Simulating the Transmission of Wealth Inequality

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The role of bequests in propagating wealth inequality has long interested economists, policymakers, and social commentators. Josiah Wedgwood's (1929) study of wealthy Britons indicated that most had received large inheritances and suggested that one-third owed their position in the wealth distribution entirely to inheritance. These findings and those of J. E. Meade (1966), C. D. Harbury and D. M. W. N. Hitchens (1979), and Paul L. Menchik (1979) support the public's general view that restricting inheritances by taxing estates or inheritances or by forcing annuitization would lead to a more equal wealth distribution.[1]

Would wealth inequality actually be reduced if inheritances and, for that matter, all private inter vivos transfers were eliminated? The answer is not obvious. Private wealth holdings would, in this case, be traced to precautionary and retirement saving, with the distribution of wealth determined by the distributions of after-tax labor earnings, rates of return, demographics, and saving preferences. Household labor income is distributed very unequally because of differences in genetic endowments, educational opportunities, parental care, health, labor–leisure preferences, assortative mating, and a host of other factors. Rates of return earned on saving also vary widely across households for systematic and nonsystematic reasons. Also, as recently documented by Steven F. Venti and David A. Wise (2000), there is a great deal of heterogeneity with respect to saving behavior.

Thus, a high degree of wealth inequality would exist in the absence of bequests and inter vivos gifts. Adding them back into the mix could actually reduce overall wealth inequality if they were made to children with relatively low earnings, low rates of return, or poor saving discipline or were made primarily to children whose parents died young.

Clearly, understanding the precise role that bequests and gifts play in wealth inequality requires building a fairly elaborate model that can control for different factors and their interactions. The model we co-developed in Gokhale et al. (2001) to study U.S. wealth inequality, which we extend here, represents a step in this direction. The model features 88 overlapping generations. It incorporates marriage, fertility patterns, random death, heterogeneous skill endowments and rates of return, assortative mating based on skills, skill inheritability, progressive income taxation, and wealth annuitization via Social Security.

Given the strong evidence against intergenerational altruism reported in Kotlikoff (2002) and the dictates of tractability, we modeled bequests as arising solely from imperfect annuitization. The model generates a realistic ratio of aggregate wealth to aggregate labor income, a realistic flow of bequests relative to the stock of wealth, and a realistic distribution of wealth at retirement, including the share of wealth held by those in the top tail of the distribution. Bequests play a limited role in influencing wealth inequality, the major determinant of which is skill (earnings) differences. Interestingly, bequests serve to equalize the distribution of wealth because, when children inherit, wealth is determined by the random date of parent's death. In contrast, Social Security plays a disequalizing role. As stressed by Martin S. Feldstein (1976), Social Security annuitizes a much larger share of the assets of the poor than of the rich, leaving them with relatively little fungible wealth.

I. The Model

Our model's agents live for at most 88 years: the first 22 years as children; the second 22 as

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[1] These studies are part of an extensive literature on bequests surveyed briefly in Gokhale et al. (2001).

young adults who procreate; the third 22 as married, middle-aged adults who do not produce additional offspring; and the last 22 as married or widowed retirees facing lifespan uncertainty. Upon completing 22 years of age, agents marry a fellow cohort member of the opposite sex. Agents choose their partners partly on the basis of skill (earnings capacity). The couple then has children over the next 22 years at assigned ages based on a random draw from a sample of lifetime fertility experiences.

Agents who die before reaching age 88 bequeath their wealth to their spouses. If their spouses have already died, they bequeath their wealth in equal portions to their children, all of whom are alive, given the model's timing. How much a child inherits depends not only on when the last parent died, but also on the number of siblings with whom the bequest must be shared. The size of the inheritance obviously also depends on the bequeathable wealth that the second-to-die parent has at death. This amount depends, in turn, on how much the parents themselves inherited (which depends on when their ancestors died), the level of their earnings out of which they saved, the rate of return they received on their savings, the number of children they had to support, and their saving preferences.

Agents' expected utility is represented by 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, at age 25 and 28:

$$(1)\quad \mathrm{EU} = \sum_{a=22}^{87} \beta^{a-22}(p_{\mathrm{h}a}c_{\mathrm{h}a}^{1-1/\sigma} + p_{\mathrm{w}a}c_{\mathrm{w}a}^{1-1/\sigma}) + \delta \sum_{a=25}^{46} \beta^{a-22}c_{\mathrm{k}1a}^{1-1/\sigma} + \delta \sum_{a=28}^{49} \beta^{a-22}c_{\mathrm{k}2a}^{1-1/\sigma}.$$

The first summation considers the utility of each spouse from his or her own consumption at each possible age to which he or she could live. The second two summations consider the utility that the couple derives from their children's consumption. The terms $c_{\mathrm{h}a}$, $c_{\mathrm{w}a}$, $c_{\mathrm{k}1a}$, and $c_{\mathrm{k}2a}$ refer, respectively, to the husband's, wife's, first child's, and second child's consumption when the couple is aged a. The term β is the time-preference factor, σ is the intertemporal elasticity of substitution, and δ is a child-consumption weighting factor.

We assume that σ, the inverse of the coefficient of relative risk aversion, is very close to zero.[2] This implies that households consider only their safe resources in deciding how much to consume at each point in time. Thus, households will ignore future inheritances when making current consumption and saving decisions because they do not know for sure that they will receive any (one of their parents may live to age 88).

Were we to assume a positive value of σ, households would take a gamble and consume more in the present in anticipation of inheriting in the future. However, 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 seven state variables: their own wealth level, those of two sets of parents, and those of up to four sets of grandparents. Solving dynamic programs with seven state variables within reasonable time seems beyond the capacity of the fastest computers available.

II. Calibration

The probabilities of dying at ages 67–87 are taken from U.S. mortality statistics. The fertility experience of each couple, which specifies the number, sexes, and timing of children to be born, is drawn at random from a distribution of such experiences generated by CORSIM, a dynamic microsimulation model of the U.S. economy developed by Steven Caldwell (1996). The simulation considers 40,434 females born between 1945 and 2000 and records their fertility

[2] Robert Hall (1988 p. 339) 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."

experiences between ages 22 and 43.[3] We adjust the set of fertility experiences that are drawn to ensure that an equal number of males and females (2,000) are born each year. Hence, each cohort is of equal size, and there is no population growth.

We assign lifetime wage profiles to agents based on profiles derived from another CORSIM simulation. CORSIM simulates wage trajectories for a representative sample of U.S. individuals either alive in 1960 or born thereafter.[4] We use a subsample of 2,000 male and 2,000 female wage trajectories selected randomly from the CORSIM cohort of individuals born between 1970 and 1974. The wage trajectories are growth-adjusted to 1970, based on Social Security's average wage index, to conform to our assumption of zero productivity growth.

Data on household portfolio holdings from the 1995 Survey of Consumer Finances (SCF) are used to incorporate rate-of-return heterogeneity. Households' reported assets are classified into several categories, a rate of return is assigned to each category, and a portfolio-weighted rate of return is computed for each household. Households earn their assigned rate of return in each year of their lives, and rates of return earned by parent and child households are uncorrelated. The time preference rate used in the simulations is 4 percent. The child weight, δ, is set to 0.4.

We apply the federal income-tax schedule in determining personal income taxes. We model Social Security by assuming that 15.3 percent (the OASDHI payroll tax rate) of each year's labor income, up to a maximum taxable limit (calibrated to correspond to the actual limit), is accumulated at a 4-percent interest rate and converted, at retirement, into an actuarially unfair annuity. Caldwell et al. (1999) estimate that on average, 67 cents of every dollar paid in Old Age Survivors Insurance (OASI) payroll taxes represents a pure tax. That is, the present value of Social Security OASI benefits at retirement equals the accumulated value of only 33 percent of OASI payroll taxes paid during the working lifetime. Unfortunately, similar "money's worth" calculations are not available for Medicare or the Disability Insurance program. We assume that only 30 percent of each person's payroll taxes are converted into an annuity, with the rest a pure tax.[5]

There is scant evidence with which to calibrate the degree of marital sorting and inheritability of skills. What evidence exists suggests a 0.5 correlation coefficient between the lifetime earnings of husbands and wives and a 0.7 correlation coefficient between the lifetime earnings of fathers and sons and those of mothers and daughters. As detailed in Gokhale et al. (2001), we use these parameter values in assigning lifetime earnings and marriage partners. In specifying a rate of time preference, we assumed that consumption per equivalent adult rises at 1.5 percent per year through age 66 and is constant thereafter. This produces a realistic longitudinal age–consumption profile.

III. Findings

Our focus is on household wealth inequality within a cohort measured at age 66, when all the parents of all cohort members have died and all cohort members have received all the inheritances that are coming their way. To calculate our model's steady-state wealth distribution, we start with an arbitrary distribution and run the

[3] CORSIM's fertility module includes separate logistic functions for 30 different subgroups of women estimated using data from the National Longitudinal Survey.

[4] CORSIM's earnings module was estimated from the Panel Survey of Income Dynamics (PSID). It includes separate logistic and regression equations for whether an agent works, whether a working agent works full- or part-year, how many weeks full-year or part-year workers work, how many hours per week full-year or part-year workers work, and how much full-year and part-year workers earn per hour. Unfortunately, the PSID does a poor job of sampling high-income and high-wealth households. Consequently, in our analysis we adjusted the levels of lifetime earnings in the top 5 percent of the CORSIM lifetime earnings distribution to accord with the upper-tail skewness in the Survey of Consumer Finances' cross-sectional distribution of annual earnings of middle-aged workers.

[5] Adding Social Security to the model raises the possibility that households for whom consumption per adult is small relative to annuity income per adult will wish to borrow against their benefits. 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.

TABLE 1—COMPARISON OF MODEL AND SCF WEALTH DISTRIBUTIONS FOR HOUSEHOLD HEADS AGED 60–69

Specification	Percentage of wealth held by the top: 10 percent	5 percent	1 percent	Gini
SCF	62.5	51.0	30.4	0.727
Base case	58.8	49.4	32.8	0.674
No skill differences	13.3	7.1	1.6	0.092
No bequests	60.1	51.1	35.7	0.684
No Social Security	53.3	44.2	29.5	0.608
No assortative mating	55.1	46.3	31.2	0.628
No skill inheritances	59.5	50.5	34.7	0.676
No interest-rate heterogeneity	57.4	47.9	31.5	0.660
No Social Security, no bequests	56.2	47.8	34.2	0.643
No top-tail adjustment	38.2	25.2	8.7	0.514

Source: Authors' calculations.

model into the future until the age-66 distribution of wealth stabilizes along with the total amount of wealth in the economy.

Table 1 compares our model's wealth distribution with the distribution of wealth in the 1995 SCF for married households with heads aged 60–69. In the SCF, the richest 1, 5, and 10 percent of households hold 30.4, 51.0, and 62.5 percent of aggregate U.S. net worth, respectively. The Gini coefficient is 0.727. Our model generates corresponding wealth shares for the top 1, 5, and 10 percent of households of 32.8 percent, 49.4 percent, and 58.8 percent. Our model's Gini coefficient is 0.674. Thus, our model appears capable of reproducing actual U.S. wealth inequality. Furthermore, under these assumptions, the model generates realistic ratios of aggregate wealth and the aggregate flow of bequests to labor income. The respective values of 6.0 and 0.055 are close to their empirical counterparts.

The third row of Table 1 shows the dominant role that earnings inequality plays in generating wealth inequality. When all agents have the same skills, the Gini coefficient is 0.092 rather than 0.727, and the top 1 percent of households possesses only 1.6 percent of total wealth. The last row in the table indicates that the severe skew in the top tail of the earnings distribution is primarily responsible for the severe skew in the top tail of the wealth distribution.

With no early mortality and, therefore, no bequests, the Gini coefficient is 0.684, and the richest 1 percent of households have 35.7 percent of all wealth. Hence, bequests serve, in our model, to reduce wealth inequality. Eliminating Social Security does the opposite: it lowers the Gini to 60.8 and the share of wealth held by the top 1 percent of households to 29.5 percent. Eliminating assortative mating also generates a nontrivial reduction in the Gini coefficient but does little to affect the skewness in the top tail. Finally, skill inheritance and interest-rate heterogeneity make very little difference to wealth inequality.

We also use our model to study intergenerational wealth mobility. Almost one-half of children whose parents are in the top 20 percent of wealth-holders at age 66 end up in the top 20 percent of wealth-holders when they themselves reach age 66; and roughly 95 percent of the children of the lowest category of wealth-holders end up with low wealth holdings upon reaching retirement. These results are in rough agreement with the evidence in Wedgwood (1929), Harbury and Hitchens (1979), and Menchik (1979).[6] While the children of the very rich have roughly 40 times better odds of being very rich than do the children of the poor, most children of very rich parents end up in our model in the middle of the wealth distribution upon retirement. Hence, intergenerational wealth mobility is high from some perspectives, and low from others.

Wealth mobility is highly sensitive to our assumed degree of inheritability of skills. For high degrees of skill inheritance, mobility decreases substantially at higher degrees of assortative mating. For example, the probability that the children of the super rich end up super rich themselves rises from 15.9 percent to 49.3 percent if the correlation coefficient of inheritability is increased from 0.7 to 1.0. Holding the coefficient at 0.7, this probability rises from 15.9 percent to 20.9 percent if the correlation coefficient of assortative mating is raised from 0.5 to 1.0.

[6] Note, however, that these studies do not control for the age at which the wealth of parents and children is observed, and it is unclear to which segments of the overall wealth distribution these authors' samples correspond.

IV. Conclusion

Many, if not most, bequests in the United States appear to arise because the resources of the elderly are not fully annuitized. Consequently, who receives inheritances is, in large part, a random process, which can, according to our model, equalize the distribution of wealth. While bequests are important, the main determinant of wealth inequality, according to our model, is earnings inequality. Bequests, assortative mating, the annuitization of retirement savings via Social Security, the inheritance of skills, and interest-rate heterogeneity play more limited roles in generating wealth inequality.

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