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**The Impact of Social Security
and Other Factors on the
Distribution of Wealth**

by Jagadeesh Gokhale and
Laurence J. Kotlikoff



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Abstract

Auerbach et al. (1995), document the dramatic postwar increase in the annuitization of the resources of America's elderly. Gokhale et al. (1996) suggest that greater annuitization may explain the significant postwar rise in the consumption propensity of the elderly out of remaining lifetime resources. Gokhale et al. (2000) consider the related point that increased annuitization will reduce bequests, especially for lower and middle-income households, whose entire earnings are taxed under Social Security. By differentially disenfranchising the children of the poor from receipt of inheritances, Social Security may materially alter the distribution of wealth. This paper uses data from the PSID to further analyze how Social Security and other factors affect wealth inequality. The Gini coefficient of the simulated equilibrium wealth distribution is 21 percent larger and the share of wealth held by the wealthiest 1 percent of households is 79 percent higher in the presence of Social Security.

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Distribution of Wealth**

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Abstract

As documented in Auerbach, et. al. (1995), the postwar period has witnessed a dramatic increase in the annuitization of the resources of America's elderly. Social security appears to be the main force behind this process, but Medicare, Medicaid, and private defined benefit pensions also play an important role in replacing household wealth accumulation with survival-dependent old-age resource streams. Gokhale, et. al. (1996) suggest that the increased annuitization may explain the significant postwar rise in the propensity of the elderly to consume their remaining lifetime resources. Gokhale, et. al. (2000) considers a related point, namely, that increased annuitization will reduce bequests. This is particularly the case for lower and middle-income households, who face social security taxation on all of their earnings. In differentially disenfranchising the children of the poor from the receipt of inheritances, social security may be materially altering the distribution of wealth. This paper builds on Gokhale, et. al. (2000) in trying to understand how social security and other factors affect wealth inequality.

Gokhale, et. al. (2000) use synthetic data generated by CORSIM – a micro simulation model – in conjunction with cross-section earnings data from the Survey of Consumer Finances (SCF) to calibrate the distribution of lifetime labor earnings. Their simulated distribution of wealth held by those reaching retirement closely matches that observed in the SCF. This is particularly true at the upper tail of the wealth distribution. In addition to matching the wealth distribution, Gokhale, et. al. decompose the influence of various factors, including social security, on wealth inequality. They point out that social security, in differentially disenfranchising the children of the poor from receiving substantial inheritances, plays a significant role in exacerbating wealth inequality.

While intriguing, Gokhale, et. al.'s (2000) results should be viewed with caution given the synthetic generation of lifetime earnings upon which they rely. This paper attempts to deal with that shortcoming by considering actual lifetime earnings as reported in the long PSID panel. The availability of actual lifetime earnings also permits a more accurate calibration of the degree of assortative mating and inheritability of skills. These advantages must be set against a key disadvantage: the PSDI does not adequately capture the skewness in the upper tail of the distribution of lifetime earnings.

Because we are using the PSID, which under-represents high earners, to generate the distribution of lifetime earnings, and because the PSID data suggest a rather minor degree of assortative mating, our simulated distribution of wealth holdings among households reaching retirement is much less skewed than that reported in Gokhale, et. al. (2000). It is also less skewed than the 1995 SCF and 1984 PSID wealth distributions of married households ages 60-69. Although we are less successful than Gokhale, et. al. (2000) in matching the upper tail of the wealth distribution, we continue to find that social security plays an important role in making wealth holdings less equal. The Gini coefficient for our simulated distribution of wealth is 21 percent higher in the presence of social security than in its absence. And social security raises the share of wealth held by the wealthiest 1 percent of retiring households by 79 percent.

I. Introduction

As documented in Auerbach, et. al. (1995), the postwar period has witnessed a dramatic increase in the annuitization of the resources of America's elderly. Indeed, between 1960 and 1990, the annuitized share of resources of older men doubled and that of older women quadrupled. Social security is the main force behind this process, but Medicare and Medicaid as well as private pensions play an important role in replacing household wealth accumulation with survival-dependent old-age resource streams. Gokhale, et. al. (1996) suggest that the increased annuitization may explain the significant postwar rise in the propensity of the elderly to consume their remaining lifetime resources. Gokhale, et. al. (2000) considers a related point, namely, that increased annuitization will reduce bequests. This is particularly the case for lower and middle-income households, who face social security taxation on all of their earnings. In differentially disenfranchising the children of the poor from the receipt of inheritances, social security may be materially altering the distribution of wealth.

This paper builds on Gokhale, et. al. (2000) in trying to understand how social security and other factors affect wealth inequality. Specifically, this paper uses lifetime earnings data from the Panel Study of Income Dynamics (PSID) to calibrate Gokhale, et. al.'s (2000) bequest simulation model. The model features random death, random fertility, assortative mating, heterogeneous human capital endowments, heterogeneous rates of return, the inheritability of human capital, progressive income taxation, and the partial annuitization through social security of households' retirement savings. Agents have no bequest motive. They live for at most 88 years, the first 22 as children, the second 22 as young married adults who have children, the third 22 as middle-aged adults raising children, and the last 22 as elderly individuals who die at random. Surviving

spouses inherit all their partner's wealth, but bequeath their own wealth in equal portions to their children.

Gokhale, et. al. (2000) use synthetic data generated by CORSIM – a micro simulation model – in conjunction with cross-section earnings data from the Survey of Consumer Finances (SCF) to calibrate the distribution of lifetime labor earnings. Surprisingly, their simulated distribution of wealth held by those reaching retirement closely matches that observed in the SCF. This is particularly true at the upper tail of the wealth distribution. In addition to matching the wealth distribution, Gokhale, et. al. decompose the influence of various factors, including social security, on wealth inequality. They show that absent social security, inheritances would reduce slightly the degree of wealth inequality. But in social security's presence, they find that inheritances significantly exacerbate wealth inequality.

While intriguing, Gokhale, et. al.'s results should be viewed with caution given the synthetic generation of lifetime earnings upon which they rely. This paper attempts to deal with that shortcoming by considering actual lifetime earnings as reported in the long PSID panel. The availability of actual lifetime earnings also permits a more accurate calibration of the degree of assortative mating and inheritability of skills. These advantages must be set against a key disadvantage: the PSDI does not adequately capture the skewness in the upper tail of the distribution of lifetime earnings. Since the upper tail of the distribution of lifetime earnings plays such a key role in determining the upper tail of the distribution of wealth, this paper focuses on the shape of the distribution of wealth in the bottom half of the wealth distribution.

Because we are using the PSID to generate the distribution of lifetime earnings, and because the PSID data suggest a rather minor degree of assortative mating, our simulated distribution of wealth holdings among households reaching retirement is much

less skewed than that reported in Gokhale, et. al. (2000). It is also less skewed than the 1995 SCF and 1984 PSID wealth distributions of married households ages 60-69.

Although we are less successful than Gokhale, et. al. (2000) in matching the upper tail of the wealth distribution, we continue to find that social security plays an important role in making wealth holdings less equal. The Gini coefficient for our simulated distribution of wealth is 16 percent higher in the presence of social security than in its absence. And social security raises the share of wealth held by the wealthiest 10 percent of retiring households by almost one quarter.

The paper proceeds in Section II with a brief literature review. Section III draws heavily on Gokhale, et. al. (1990) in describing the model. Section IV discusses the model's calibration. Section V presents results, and Section VI draws conclusions.

II. Related Literature

Wedgwood (1929), Harbury and Hitchens (1979), and Menchik (1979) are well-sited studies that connect the wealth of sons to the estates of their fathers. While suggestive, their data don't necessarily imply that inherited wealth is a source of inequality.¹ Nevertheless, they reinforced Meade's (1976) view that inheritances exacerbate wealth inequality -- a conclusion supported by the theoretical model of Wilhelm (1997). Stiglitz (1969) and Stiglitz and Atkinson (1980) offered an alternative perspective. They showed that under certain assumptions, a stable, egalitarian distribution of wealth would emerge if inheritances were distributed evenly among all of one's children.

¹ Their data record the total value of the father's estate, rather than the amount actually inherited by the son. And their findings may be explained, in large part, by the inheritances by sons of their fathers' human capital.

The models Becker and Tomes (1979) and Tomes (1981) go beyond these studies in examining the joint role that inheritances of financial wealth and earning power (human capital) play in determining whether intergenerational transfers are equalizing. 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 – an issue first examined by Blinder (1973). The studies of Meade (1964), Stiglitz (1969), Pryor (1973), Atkinson and Harrison (1978), and Atkinson (1980) also stress the role of imperfect correlation of spouses' inheritances in equalizing the distribution of inheritances.²

Early simulation studies of wealth inequality include Atkinson (1971), Flemming (1976), Oulton (1976), and Wolfson (1977). Their central finding is that, absent bequests, the life-cycle model is unable to explain the upper tail of the wealth distribution. Wolfson (1979) and Davies (1982) add bequests, specifically desired bequests, and generate much more realistic skewness in the distribution of wealth.

Flemming (1979) is the closest antecedent to our work. He too considers earnings heterogeneity and the inheritability of skills, but not marriage, assortative mating, or heterogeneity in the number and spacing of children. Flemming finds that wealth is much more unequally divided than earnings and that both unintended and intended bequests can markedly increase wealth inequality. Although many of our findings agree with Flemming's, we find that, in the absence of social security, unintended bequests serve to reduce slightly intragenerational wealth inequality.

² Theoretical work on taxation provides additional grounds for believing that inheritances are equalizing. 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

Empirical Support for Excluding Altruism

Although Laitner and Juster (1996) provide some limited support for altruism, most recent studies do not. To be precise, Boskin and Kotlikoff (1985), Altonji, Hayashi and Kotlikoff (1992, 1997), Abel and Kotlikoff (1994), Hayashi, Altonji, and Kotlikoff (1996), Gokhale, Kotlikoff, and Sabelhaus (1996), Wilhelm (1996), and Hurd (1992) show that a) the distribution of consumption across cohorts is very strongly dependent on the cross-cohort distribution of resources, b) the distribution of consumption within extended families is very strongly dependent on the distribution of resources within extended families, c) that taking a dollar from a child and handing it to parents who are actively transferring income to that child leads the parent to hand back only 13 cents to the child, d) that the very major postwar increase in the annuitization of the resources of the elderly has not been even partially offset by an increase in their holdings of life insurance, e) that the vast majority of bequests are distributed equally among children independent of their economic needs, and f) the presence of children doesn't influence post-retirement dissaving. Individually and as a group, these studies constitute very strong evidence against intergenerational altruism, suggesting that most bequests may be unintended or motivated by non-altruistic considerations – the modeling assumption made here.

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 to include the capitalized value of social security receipts, it falls throughout retirement. Hurd also concludes from a careful analysis of panel and cross-section data

considered by Loury (1981), redistributive taxation of bequests can reduce intragenerational inequality.

that the evidence on wealth changes is consistent with the life-cycle hypothesis and the view that bequests are accidental.

Meade (1966) and Flemming (1976) provide a final reason to doubt the prevalence of altruistically motivated bequests. They pointed out that anything less than very strong altruism would not suffice to generate ubiquitous and significant bequests since the lifetime incomes of children significantly exceed those of their parents.

III. The Model and Its Calibration

This section describes the model's demographic structure, skill allocation, determination of inheritance, and consumption and saving behavior.

Demographics

Agents can live for 88 periods, the first 22 of which they spend as children whose consumption is financed by their parents. All events, including earnings, consumption, marriages, births, deaths, wealth transfers, occur at the end of each period. Agents marry on their 22nd birthday. They give birth to children at ages 22 through 43, depending on their draw from a "birth matrix" described below. They also enter the work force on their 22nd birthday and work through age 66. They face positive probabilities of dying between ages 67 and 88. The probability of an agent's dying on her 88th birthday, given that she has lived to that date, is 100 percent. The probabilities of dying at ages 67 through 87 are taken from U.S. mortality statistics.

The number, sexes, and timing of children born to each couple are determined randomly. This distribution is aligned to ensure that 2000 males and 2000 females are born each year. There is no population growth, so total annual births remain fixed through time.

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 will have two children, one when the couple is age 25 and the other when it is 28:

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

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.

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."

Assuming 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 die by age 88), 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 present 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

Assortative Mating

Agents are assigned their marriage partners at age 22 on a partly systematic basis in which the probability of a match is higher the closer are the respective skill ranks of the two partners. Our assortative mating works as follows. We first construct for each year of the simulation a vector A containing 2000 random numbers drawn from a uniform distribution with support (0,1). Vector A is sorted in ascending order. Second, a vector B is constructed containing 2000 random numbers from the same distribution but is left unsorted. Third, vector $C = \alpha A + (1-\alpha)B$ is constructed to yield a new vector of

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.

numbers between 0 and 1. Fourth, we associate with the first element of the C vector the integer 1, with the second element the integer 2, and so on up to the last element of C to which we associate the integer 2000. Fifth, we sort C such that C ends up in ascending order and denote the associated integers as vector R. This vector is used to assign the husband's skill rank, j , for each female skill rank, where the female skills are aligned in ascending order), $i=1\dots 2000$.

For example, suppose that, for a given year, after the C vector has been generated and sorted in ascending order, the first three integers associated with the first three elements of the C vector are 3, 51, and 1290. Then the most skilled 22 year-old female in that year will be married to the 3rd most skilled 22 year-old male, the 2nd most skilled 22 year-old female will be married to the 51st most skilled 22 year-old male, and the 3rd most skilled 22 year-old female will be married to the 1290th most skilled 22 year-old male. The parameter α is chosen to reproduce the rank correlation coefficient between husband's and wives' lifetime earnings, which we estimate in the PSID.

Inheritance of Skills

The procedure just described for correlating husbands' and wives' lifetime earnings is also used to determine the correlation between fathers' and sons' lifetime earnings as well as the correlation between mothers' and daughters' lifetime earnings. In each case, the relevant parameter α is calibrated to reproduce the rank correlation coefficient observed between sons' (daughters') and fathers' (mothers') lifetime earnings.

Fertility

An initial population (at time $t=0$) of 4000 thousand individuals (2000 males and 2000 females) was created for each age between 0 and 87. This was done as follows:

First, a matrix of "birth ages" was derived from a fertility simulation of CORSIM – a dynamic microsimulation model of the U.S. economy described in Caldwell et al. (1998). The simulation considered 40,434 females born between 1945 and 2000 and recorded their ages of giving birth if those ages fell between ages 22 and 43. For each female in our CORSIM sample, we stored this information in our CORSIM birth matrix that accommodates 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 allowed us to process only 4000 individuals in each year of birth, we needed 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 started by selecting 2000 rows from the birth matrix. The selection was done at random without replacement except that rows containing more than 5 births were excluded. The total number of births in the selected 2000-row matrix exceeded 4000. Hence, we randomly eliminated male and female births in the rows of this matrix for rows containing more than one birth until we were left with precisely 2000 male and 2000 female births. This guaranteed that the 2000 rows of the final birth matrix would generate exactly 2000 female and 2000 male births. Table 1.2 shows the distribution of females by the number and sex of their births in the birth matrix used in the simulation.

Populating the Model at Time Zero

We populated our model by first creating 2000 male and 2000 female old-adults for each age between 67 and 88. These males and females were then married to each other sequentially. Some of these oldsters were treated as dead when we initiate the simulation. But we needed to include their ghosts at this stage of our process of

populating the model in order to establish complete family trees. Marriage was 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 wives were 22). Family relationships were established by exchanging id numbers.

In our next step, we drew from the 2000 thousand rows of the birth matrix at random (but without replacement) the middle-aged and young-adult children of the initial oldsters, ranging in age from 24 through 66. In this process, we do not permit 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.

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 has been considered, but not everyone who gave birth to those between ages 24 and 44 and those between ages 46 and 66 has been considered.

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) were married at random, making sure that siblings were not married to each other. Next, the children of middle-aged adults were 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 had been considered. The children produced by this process range in age from 2 through 44.⁵ 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 was also used to marry the young adults.

The next step in the creation of the initial population was creating the children of the t=0 young adults that were born at t=-1 or earlier. Each young-adult female was assigned a row of the birth matrix at random without replacement, and children were 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 were 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 were not created as yet. At the end of this process, exactly 2000 males and 2000 females had been created for each age between 1 and 88. The final step in creating the initial population was to kill off oldsters (make the ghosts disappear) according to their cumulative mortality probabilities.⁶

Populating the Model through Time

In populating the model through time we do the following. First, for t=0, we allocate at random and without replacement a row from the birth matrix to all 22 year-old females. Second, we marry 22-year-olds males and females at random, or according to the assortative mating procedure described above. Third, we have females age 22-43

⁵ 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.

⁶ 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

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

give birth as determined by their assigned birth matrix row creating 2000 newborn (0-year-old) males and 2000 newborn (0 year-old) females. Fourth, we kill off oldsters at random according to the conditional probability of dying at their respective ages. The wealth of these oldsters is transferred to the surviving spouse or children. Fourth, we age everyone by one year.

Using the PSID to Calculate Lifetime Earnings

The Panel Study of Income Dynamics (PSID) began in 1968 with a representative sample of 5,000 U.S. households. The PSID has re-interviewed (or attempted to re-interview) the individuals from those households every year since that time, regardless of their demographic status, living arrangements, etc. Children of original PSID respondents have been followed after they have left their parents' households.

Forming longitudinal labor income profiles involves the following steps: First, labor income, family number, and sex variables for “head” and “wife” are extracted from the family file for year x and merged with the individual file by year- x family number, retaining only those observations that appeared in year x .⁷ Step 1 is repeated separately for each year from 1968 to 1993 to create 26 separate data files. Each data file is sorted by “family interview number” and “person number” (in that order), and all are merged together to form a single “cross-year individual” file containing individual longitudinal labor income profiles.

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

⁷ The PSID's file structure comprises one cross-year individual file and several single-year family files. The cross-year individual file contains records for all individuals that ever appeared in the survey—whether these individuals were members of the original sample of households or households that formed after 1968. This individual file contains a “person number” variable indicating the response status for each individual which can be associated with the family number to create a unique person identifier. Unfortunately, the cross-year individual file does not contain labor income for “head” and “wife” for all of the years. Hence it was necessary to select these variables from the single-year family files and merge them together to form individual longitudinal labor income profiles.

The PSID reports annual labor income in nominal dollars. To place the income earned in different years on a comparable basis, we divide each year's values by the ratio of that year's Social Security Administration's average wage index to the average wage index in 1997. Using this wage index to re-scale nominal labor income adjusts not only for inflation, but also for labor productivity growth. The base year is selected to be 1997 because that year's federal income tax rates and brackets are used to implement progressive income taxation in our simulation. Our motivation for controlling for productivity growth in forming lifetime earnings is simple: our model does not account for productivity growth. Our next step is to sort the cross-year individual file by sex.⁸

Not all individuals appear in the PSID in each year between 1968 and 1993. Moreover, some individuals appear as "head" or "wife" for just a few years. To ensure a minimum number of data points from which to form lifetime earnings, we retained in our sample only those individuals who appear for at least 10 years as "head" or "wife" between the ages of 23 and 66.

Since the PSID spans only 26 years it cannot provide us with earnings profiles for the full complement of 44 years (from age 23 to age 66) of earnings – the lifetime earnings profile as required by our simulation. Hence, we adopt a procedure for extrapolating each individual's labor income both backward and forward as required. First, we calculate average labor incomes for all males who appeared in the sample (as "head" or "wife") at each age between 23 and 66.⁹ This provides us with a benchmark age-earnings profile for males—M23-M66. This procedure is repeated for females to generate a corresponding benchmark profile for females—F23-F66.

⁸ We classify appropriately female "heads" and male "wives."

⁹ Thus, those who appeared in the sample at their age 23 are included in calculating the average labor income for age 23; those who appeared in the sample at age 24 are included in calculating the average labor income at age 24...and so on through age 66.

Next, for each individual, we calculate two average labor incomes. A1 is the average labor income over the first five years of the person's presence in the sample, and A2 is the average labor income over the last five years that the person is present in the sample (as "head" or "wife"). For example, if a female appeared in the sample at each age between 35 and 54, A1 would be her average labor income at ages 35 through 39, and A2 would be average labor income at ages 50 through 54. A1 is used to extrapolate her labor income backward—from age 34 through age 23. Her imputed income at age 34 equals A1 times the ratio of M34 to the average of M35-M39; her imputed income at age 33 equals A1 times the ratio of M33 to the average of M35-M39, and so on. A similar procedure is adopted when extrapolating individuals' labor incomes forward—beyond their oldest age as a PSID "head" or "wife" (54 for the male in the current example) through age 66.

The sample of individuals for whom we could compute/impute lifetime earnings profiles in this manner included 4206 males and 4419 females. However, our simulation includes only 2000 individuals of each sex. To arrive at 2000 male and female lifetime earnings profiles, we proceed in the following manner. First we replicate each of the 4206 male and 4419 female observations in proportion to their sample population weights. Second, we group to the nearest integer the "blown-up" males and females into .05 percentiles of the present value of lifetime earnings. Third, we pick the observation with the highest value of lifetime earnings in each of the .05 percentiles. This gives us 2000 males and 2000 females whose level and pattern of lifetime earnings are used in the simulation.

Calibrating the Degree of Assortative Mating and the Inheritability of Skills

Armed with the original (not blown up by population weights) lifetime earnings of the sample of 4206 males and 4419 females, we formed for each year of the PSID sample the rank correlation coefficients between a) the lifetime earnings of husbands and their wives observed in that year and b) the lifetime earnings of fathers (mothers) and sons (daughters) observed in that year. The average (across all the years) values of the husband-wife and same-sex parent-same-sex child rank correlation coefficients are .10 and .44, respectively. These coefficients are used to calibrate the α parameters mentioned above.

Before proceeding, we should point out that the .10 husband-wife rank correlation coefficient is quite small relative to our priors. It's also much smaller than the .70 guesstimate used by Gokhale, et. al. (2000). If the value is correct, and we have no reason to doubt it, it suggests that assortative mating on the basis of lifetime earnings may not be an important factor.

Bequests and Inheritances

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

Initial Wealth Endowments and Length of the Simulations

We start each of our simulations by giving 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 run each simulation for 150 years.

Including Interest Rate Heterogeneity

Different households face different rates of return on their portfolios because they systematically choose to hold different portfolios. To incorporate rate-of-return heterogeneity, we use data on the portfolio holdings of households from the 1995 SCF. Our first step entails classifying those household assets reported in the survey into several categories. Next, we assign a rate of return to each asset category, and compute the portfolio-weighted rate of return that each household faces, given its portfolio of assets.¹⁰ Finally, we compute the weighted frequency of households for rates of return ranging

¹⁰ The asset categories are liquid assets, government bonds, private bonds and bond mutual fund shares, stocks and stock mutual funds, real estate, and other non-financial assets. Liability categories include mortgages and real estate debt and other debt. In forming a weighted average rate of return on each household's portfolio, we used the absolute value of liabilities. For liquid assets we assumed the geometric average annual real rate of return (0.68 percent) on U.S. Treasury bills during the period 1926-97. For government bonds we use the geometric average annual real rate of return on long and intermediate term government bonds between 1926 and 1997 (2.09 percent). For private bonds and bond mutual funds we use the geometric average rate of return on long-term corporate bonds between 1926 and 1997 (2.52 percent). For stocks and stock mutual funds, we use the weighted average of real rates of return on large and small company stocks (8.00 percent). The weights for the two stock market returns were obtained from analysts at the Wilshire 5000 company. The source for the aforementioned average rates of return is the 1998 Yearbook published by Ibbotson Associates. The average rates of interest on mortgages and other real estate debt was constructed using data from Case and Shiller (1990) who report annualized excess returns (excess over the 3-month T-bill return) on home-purchases for each quarter between 1971 and 1986 in four large U.S. metropolitan areas. We computed the total returns by adding the annualized real T-bill return for each quarter, calculated the geometric mean over the period of the study, and averaged the rates of return over the four metropolitan areas. This procedure yields a real rate of return of 0.45 percent. Finally the rate of return for mortgage and real estate debt was calculated as the geometric average nominal mortgage rate between 1973 and 1997 divided by the geometric average rate of inflation over the same period. This yielded 3.91 percent. The average real rate on other debt was assumed to be 13.54 percent the rate applicable for 1995—obtained from the Statistical Abstract for the United States, 1998, Table 820.

from zero to 10+ percent in steps of 0.5 percent. This frequency distribution is used to randomly allocate the average rate of return within each step to households in the simulation. Households are assumed to earn their assigned rate of return in each year of their lives.

Additional Issues of Calibration

The mortality probabilities used in the analysis are those released by the U.S. Social Security Administration for 1995. The interest rate used in the simulations is 4 percent. To obtain a realistic shape of the age-consumption profile, we assume that the time preference factors generate a 1.5 percent growth in the planned path of consumption per equivalent adult through age 65.¹¹ From age 66 through age 88, planned consumption per equivalent adult remains constant. As mentioned, our fertility matrix is derived from simulating CORSIM. Its fertility module includes separate logistic functions for 30 different subgroups of women estimated 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.

¹¹ Actual consumption per equivalent adult prior to age 66 will differ from planned consumption if the household receives one or more inheritances.

IV. Findings

Tables 1 and 2 describe the distributions of wealth resulting from 11 different simulations. Our base-case simulation incorporates mortality prior to age 88, assortative mating, heterogeneity in skills, inheritance of skills, life-cycle consumption growth, heterogeneity in rates of return, progressive income taxation, and a social security system with a ceiling on taxable income. The other 10 simulations are variants on the base case that leave out one, or, in the case of simulation 11, two of these elements.

Row 1 in Table 1 shows results for our base-case simulation, including a wealth Gini of .336 and a consumption Gini of .283 among age-66 households. The consumption Gini is smaller because consumption is financed in part by social security benefits, and these benefits are more evenly distributed than is net wealth. Row 1 also indicates that the steady-state flow of total bequests in our model is 4.5 percent of aggregate labor earnings, and the cross-generational flow is 1.5 percent of aggregate labor earnings. This cross-generational flow of bequests appears to be about half as large as in the actual U.S. economy. We say this because our own unpublished calculations using the 1962 and 1995 SCFs suggest that cross-generational bequests in the actual economy are roughly 3 percent of total labor compensation.¹²

Figure 1 graphs the first row of Table 2 -- the wealth distribution of age-66 couples generated by our base-case simulation. It also compares this distribution with wealth distributions of married couples whose heads are age 60-69 in a) the 1995 SCF and b) the 1984 PSID. As the figure makes clear, the concentration of wealth at the very

¹² In forming these calculations we first benchmarked 1962 and 1995 SCF net worth and life insurance holdings to Federal Reserve Flow of Funds and American Council of Life Insurance respective reported aggregates. Next we calculated the flow of bequests by age and sex by a) assuming that single people with children leave their entire estates to their children, b) assuming that married decedents leave 15 percent of their estates to their children, and c) assuming that all decedents have the same age- and sex-specific mortality rates as those that prevailed in 1962 and 1994. Our estimated ratios of cross-generational bequests to total labor compensation are .030 for 1962 and .033 for 1994.

top of the wealth distribution is much more substantial in the SCF. The SCF wealth Gini is .73 – more than twice as large as our simulated Gini.

Why is our model generating too little skewness in the distribution of wealth compared to the SCF? The answer, we believe, is that a) the PSID distribution of lifetime earnings is much less skewed than that of the actual economy and b) the skewness of lifetime earnings makes a big difference for the skewness in our simulated distribution of wealth. To see the importance of our assumed degree of earnings inequality to our simulated wealth inequality, consider the row-2 results in Tables 1 and 2, which omit labor earnings heterogeneity. Without skill differences, the wealth Gini falls from .336 to .097. The fact that there is any wealth inequality in the absence of skill inequality is due to differences across households in the number and timing of their children as well as differences in the rates of return earned on their saving.

The PSID earnings data from which we construct our male and female distributions of lifetime earnings is certainly much less skewed than the corresponding male and female cross-section distributions of earnings in the SCF. This would explain why the simulated wealth distribution in our base case is less concentrated than in the SCF.

What's harder to explain is why the PSID's wealth concentration in the top tail is much greater than that simulated by the model. This may reflect a higher degree of underreporting of earnings among the rich than of their assets. One way to get at this possibility is to compare the distribution of wealth among the poorest (measured in terms of wealth) of our age-66 simulated couples with the corresponding distribution of wealth among the poorest half of the SCF age 60-69 year-old couples. Figure 2 makes this comparison. While our model fits the distribution of the truncated data quite well at the very top of the tail, the fit in the rest of the top tail is not very good.

Determinants of Wealth Inequality

The remaining simulations in Tables 1 and 2 examine other determinants of wealth inequality. Consider first simulation 3, which eliminates assortative mating. Given the limited assortative mating we find in the data and incorporate in the base case, it's not surprising that eliminating assortative mating altogether makes very little difference to simulated wealth inequality. A second "non-factor" with respect to the distribution of wealth is the inheritance of skills from parents. How agents come to have their skills doesn't appear to matter much for the cross-section distribution of wealth. This is clear from Simulation 4 that eliminates the inheritability of skills, leaving the Gini at essentially its base-case value.

Simulation 5 eliminates consumption growth by which we mean we alter the model's time-preference factors so that agents wish to have the same living standard per equivalent adult as they age. This smoothing of consumption generates more liquidity constrained households showing up at age 66 with zero wealth, which, in turn, implies more wealth inequality. The wealth Gini in this case is .427 – 27 percent higher than in the base case.

Simulation 6 turns off interest rate heterogeneity. This makes little difference to the distribution of wealth. The explanation here is that, other things equal, households earning higher rates of return can afford to and do consume more at each point in time. Since accumulated assets reflect accumulated differences between past levels of earnings and consumption, this factor lowers the age-66 wealth holdings of couples earning high rates of return. On the other hand, the smaller differences between past earnings and consumption are accumulated at a higher rate of return. This factor raises the age-66 wealth holdings of high rate or return couples. According to the results, these two factors roughly cancel leaving wealth inequality essentially the same as in the case of no interest

rate heterogeneity. In contrast to interest rate heterogeneity, progressive income taxation does play an important role in influencing wealth. In Simulation 7, this form of taxation is eliminated raising the Gini coefficient from .336 to .436. And the share of wealth held by the top 1 percent of the wealth distribution rises from 7 percent to 9.4 percent.

The Role of Inheritances and Social Security in Wealth Inequality

How important are bequests and their associated inheritances to wealth inequality? Simulation 8 addresses this question. It sets the probability of dying prior to age 88 at zero. Compared to the base case, this experiment reduces only slightly wealth inequality. So, in the presence of social security, inheritances make the distribution of wealth more unequal. Is the same true if social security is absent? The answer, found by comparing Simulations 9 and 11, is no. With inheritances, but without social security, wealth inequality is somewhat smaller – the same finding reported in Gokhale, et. al. (2000).

How much does social security itself raise wealth inequality? The answer found by comparing Simulations 9 and 1 is a fair amount. Adding social security to the model's other features raises the wealth Gini by over 20 percent. It also almost doubles the share of wealth held by the top 1 percent of wealth holders. Figure 3 shows the impact of removing social security on the wealth levels of age-66 couples at different percentiles of the wealth distributions. For those in the 75th percentile, eliminating social security would raise their age-66 wealth by a factor of 2.55. In contrast, for those in the top 1 percentile, eliminating social security would raise their wealth by a factor of only 1.55.

Why does social security increase wealth inequality? A small part of the reason, as previously mentioned, is that social security transforms inheritances into a disequalizing force. According to Table 1, it also reduces the intergenerational flow of

inheritances by over 50 percent. But the main reason, as confirmed by Simulation 10, that social security is disequalizing is simply the ceiling that social security applies to its tax collection. This ceiling makes social security treat the lifetime rich more favorably than the lifetime poor. It also differentially annuitizes the lower classes. Absent the ceiling, the wealth Gini would be .242, compared to .336 in the base case, and the share of wealth held by the top 1 percent would be 2.9 percent, compared with 7 percent in the base case.

V. Conclusion

Given our use of the PSID, which under-samples very high earning Americans, to calibrate the distribution of lifetime earnings, it's not surprising that our model fails to reproduce the extreme skewness of the top tail of the U.S. wealth distribution. On the other hand, our analysis confirms the proposition advanced by Gokhale, et. al. (2000) that social security exacerbates wealth inequality by annuitizing a larger proportion of the old age resources of the lifetime poor than of the lifetime rich. In so doing, social security not only changes the form in which the poor elderly hold most of their resources, it also denies their children the opportunity to receive inheritances. Consequently, inheritances become a cause of wealth inequality rather than wealth equality. All told, social security appears to be raising wealth inequality, as measured by the Gini coefficient, by roughly one fifth, substantially increasing the share of total wealth held by the richest members of society, and greatly reducing the flow of bequests to the next generation.

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Table 1: Inequality and Bequest Flows—Base Case and Alternative Simulations

Case	Simulation	Wealth Gini	Consumption Gini	Bequest/Earnings	Cross Generation Bequest/Earnings
1	Base Case	0.336	0.283	4.5	1.5
2	No Skill Differences	0.097	0.045	4.3	1.4
3	No Marital Sorting	0.324	0.270	4.6	1.5
4	No Inheritance of Skills	0.327	0.277	4.6	1.5
5	No Consumption Growth	0.427	0.286	1.8	0.6
6	No Interest Rate Heterogeneity	0.332	0.279	4.5	1.4
7	No Progressive Income Taxes	0.436	0.317	3.2	1.0
8	No Inheritances	0.325	0.287	0.0	0.0
9	No Social Security	0.278	0.271	10.6	3.4
10	No Ceiling on SS Taxable Income	0.242	0.272	3.9	1.2
11	No Inheritances and No Social Security	0.285	0.278	0.0	0.0

Source: Authors' calculations.

Table 2: Simulated Wealth Distributions

Case	Simulation	Percent of Wealth Held by Top								
		99%	95%	90%	75%	50%	25%	10%	5%	1%
1	Base Case	100.0	99.2	97.4	89.8	71.8	47.6	27.6	18.4	7.0
2	No Skill Differences	99.4	96.7	92.9	80.3	56.9	30.5	13.5	7.2	1.6
3	No Marital Sorting	100.0	99.1	97.2	89.3	71.0	46.7	26.8	17.8	6.6
4	No Inheritance of Skills	100.0	99.2	97.4	89.5	71.2	46.8	26.9	17.8	6.6
5	No Consumption Growth	100.0	99.5	98.2	92.2	76.9	54.9	35.4	25.1	10.3
6	No Interest Rate Heterogeneity	100.0	99.3	97.5	89.7	71.6	47.1	27.1	17.9	6.5
7	No Progressive Income Taxes	100.0	99.5	98.4	92.8	78.1	55.5	34.4	23.8	9.4
8	No Inheritances	100.0	99.4	97.7	89.8	71.2	46.3	26.2	17.2	6.3
9	No Social Security	100.0	99.2	97.4	89.1	69.0	42.1	21.2	12.6	3.8
10	No Ceiling on SS Taxable Income	100.0	99.1	97.0	87.8	66.8	39.4	18.9	10.7	2.9
11	No Inheritances and No Social Security	100.0	99.4	97.7	89.6	69.5	42.4	21.3	12.7	3.9

Source: Authors' calculations.

Figure 1: Comparison of Wealth Distributions: Simulated, SCF-1995, and PSID-1984

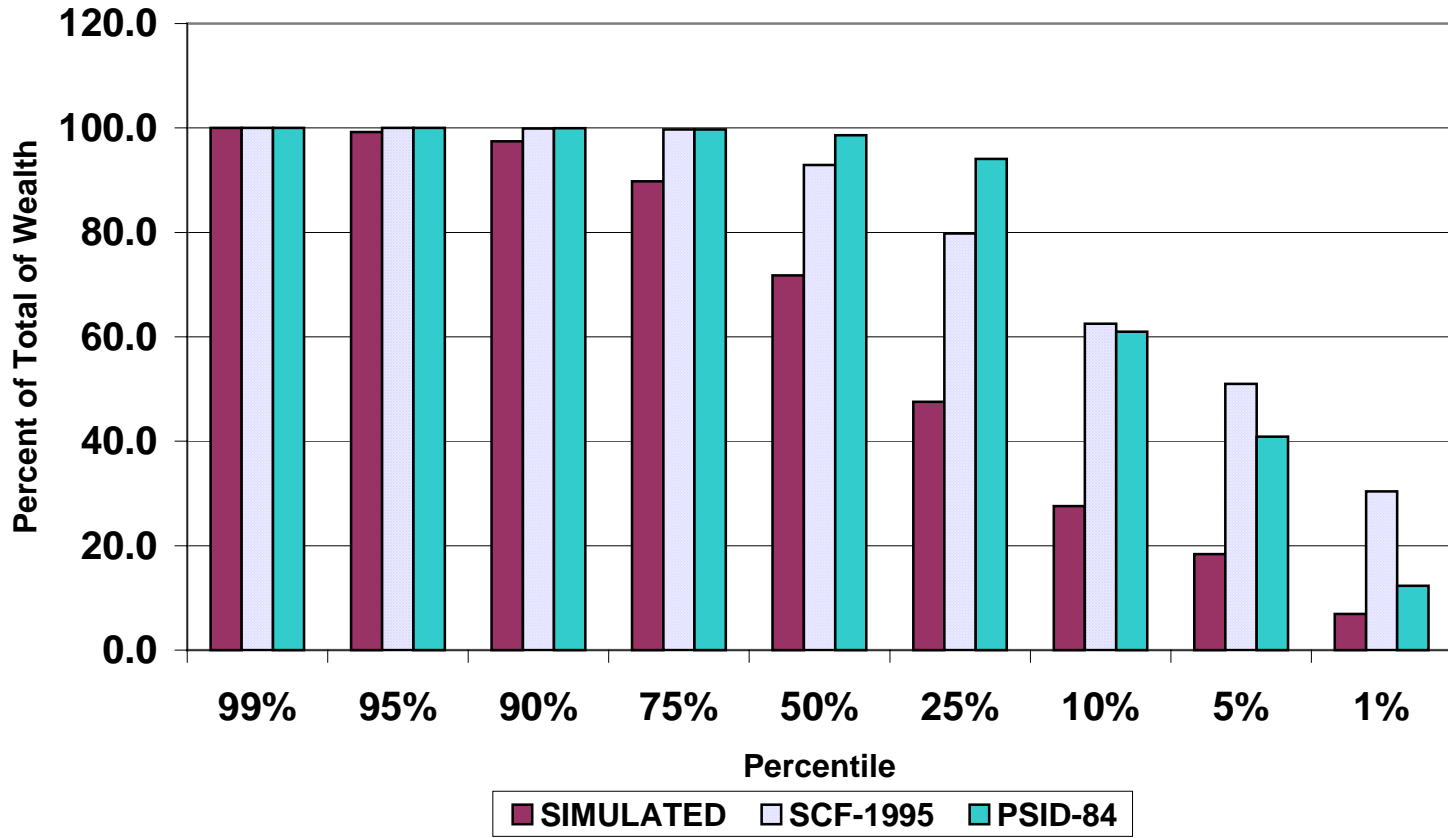


Figure 2: Simulated and SCF-1995 Distributions of Wealth Among Bottom 50 Percent of Wealth Holders

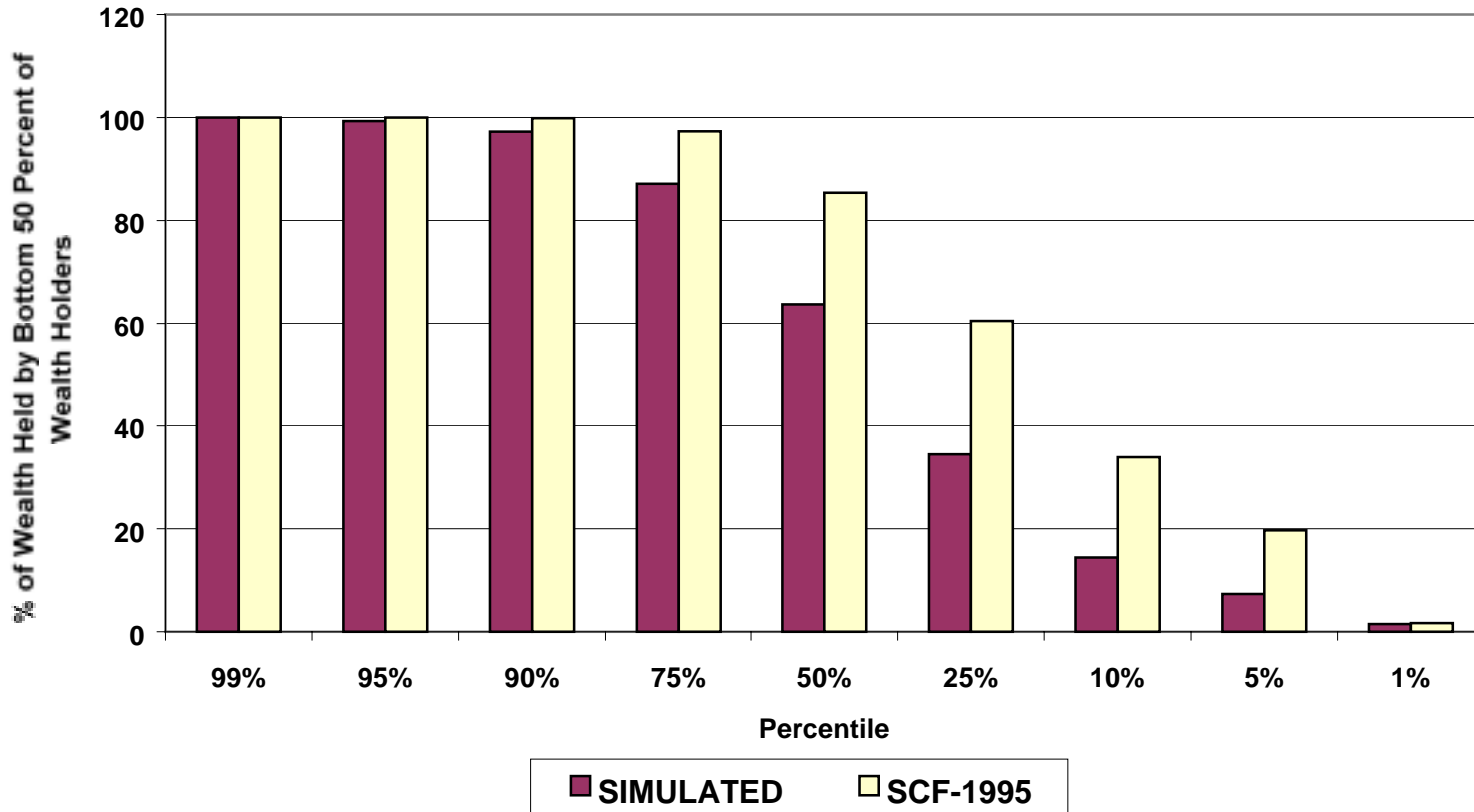


Figure 3: Average Wealth Holding Within Selected Percentiles of the Age-66 Wealth Distribution: With and Without Social Security

