, this child consumption level equals 40 percent of the parental consumption level.

But most important, our assumption that σ is very close to zero means that households only consider their safe resources in deciding how much to consume at each point in time. Thus households who expect to receive an inheritance, but don't know for sure that they'll get one (because all of their parents may live through age 87), will ignore this potential source of future income in making their current consumption and saving decisions.

At each point in time, married households will calculate the number of years of remaining life, multiply this amount by 2 (to take into account the presence of both spouses) and then add to the resulting value .4 times the number of years of consumption of their children. This total number of effective adult consumption-years is then divided into the household's safe resources to determine consumption per effective adult. The household's safe resources consist of its wealth (which may reflect the receipt of past inheritances) plus the present value of its remaining lifetime labor earnings. Given the level of consumption per effective adult, it's straightforward to calculate total household consumption and subtract it from total household income to determine household saving.

We want to emphasize that inheritances affect consumption behavior, but only once they are received. There is no consumption out of potential future inheritances. Instead households, at each point in time, consider the worst-case scenario and formulate their consumption and saving plans accordingly. Were we to assume a positive value of σ, households would take a gamble and consume more in the presence in anticipation of possibly inheriting in the future. But their decision as to how much to consume would be extraordinarily complex. The reason is that they would, at certain ages, have to take into account not simply their own resources, including their own wealth, but also that of their parents and their grandparents, assuming their grandparents are still alive. Take, for example, a 25 year-old couple with two sets of living parents and four sets of living grandparents. In deciding how much to consume the household has to consider its own current wealth level as well as the wealth levels of all six parental and grandparental households. Formally, the dynamic program that the household must solve to determine how much to consume involves up to seven state variables, namely all seven of these wealth levels.[3] Unfortunately, solving dynamic programs with seven state variables appears to be beyond the capacity of current computers.[4]

Data and Calibration

The mortality probabilities used in the analysis are those released by the U.S. Social Security Administration for 1995. The interest rate (equal to the time preference rate) used in the simulations is 4 percent. As mentioned, the skill distribution is derived from the March 1997 Current Population Survey. The CORSIM fertility module is highly detailed. It includes separate logistic functions for fertility estimated for 30 different subgroups of women using data from the National Longitudinal Survey. The subgroups are distinguished by age, the presence of children, marital status, race, and work status. The regressors in the logits are age, duration of current marriage, earnings, family income, homeowner status, marital status, schooling status, work status, and duration since the birth of women's two youngest children. In producing the larger birth matrix from which we selected 2000 rows, we ran the CORSIM model from its start year of 1960 through 2000. In so doing, we used the entire panoply of CORSIM modules to assign CORSIM agents the various socio-economic characteristics, such as work status, entering as regressors in the fertility logits.

[3] We say "up to" because during years in which the household is age 66 and over, it has neither living parents nor living grandparents, and during years in which the household is age 44 through 65, it has no living grandparents.

[4] The fact that even supercomputers would have difficulty solving this problem in a reasonable amount of time raises the question of how mere mortals can actually deal with this complexity.

IV. Findings

Wealth Inequality in the SCF

For reference, we first report findings from the 1995 Survey of Consumer Finances on the distribution of net worth among married households with household heads aged between 60 and 69. The net worth calculation is based on computer code provided in the SCF documentation. Net worth percentiles are calculated using the final non-response adjusted sample weights provided in the SCF. The percent of wealth held by the top x percent of households for selected values of x is reported in Table 2. The richest 1, 5, and 10 percent of households hold 30.4, 51.0, and 62.5 percent, respectively, of aggregate U.S. net worth. The associated Gini coefficient for this wealth distribution is 0.727. These calculations indicate two things: first, the U.S. wealth distribution is highly unequal among married households whose household heads are of retirement age and second, the very rich account for a very sizeable fraction of total wealth.

Wealth Inequality Generated by Our Model

Table 3 begins to consider wealth inequality generated by our model. It reports Gini coefficients of wealth and consumption distributions for households aged 66. It also shows the flow of bequests as a share of labor income, and the flow of bequests left to children (as opposed to spouses) as a share of the economy's labor income. Table 4 shows the percent of wealth owned by the richest households in the same manner as in Table 2. In both tables, the odd numbered rows report results without inheritances and the even numbered rows those with inheritances.

The first point to make about Table 3 is that the flow of bequests is a significant fraction – roughly 8 to 9 percent -- of labor income for each of the simulations involving uncertain lifetimes. The flow of bequests to children, as opposed to spouses, is also significant – roughly 3 percent of labor income. Second, the flow of consumption is higher with inheritances than without. This is as expected since inheritances constitute an intergenerational redistribution from the old to the young. This raises the lifetime resources of each successive new generation, permitting it to consume at higher levels.

The first column of Table 3 indicates that the inclusion of uncertain lifetimes in the simulation has only a modest effect on wealth inequality. Leaving out skill differences and mortality, the Gini is just 0.045. This Gini is non-zero because of differences across households in the number and timing of their children. These differences influence the amounts that households consume when young and, thus, the amounts of wealth they bring into old age. Although the addition of uncertain lifetimes raises the Gini coefficient by almost one third, to 0.075, this is still a very small value and suggests that, by themselves, inheritances arising from random death date are not a major source of wealth inequality across members of the same cohort.

Table 3 also indicates that skill differences are a major force behind wealth inequality in our model. With inheritances, the introduction of skill differences increases the wealth Gini from 0.075 to 0.355 (compare rows 2 and 4). Under our assumptions and parameterization, fertility differences, inheritances, and skill differences together explain almost 50 percent of the intragenerational inequality observed in the SCF data, with skill differences being the predominant factor among the three.

The inclusion of marital sorting by skill increases the wealth Gini coefficient further to 0.436 (Table 3, row 6). This effect is significant, but not huge. The reason is that the rate of increase in skill levels for each skill-rank increment is not very steep for the first 95 ranks (see Figure 1). Hence, marital sorting by skill class does not imply pairing individuals with very different skill levels relative to marrying them at random. This effect accounts for a further 11 percent of the Gini observed in the SCF data. Further adding inheritance of skills only marginally increases the Gini coefficient on wealth to 0.443 (Table 3, row 10). Thus, inheritance of skills contributes only a very small amount (if at all) to intragenerational wealth inequality at retirement.

Although uncertainty in dates of death raises wealth inequality slightly in the absence of skill differences, it does the opposite in the more realistic case that skill differences exist. As rows 3 through 10 in Table 3 indicate, this is true whether or not couples sort themselves in the marriage market based on skills or whether skills are inherited. Under each of these assumptions, the Gini coefficient is somewhat smaller with uncertain lifetimes than without; that is, inheritances reduce, rather than raise, wealth inequality. This result is not surprising. Because only a few households in each birth cohort have very high skills, very large bequests are likely to go to children with skill levels lower than their parents' skill level. This has a slight equalizing effect on the distribution of wealth at retirement.

Note that the Gini values for consumption at retirement are the same as those for wealth. This is because for a given number of children, lifetime resources, consumption, and wealth at retirement are all strictly proportional in all of the simulations reported in Table 3.

Table 4 shows wealth held by households in the top x percentiles for selected values of x. Consistent with the results of Table 3, wealth held by richer households is significantly larger when skill differences are present. In the presence of inheritances, for example, the share of wealth held by the richest 5 percent of households increases by more than a factor of three (compare rows 2 and 4 in Table 4). The fractions of wealth held by the richest 1, 5, and 10 percent of households are all higher when marital sorting by skill is included. They are not significantly different when children inherit skills from their parents compared to the case that skills are assigned at random to members of each cohort.

The wealth distributions for the simulation results reported thus far exhibit much less inequality than found in the SCF. In each of the rows in Table 4, the shares of wealth held by the richest 1, 5, and 10 percent of households are much smaller compared to those reported in Table 2.

Adding Progressive Income Taxation

Tables 5 and 6 add progressive income taxation to each of the cases of Tables 3 and 4.[5] Because a part of income is taxed away, total consumption, total bequests and intergenerational bequests are all smaller as shares of aggregate labor income. All of the Gini coefficients on wealth are marginally smaller compared to those shown in Table 3. The pattern of these Gini coefficients is similar to those in Table 3: Differences in skills

[5] In incorporating progressive income taxation, we iterate over guesses of consumption per person until the household's remaining lifetime budget constraint, including income tax payments along the way, is satisfied. This is done in each period and for each household. If the household is subject to the borrowing constraint at retirement, we first solve the households consumption problem through retirement to deliver zero wealth at retirement. Finally, post retirement consumption is calculated using the same procedure

contribute the most to wealth inequality at retirement. Marital sorting by skill class induces greater wealth inequality, but the inheritance of skills does not.

As a comparison of Tables 3 and 5 reveals, the Gini coefficients for consumption are somewhat smaller than those for wealth at retirement in the presence of progressive income taxation. This is as expected because under progressive income taxation, a larger wealth level at any age cannot be converted into a proportionally larger stream of consumption; the asset income generated along the way is taxed at a higher marginal (and average) rate, the higher the level of wealth.

A comparison of Tables 4 and 6 shows that richer households own somewhat smaller fractions of total wealth in the presence of progressive income taxation. For example, when all factors are present (rows 10 in Table 4 and 6), the introduction of progressive taxation reduces the wealth held by the top 10 percent of households from 36.6 percent to 33.2 percent. These results suggest that progressive income taxation reduces inequality is rather ineffective in reducing wealth inequality at retirement.

Introducing Social Security

Tables 7 and 8 show the effect of introducing annuities via a social security system. Specifically, 15.3 percent of each year's labor income (the OASDHI Social Security and Medicare payroll tax rate) up to a maximum taxable limit calibrated to correspond to the U.S. Social Security System's taxable limit is accumulated at a 4 percent interest rate and converted into an actuarially unfair annuity at retirement (age 67). The payment of the annuity is made contingent on the individual being alive.

---

subjecting Social Security benefits to income taxation.

Adding annuitization to the model raises the possibility that those households for whom lifetime consumption per capita is less than their annuity per capita during retirement will choose to arrive at retirement with a negative net worth. To prevent households from leaving negative bequests, we subject such households to a borrowing constraint *at retirement*. That is, net borrowing is permitted prior to retirement but the liability must be extinguished to leave the household with exactly zero net worth at retirement.

The annuities are calibrated to be unfair because payroll taxes are not reimbursed in retirement in the form of fair annuities in the United States. Caldwell et al. (1999) estimate that on average, 74 cents of every dollar of the payroll tax represents a pure tax. That is, the present value of Social Security benefits at retirement equals the accumulated value of only 26 percent of payroll taxes paid during the working lifetime. It is, nevertheless, difficult to approximate the correct degree of unfairness because similar "money's worth" calculations are not available for Medicare. The simulations reported in Tables 7 and 8 assume that, for each person, only 30 percent of payroll taxes are converted into an annuity, with the rest representing a pure tax.

All of the cases in Table 7 show a significant increase in wealth inequality relative to the corresponding cases of Table 3. For example, with inheritances and skill differences, the presence of annuities increases the Gini coefficient to 0.550 (Table 7, row 4) from 0.355 (Table 3, row 4). Wealth inequality is increased because a sizable fraction of low earning households now arrive at retirement with zero wealth whereas the richer households--for whom the annuity is very small relative to consumption per capita--accumulate roughly the same amount of wealth they would have accumulated in the absence of social security. Consumption inequality is also slightly higher in most cases because the regressive payroll tax reduces the lifetime resources of those earning less than the taxable limit by a greater proportion than those earning above this limit.

Like the results of Table 3, Table 7's results also indicate that marital sorting by skill levels increases inequality (compare rows 4 and 6), but inheritance of skills from parents does not (compare rows 4 and 8). When all of the factors are present, the Gini coefficient is 0.63, much closer to the 0.727 value for the SCF wealth distribution. As row 10 of Table 8 indicates, so too is the upper tail of the wealth distribution.

It is worth noting that the introduction of an unfair annuity changes qualitatively the impact of inheritances on intragenerational wealth inequality. Unlike Tables 3 and 5, each pair of rows in Table 7 indicates that inheritances *increase* wealth inequality. For example, the Gini coefficient on wealth increases from 0.567 without inheritances (row 9) to 0.627 with inheritances (row 10). This occurs despite the relatively small flow of intergenerational transfers—1.2 percent of labor earnings. The explanation for this is that the availability of annuities renders the distribution of bequeathable wealth considerably more unequal and perpetuates wealth inequality across extended families. High earning parents who accumulate positive wealth through retirement may bequeath a lot if they die early. The receipt of inheritances by their children causes the retirement borrowing constraint to be non-binding for them and induce a positive wealth balance at retirement. Hence, they may, in turn, bequeath substantial wealth to their children and so on.

This sequence of bequests and accumulation by households for whom the borrowing constraint at retirement is non-binding stands in sharp contrast to that of households for whom it is binding. The latter households do not bequeath any wealth to their children most of whom may, therefore, be subject to the borrowing constraint themselves. The annuitization of lifetime resources makes wealth inequality and its persistence across bequeathing and non-bequeathing households so large that the inheritance process reinforces rather than reduces wealth inequality at retirement. The Gini coefficient increases from 0.460 when no annuities are available (Table 3, row 10) to 0.627 when they are available (Table 7, row 10).

Adding Social Security and Progressive Income Taxation

Tables 9 and 10 introduce both social security and progressive income taxation. In each of the cases with inheritances and skill differences the wealth Gini is significantly higher with annuitization and progressive income taxation (Table 9) relative to the cases where both of these factors are absent (Table 3). For example, when both marital sorting by skills and inheritance of skills are present (rows 10 in the two tables), the Gini increases to 0.64 when annuitization and progressive income taxation are present (Table 9) from 0.46 when they are absent (Table 3).

The wealth unequalizing impact of inheritances when social security is in effect is magnified in the presence of progressive income taxation. Rows 9 and 10 of Table 9 show that introducing inheritances increases the Gini coefficient from 0.52 to 0.64 -- a quite important difference. It is also a larger difference than that between the corresponding cases of Table 7. Without inheritances, progressive income taxation reduces wealth inequality even when annuitization is present (compare rows 9 in Tables 7 and 9). This occurs because income taxes are more than proportionally higher for those with higher incomes leading to lower lifecycle accumulation by higher earning households. However, the resulting distribution of wealth is still considerably more unequal (and the inequality is more persistent across bequeathing and non-bequeathing households) compared to the case of progressive income taxation without annuitization (compare rows 9 in Tables 5 and 9).

Comparing Gini values in rows 9 and 10 in Table 9 shows that inheritances increase wealth inequality substantially when both annuitization and progressive income taxation are present. Indeed, the presence of progressive income taxation increases the number of households that may be subject to the borrowing constraint at retirement. This accounts for the higher Gini value of 0.643 when annuitization and progressive income taxation are both present (Table 9, row 10), relative to when only annuitization is present -- 0.627 (Table 7, row 10). Hence, progressive income taxation may intensify the wealth unequalizing impact of inheritances when annuities are available.

Finally, Table 10 shows the wealth distributions obtained for the cases reported in Table 9. The final simulation (row 10) shows that the top 1, 5, and 10 percent of 66-year-old households hold 27.4, 53.7, and 60.5 percent of aggregate wealth respectively. As shown in Figure 2, these wealth shares closely approximate those observed in the SCF 1995 wealth distribution for married households aged 60-69 -- namely, 30.4, 51.0 and 62.5 percent respectively.

V. Conclusion

Many people intuitively believe that inheritances, because of their random nature and receipt by the lucky few, contribute significantly to inequality in wealth holdings among members of the same cohort. As economic theory suggests and as this paper's simulations confirm, this is not necessarily the case: Indeed, because the process underlying inheritances is, in large part, unrelated to the earnings differences that are the key determinant of life cycle wealth accumulation, inheritances can be a wealth-equalizing. This result goes the other way, however, when annuities are available.

This paper develops a large-scale life-cycle simulation model with uncertain longevity, skill differences, assortative mating, inherited skills, annuitization via a social security system, and progressive income taxation. We find that skill differences, the annuitization of retirement savings, and assortative mating are the major factors underlying intragenerational wealth inequality. In addition, the inheritance of bequests is an important contributor to wealth inequality, but only in the presence of social security.

In contrast, the inheritance of skills from one's parents does not seem to matter much for wealth inequality. Progressive income taxation reduces wealth inequality by a small but not insignificant amount when annuities are unavailable. However, by making a larger fraction of households borrowing-constrained at retirement, it can amplify the wealth unequalizing impact of inheritances in the presence of annuities.

Taken together, the factors examined in this paper are capable of explaining observed U.S. wealth inequality at retirement. Including all of the factors in our simulation produces a Gini coefficient of 0.643, which is 88 percent as large as the value observed in the 1995 SCF. With a higher degree of annuitization, arising from, for example, civil service and private defined benefit pensions, we could easily achieve a Gini as large as that in the SCF. As it is, the upper tail of our simulated wealth distribution matches quite closely the upper tail in the SCF distribution. Hence, our model can explain both the overall inequality as well as the skewness in the actual U.S. wealth distribution.

References

Abel, Andrew and Laurence J. Kotlikoff, "Intergenerational Altruism and the Effectiveness of Fiscal Policy: New Tests Based on Cohort Data," in *Savings and Bequests*, Ann Arbor, Michigan: University of Michigan Press, 1994.

Altonji, Joseph, Fumio Hayashi, and Laurence J. Kotlikoff (1992), "Is the Extended Family Altruistically Linked? Direct Tests Using Micro Data," *The American Economic Review*, December.

Altonji, Joseph G., Hayashi, Fumio, and Laurence J. Kotlikoff, (1997). 'Parental Altruism and Inter Vivos Transfers: Theory and Evidence. '*Journal of Political Economy* , Vol 105(6), 1121-66.

Atkinson, Anthony and Stiglitz, Joseph (1980). '*Lectures in Public Economics*', McGraw-Hill, Singapore.

Auerbach, Alan J., Jagadeesh Gokhale, Laurence J. Kotlikoff, John Sabelhaus, and David Weil (1999). "The Annuitization of Americans' Resources – A Cohort Analysis," forthcoming in *The Economics of Reciprocity, Gift Giving and Altruism*, London, England: Macmillian Publishing Co.

Becker, Gary S. and Tomes, Nigel (1986). 'Human Capital and the Rise and Fall of Families. '*Journal of Labor Economics*, Vol 4(3), S1-39.

Becker, Gary S. and Tomes, Nigel (1979). 'An Equilibrium Theory of the Distribution of Income and Intergenerational Mobility. '*Journal of Political Economy*, Vol 87(6), 1153-89.

Bernheim, B. Douglas, Shleifer, Andrei and Summers, Lawrence H. (1985). 'The Strategic Bequest Motive. '*Journal of Political Economy* , Vol 93(6), 1045-76.

Blinder, Alan S. (1973). 'A Model of Inherited Wealth. '*Quarterly Journal of Economics*, Vol 87(4), 608-26.

Blinder, Alan S. (1974). *Toward An Economic Theory of Income Distribution,* Cambridge, MA, MIT Press.

Blinder, Alan S. (1976). 'Inequality and Mobility in the Distribution of Wealth,' *Kyklos,* Vol. 29, 607-38.

Boskin, Michael J. and Laurence J. Kotlikoff (1985), "Public Debt and U.S. Saving: A New Test of the Neutrality Hypothesis," Carnegie-Rochester Conference Series on Public Policy, Autumn.

Caldwell, Steven, Melissa Favreault, Alla Gantman, Jagadeesh Gokhale, Thomas Johnson, and Laurence J. Kotlikoff (1999), "Social Security's Treatment of Postwar Americans," forthcoming in *Tax Policy and the Economy*, NBER volume, Vol. 13, MIT Press.

Davies, James B. and Kuhn, Peter J. (1991). 'A Dynamic Model of Redistribution, Inheritance, and Inequality. '*Canadian Journal of Economics*, Vol. 24(2), 324-44.

Davies, James B. (1982). 'The Relative Impact of Inheritance and Other Factors on Economic Inequality.' *Quarterly Journal of Economics*, Vol. 97(3), 471-98.

Dearden, Lorraine and Machin, Stephen and Reed, Howard (1997). 'Intergenerational Mobility in Britain. '*Economic Journal*, Vol 107(440), 47-66.

Gokhale, Jagadeesh, Laurence J. Kotlikoff, and John Sabelhaus, "Understanding the Postwar Decline in United States Saving: A Cohort Analysis," *The Brookings Papers on Economic Activity*, 1996.

Hall, Robert E., "Intertemporal Substitution in Consumption," Journal of Political Economy, 96(2), April 1986, 339-357.

Harbury, C.D. and D.M.W.N. Hitchens (1979). *Inheritance and Wealth Inequality in Britain*. London. George Allen and Unwin.

Hayashi, Fumio, Altonji, Joseph, and Kotlikoff, Laurence (1996). 'Risk-Sharing between and within Families. '*Econometrica*, Vol . 64(2), 261-94.

Hugget, Mark (1996), "Wealth Distribution in Life Cycle Economies." *The Journal of Monetary Economics*, Vol. 38, 469-94.

Hurd, Michael D. (1990). "Research on the Elderly: Economic Status, Retirement and Consumption & Saving". *Journal of Economic Literature*. Vol 28. Pp 565-637.

Hurd, Michael D. (1992). "Measuring the Bequest Motive: the Effect of Children on Saving by the Elderly in the United States". In. *Savings and Bequests*. Ed. T. Tachibanaki. University of Michagan Press. Pp. 111-136.

Ionnides, Y.M. and Sato, R. (1987). 'On the Distribution of Wealth and Intergenerational Transfers'. *Journal of Labour Economics*, Vol 5(3), 366-385.

Kotlikoff, Laurence J. and Summers, Lawrence H. (1981). 'The Role of Intergenerational Transfers in Aggregate Capital Accumulation. '*Journal of Political Economy*, Vol. 89(4), 706-32.

Laitner, John and Juster, F. Thomas (1996). ‘New Evidence on Altruism: A Study of TIAA-CREF Retirees. ’*American Economic Review*, Vol. 86(4), 893-908.

Laitner, John (1979a). ‘Household Bequests, Perfect Expectations, and the National Distribution of Wealth. ’*Econometrica*, Vol. 47(5), 1175-93.

Laitner, John (1979b). ‘Household Bequest Behaviour and the National Distribution of Wealth. ’*Review of Economic Studies*, Vol. 46(3), 467-83.

Loury, Glenn. (1981). “Intergenerational Transfers and the Distribution of Earnings”. *Econometrica*. Vol 49(4). Pp 843-67.

Meade, James, (1966). “Life-cycle Savings, Inheritance and Economic Growth”. *Review of Economic Studies.* Vol 33. Pp 61-78.

Meade, James (1976), *The Just Economy*. George Allen & Unwin, London.

Miles, David, (1997). “Demographics and Saving: Can we Reconcile the Evidence”. Paper presented to National Institute Conference on the Macroeconomics of Inequality. Churchill College, Cambridge.

Solon, Gary (1992). ‘Intergenerational Income Mobility in the United States. ’*American Economic Review*, Vol. 82(3), 393-408.

Stiglitz, Joseph E. (1969). ‘Distribution of Income and Wealth among Individuals. ’*Econometrica*, Vol. 37(3), 382-97.

Tomes, Nigel (1988). ‘The Intergenerational Transmission of Wealth and the Rise and Fall of Families.” Kessler, Denis and Masson, Andre, eds., *Modelling the accumulation and distribution of wealth* Oxford University Press, Clarendon Press.

Tomes, Nigel (1981). ‘The Family, Inheritance, and the Intergenerational Transmission of Inequality. ’*Journal of Political Economy*, Vol. 89(5), 928-58.

Wilhelm, Mark O. (1997). ‘Inheritance, Steady-State Consumption Inequality, and the Lifetime Earnings Process. ’*Manchester School of Economic and Social Studies*, Vol. 65(4), 466-76.

Wilhelm, Mark O. (1996). ‘Bequest Behavior and the Effect of Heirs' Earnings: Testing the Altruistic Model of Bequests. ’*American Economic Review*, Vol. 86(4), 874-92.

Weale, Martin (1992). ‘The Benefits of Higher Education: A Comparison of Universities and Polytechnics. ’*Oxford Review of Economic Policy*, Vol. 8(2), 35-47.

Zimmerman, David J. (1992). ‘Regression toward Mediocrity in Economic Stature. ’*American Economic Review*, Vol. 82(3), 409-29.

Table 1.1 Distribution of Females by Number and Sex of Births At Ages 22 Through 43*

CORESIM DATA

Female Births → / Male Births ↓	0	1	2	3	4	5
0	20.68	**12.94**	**6.96**	**1.49**	**.33**	**.10**
1	**13.64**	**14.77**	**5.32**	**1.38**	**.35**	.13
2	**7.83**	**5.06**	**2.16**	**.70**	.24	.12
3	**1.87**	**1.38**	**.64**	.23	.12	.05
4	**.41**	**.33**	.17	.12	.08	.00
5	**.12**	.13	.11	.05	.00	.00

*** Females with at least one but less than 5 births numbered 40434.**
Source: Authors' calculations based on CORSIM Birth Matrix.

Table 1.2 Distribution of Females by Number and Sex of Births At Ages 22 Through 43

BIRTH MATRIX USED IN SIMULATION

Female Births --> / Male Births ↓	0	1	2	3	4	5
0	.00	**13.00**	**9.00**	**2.20**	**.55**	**.15**
1	**16.05**	**22.40**	**6.45**	**1.60**	**.50**	.00
2	**12.20**	**7.15**	**2.50**	**.80**	.00	.00
3	**2.85**	**.95**	**.75**	.00	.00	.00
4	**.40**	**.40**	.00	.00	.00	.00
5	**.10**	.00	.00	.00	.00	.00

Source: Authors' calculations.

Table 2

SCF Wealth Distribution of Married Households with Household Heads Aged 60-69

	Percent of Wealth Held By Top*									Gini Coefficient
	99%	95%	90%	75%	50%	25%	10%	5%	1%	
SCF	100.00	100.00	99.90	98.70	92.90	79.80	62.50	51.00	30.40	0.727

* Weighted by the SCF's non-response adjusted "final weight."
Source: Authors' calculations from the Survey of Consumer Finances, 1995.

Table 3 Inequality and Bequest Flows-without Social Security and without Progressive Income Taxation (Age 66, 2000 Households, 150 Years, r=4%)

	Wealth Gini	Consumption Gini	Total Bequest Flow*	X-Gen Bequest Flow*	Consumption Flow*
1. No mortality	0.045	0.045	0.00	0.00	74.55
2. Mortality	0.075	0.075	9.00	2.90	76.60
3. No Mortality and Skill Differences	0.365	0.365	0.00	0.00	74.55
4. Mortality and Skill Differences	0.355	0.355	9.29	2.94	76.57
5. No Mortality, Skill Differences, and Marital Sorting	0.455	0.455	0.00	0.00	74.55
6. Mortality, Marital Sorting, and, Skill Differences	0.432	0.432	8.32	2.47	76.53
7. No Mortality, Skill Differences, and Inherited Skills	0.368	0.368	0.00	0.00	74.54
8. Mortality, Skill Differences, and Inherited Skills	0.366	0.366	9.10	3.10	76.65
9. No Mortality, Skill Differences, Marital Sorting, and Inherited Skills	0.466	0.466	0.00	0.00	74.53
10. Mortality, Skill Differences, Marital Sorting, and Inherited Skills	0.460	0.460	8.84	2.79	76.59

* Annual flow as a percent of annual labor income. X-Gen stands for cross-generation.

Table 4 Wealth Distribution—without Social Security and without Progressive Income Taxation (Age 66, 2000 Households, 150 Years, r=4%)

	Percent of Wealth Held By Top								
	99%	95%	90%	75%	50%	25%	10%	5%	1%
1. No mortality	99.21	95.87	91.49	77.68	53.22	27.34	11.09	5.58	1.12
2. Mortality	99.26	96.10	91.94	78.68	55.09	29.72	13.08	7.00	1.62
3. No Mortality and Skill Differences	99.88	98.89	97.16	90.06	73.31	50.05	31.05	22.33	6.62
4. Mortality and Skill Differences	99.86	98.78	96.97	89.62	72.70	49.46	30.39	21.63	6.28
5. No Mortality, Skill Differences, and Marital Sorting	99.98	99.64	98.73	93.70	79.06	56.20	35.88	26.43	11.25
6. Mortality, Marital Sorting, and, Skill Differences	99.97	99.52	98.49	92.90	77.68	54.60	34.42	24.97	10.57
7. No Mortality, Skill Differences, and Inherited Skills	99.89	98.95	97.24	90.10	73.42	50.38	31.48	22.80	7.01
8. Mortality, Skill Differences, and Inherited Skills	99.87	98.88	97.14	89.99	73.26	50.26	31.30	22.71	6.68
9. No Mortality, Skill Differences, Marital Sorting, and Inherited Skills	99.97	99.63	98.69	93.70	79.55	57.27	37.47	28.18	11.34
10. Mortality, Skill Differences, Marital Sorting, and Inherited Skills	99.97	99.62	98.70	93.76	79.29	56.71	36.61	27.10	11.77

Source: Authors' calculations.

Table 5 Inequality and Bequest Flows-without Social Security and with Progressive Income Taxation
(Wealth at Age 66, 2000 Households, 150 Years, r=4%)

	Wealth Gini	Consumption Gini	Total Bequest Flow*	X-Gen Bequest Flow*	Consumption Flow*
1. No mortality	0.039	0.038	0.00	0.00	61.47
2. Mortality	0.067	0.065	7.35	2.26	62.92
3. No Mortality and Skill Differences	0.325	0.315	0.00	0.00	59.43
4. Mortality and Skill Differences	0.314	0.304	7.31	2.55	60.86
5. No Mortality, Skill Differences, and Marital Sorting	0.409	0.398	0.00	0.00	58.41
6. Mortality, Marital Sorting, and, Skill Differences	0.393	0.381	7.27	2.12	59.81
7. No Mortality, Skill Differences, and Inherited Skills	0.323	0.313	0.00	0.00	59.23
8. Mortality, Skill Differences, and Inherited Skills	0.319	0.309	7.00	2.39	60.88
9. No Mortality, Skill Differences, Marital Sorting, and Inherited Skills	0.423	0.412	0.00	0.00	58.53
10. Mortality, Skill Differences, Marital Sorting, and Inherited Skills	0.420	0.409	6.90	2.27	59.62

*Annual flow as a percent of annual labor income. X-Gen stands for cross-generation.

Table 6: Wealth Distribution—without Social Security and with Progressive Income Taxation (Wealth at Age 66, 2000 Households, 150 Years, r=4%)

	Percent of Wealth Held By Top								
	99%	95%	90%	75%	50%	25%	10%	5%	1%
1. No mortality	99.19	95.78	91.34	77.43	52.83	27.04	10.92	5.48	1.10
2. Mortality	99.24	95.99	91.74	78.32	54.58	29.28	12.76	6.75	1.50
3. No Mortality and Skill Differences	99.87	98.71	96.75	88.97	70.86	46.99	27.86	19.55	5.55
4. Mortality and Skill Differences	99.86	98.69	96.68	88.61	70.40	46.02	26.89	18.72	5.33
5. No Mortality, Skill Differences, and Marital Sorting	99.97	99.55	98.43	92.66	76.54	52.40	31.98	22.82	9.39
6. Mortality, Marital Sorting, and, Skill Differences	99.96	99.44	98.18	92.03	75.45	51.25	30.95	21.93	9.09
7. No Mortality, Skill Differences, and Inherited Skills	99.87	98.81	96.91	89.12	70.81	46.52	27.69	19.28	5.63
8. Mortality, Skill Differences, and Inherited Skills	99.84	98.66	96.65	88.60	70.56	46.67	27.48	19.19	5.67
9. No Mortality, Skill Differences, Marital Sorting, and Inherited Skills	99.97	99.59	98.51	92.93	77.30	53.52	33.35	24.30	9.42
10. Mortality, Skill Differences, Marital Sorting, and Inherited Skills	99.96	99.52	98.39	92.77	77.09	53.46	33.28	24.03	9.37

Source: Authors' calculations.

Table 7: Inequality and Bequest Flows--with Social Security and without Progressive Income Taxation (Wealth at Age 66, 2000 Households, 150 Years, r=4%, 30% of Payroll Taxes Annuitized)

	Wealth Gini	Consumption Gini	Total Bequest Flow*	X-Gen Bequest Flow*	Consumption Flow*
1. No mortality	0.099	0.045	0.00	0.00	66.57
2. Mortality	0.146	0.049	2.64	0.88	68.02
3. No Mortality and Skill Differences	0.505	0.382	0.00	0.00	68.09
4. Mortality and Skill Differences	0.550	0.373	3.72	1.33	69.72
5. No Mortality, Skill Differences, and Marital Sorting	0.575	0.467	0.00	0.00	68.07
6. Mortality, Marital Sorting, and, Skill Differences	0.614	0.456	3.33	1.01	69.61
7. No Mortality, Skill Differences, and Inherited Skills	0.496	0.378	0.00	0.00	68.10
8. Mortality, Skill Differences, and Inherited Skills	0.517	0.351	3.88	1.35	69.66
9. No Mortality, Skill Differences, Marital Sorting, and Inherited Skills	0.567	0.462	0.00	0.00	68.10
10. Mortality, Skill Differences, Marital Sorting, and Inherited Skills	0.627	0.464	3.72	1.20	69.70

* Annual flow as a percent of annual labor income. X-Gen stands for cross-generation.

Table 8: Wealth Distribution—with Social Security and without Progressive Income Taxation (Wealth at Age 66, 2000 Households, 150 Years, r=4%, 30% of Payroll Taxes Annuitized)

	Percent of Wealth Held By Top								
	99%	95%	90%	75%	50%	25%	10%	5%	1%
1. No mortality	99.47	96.93	93.32	80.97	57.18	30.22	12.42	6.28	1.28
2. Mortality	99.65	97.71	94.65	83.35	60.47	32.85	14.37	7.67	1.75
3. No Mortality and Skill Differences	99.92	99.21	97.96	92.64	80.10	61.98	45.73	36.76	12.50
4. Mortality and Skill Differences	99.93	99.35	98.31	93.77	82.42	65.87	50.07	40.62	13.17
5. No Mortality, Skill Differences, and Marital Sorting	99.98	99.72	99.03	95.20	84.08	66.58	50.32	41.72	20.88
6. Mortality, Marital Sorting, and, Skill Differences	99.98	99.70	99.06	95.66	85.85	70.13	54.86	46.18	22.55
7. No Mortality, Skill Differences, and Inherited Skills	99.93	99.25	97.99	92.63	79.62	61.19	44.74	35.90	11.31
8. Mortality, Skill Differences, and Inherited Skills	99.94	99.30	98.10	93.08	80.74	62.72	46.47	37.80	15.28
9. No Mortality, Skill Differences, Marital Sorting, and Inherited Skills	99.98	99.71	99.01	95.26	84.01	66.01	49.01	39.75	19.07
10. Mortality, Skill Differences, Marital Sorting, and Inherited Skills	99.98	99.77	99.21	96.09	86.77	71.06	56.12	47.37	21.01

Source: Authors' calculations.

Table 9: Inequality and Bequest Flows--with Social Security and with Progressive Income Taxation
(Wealth at Age 66, 2000 Households, 150 Years, r=4%, 30% of Payroll Taxes Annuitized)

	Wealth Gini	Consumption Gini	Total Bequest Flow*	X-Gen Bequest Flow*	Consumption Flow*
1. No mortality	0.114	0.038	0.00	0.00	54.99
2. Mortality	0.207	0.040	1.24	0.39	56.35
3. No Mortality and Skill Differences	0.473	0.328	0.00	0.00	54.07
4. Mortality and Skill Differences	0.575	0.323	2.30	0.67	55.44
5. No Mortality, Skill Differences, and Marital Sorting	0.532	0.407	0.00	0.00	53.08
6. Mortality, Marital Sorting, and, Skill Differences	0.623	0.401	2.14	0.75	54.44
7. No Mortality, Skill Differences, and Inherited Skills	0.463	0.320	0.00	0.00	54.12
8. Mortality, Skill Differences, and Inherited Skills	0.570	0.316	2.01	0.57	55.55
9. No Mortality, Skill Differences, Marital Sorting, and Inherited Skills	0.516	0.402	0.00	0.00	53.01
10. Mortality, Skill Differences, Marital Sorting, and Inherited Skills	0.643	0.415	2.01	0.61	54.31

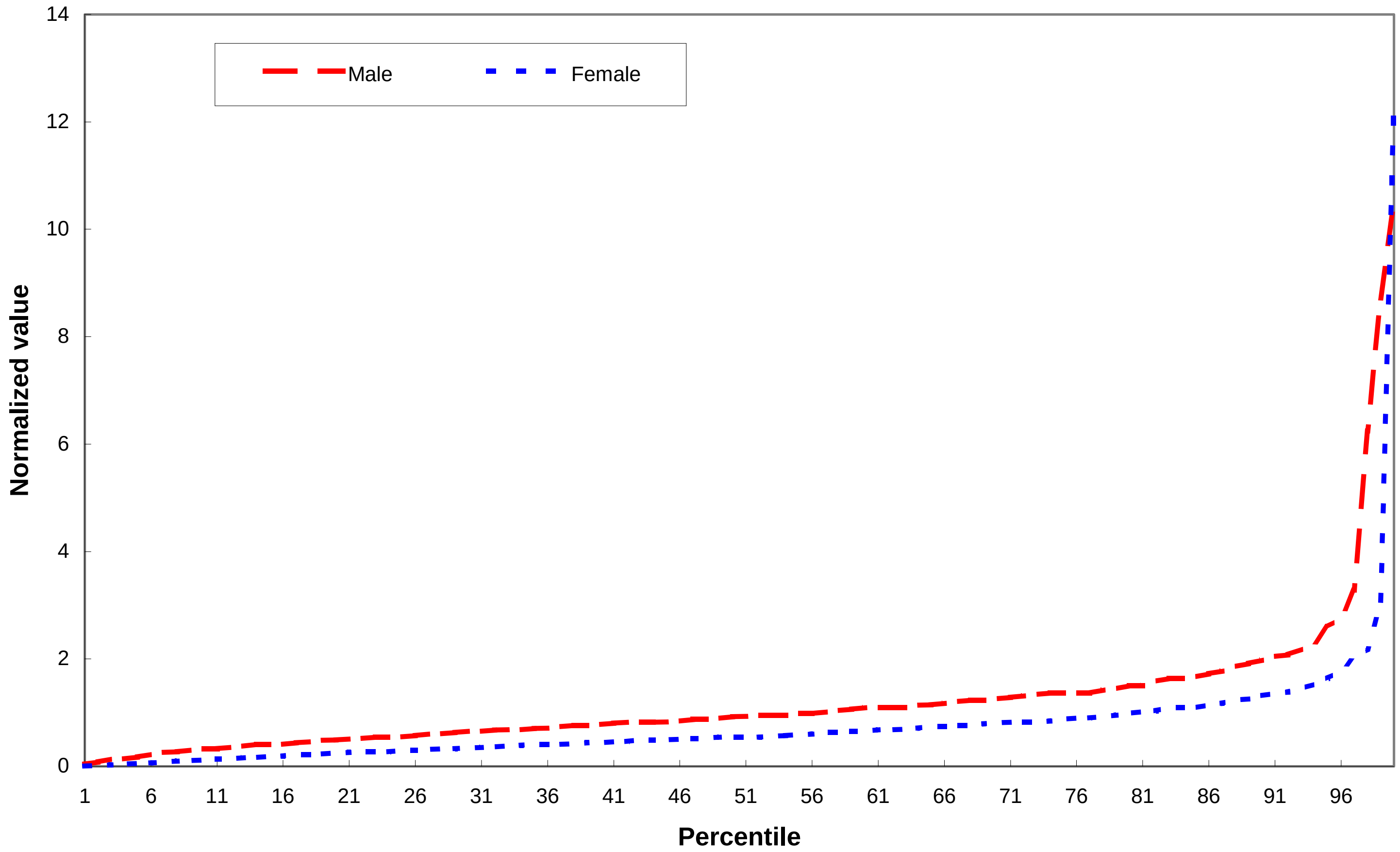
* Annual flow as a percent of annual labor income. X-Gen stands for cross-generation.

Table 10: Wealth Distribution—with Social Security and with Progressive Income Taxation (Wealth at Age 66, 2000 Households, 150 Years, r=4%, 30% of Payroll Taxes Annuitized)

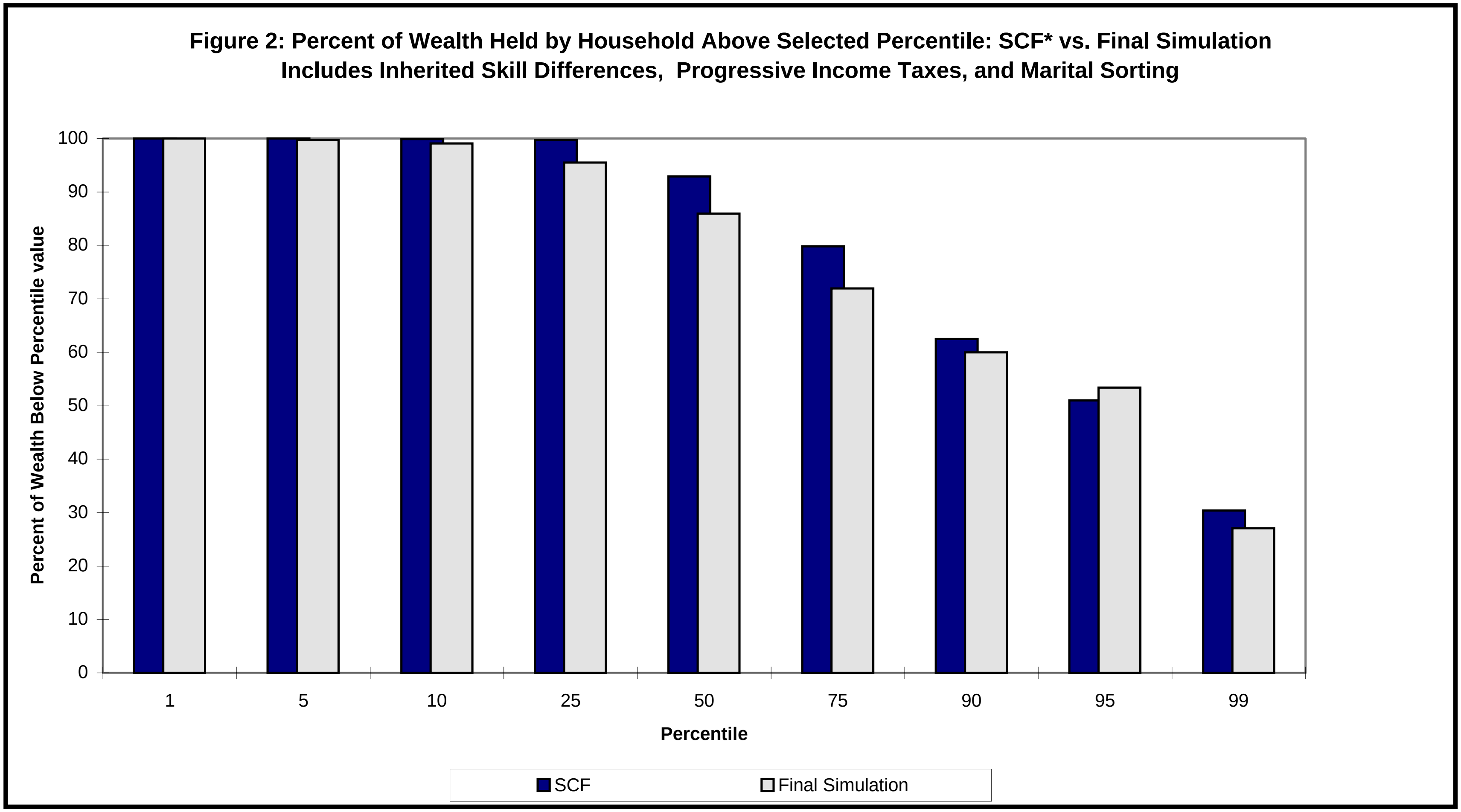
	Percent of Wealth Held By Top								
	99%	95%	90%	75%	50%	25%	10%	5%	1%
1. No mortality	99.55	97.26	93.89	82.03	58.19	30.92	12.66	6.40	1.30
2. Mortality	99.96	99.02	96.83	87.36	65.00	35.82	15.51	8.26	1.90
3. No Mortality and Skill Differences	99.85	98.89	97.33	91.31	77.63	59.61	45.19	36.85	11.44
4. Mortality and Skill Differences	99.97	99.41	98.30	93.78	83.00	67.95	54.45	45.29	14.73
5. No Mortality, Skill Differences, and Marital Sorting	99.97	99.56	98.54	93.63	80.94	63.13	48.73	41.25	20.72
6. Mortality, Marital Sorting, and, Skill Differences	99.99	99.68	98.89	95.13	85.31	70.86	58.40	50.77	25.82
7. No Mortality, Skill Differences, and Inherited Skills	99.87	98.84	97.21	91.02	77.21	58.78	43.93	35.62	12.15
8. Mortality, Skill Differences, and Inherited Skills	99.96	99.39	98.31	93.73	82.66	67.32	54.31	45.44	14.55
9. No Mortality, Skill Differences, Marital Sorting, and Inherited Skills	99.97	99.57	98.52	93.51	80.40	61.55	46.49	39.12	19.91
10. Mortality, Skill Differences, Marital Sorting, and Inherited Skills	99.99	99.73	99.05	95.52	86.20	72.30	60.54	53.78	27.37

Source: Authors' calculations.

Figure 1: Normalized Earnings Profiles*



* Normalized to yield annual wage flow of $176000 in the simulation (see text).
Source: Authors' calculations from the Current Population Survey, March 1996.



* Married households with household heads aged 60-69.

Source: Authors' calculations from the Survey of Consumer Finances, 1995 and simulation (Table 10, row 10).