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Do the Rich Save More?

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Abstract

The issue of whether higher lifetime income households save a larger fraction of their income is an important factor in the evaluation of tax and macroeconomic policy. Despite an outpouring of research on this topic in the 1950s and 1960s, the question remains unresolved and has since received little attention. This paper revisits the issue, using new empirical methods and the Panel Study on Income Dynamics, the Survey of Consumer Finances, and the Consumer Expenditure Survey. We first consider the various ways in which life cycle models can be altered to generate differences in saving rates by income groups: differences in Social Security benefits, different time preference rates, non-homothetic preferences, bequest motives, uncertainty, and consumption floors. Using a variety of instruments for lifetime income, we find a strong positive relationship between personal saving rates and lifetime income. The data do not support theories relying on time preference rates, non-homothetic preferences, or variations in Social Security benefits. Instead, the evidence is consistent with models in which precautionary saving and bequest motives drive variations in saving rates across income groups. Finally, we illustrate how models that assume a constant rate of saving across income groups can yield erroneous predictions.

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I. Introduction

It would be easy to convince a room full of non-economists that higher lifetime income levels lead to higher saving rates. Non-economists would tell you that low income people can't afford to save. Certainly a room full of journalists would need little convincing: Examples include "A sales tax would shift the tax burden from the rich to the middle class, since affluent people save a much larger portion of their earnings" (Passell, New York Times, 1995), and "The poor and middle class spend a higher percentage of their income on goods than do the rich, and so, according to most economists' studies, a value-added tax is regressive" (Greenhouse, New York Times, 1992).

A room full of economists would be less easily persuaded that higher lifetime income levels lead to higher saving rates. The typical economist would point out that people with temporarily high income will tend to save more to compensate for lower future income, and people with temporarily low income will tend to save less in anticipation of higher future income. Thus, even if the saving rate is invariant with regard to *lifetime* income, we will observe people with high *current* incomes saving more than their lower income brethren (Friedman, 1957).

Moreover, the stylized facts about the aggregate U.S. saving rate do not seem to support a positive correlation between saving rates and income. First, there has been no time-series increase in the aggregate saving rate during the past century despite dramatic growth in real per capita income. Second, the increasing concentration of income toward the top income quintile during the 1980s and early 1990s did not lead to higher aggregate saving rates.[1] Looking across countries, Schmidt-Hebbel and Serven (2000) found no evidence of a statistically significant link between measures of income inequality and aggregate saving rates.

Despite an outpouring of research in the 1950s and 1960s, the question of whether the rich save more has since received little attention. Much of the early empirical work favored the view that high income people did in fact save a higher

[1] Blinder (1975) finds little connection between shifts in the income distribution and the aggregate saving rate, but argues that the changes in the income distribution present in postwar U.S. data are unlikely to correspond to the type of pure redistribution required by the theory.

fraction of their income (e.g., Mayer, 1966, 1972). However, a sufficient number of studies, by Milton Friedman and others, reached the opposite conclusion to leave "reasonable doubt" about the alleged propensity of high lifetime income households to save more.

We return to the topic of how saving rates vary with lifetime income for two reasons. First, the empirical issues remain somewhat clouded, and a wide variety of newer data sources, such as the Panel Study of Income Dynamics (PSID), the Survey of Consumer Finances (SCF), the Consumer Expenditure Survey (CEX), and work on imputed saving from Social Security and pension contributions (Feldstein and Samwick, 1992; Gustman and Steinmeier, 1989) allow a much richer picture of empirical patterns of saving behavior. Second, we believe that the topic has important implications for the evaluation of economic policy. If Milton Friedman and his collaborators did not earn a clear-cut victory in the empirical battles of the 1960s, they won the war. Many models used for macroeconomic or microeconomic policy evaluation *assume* that saving is proportional to lifetime resources, which allows the distribution of heterogeneous people with different incomes to be collapsed into a single "representative" agent.[2] The Leeper and Sims (1994) macroeconomic policy model, and the work by Auerbach and Kotlikoff (1987) on tax incidence analysis are examples of such models.

The question we are examining bears on a number of important issues. First, a finding of heterogeneous saving rates would suggest that the effects on aggregate consumption of shocks to aggregate income or wealth would depend not only on the magnitude of the shock but also on its distribution across income groups.[3] Second, the results could shed light on the debate in the economic growth literature about whether the positive correlation between income and saving rates across countries reflects high saving rates causing high income or vice versa. Third, the results could help us understand how the degree of preparedness for retirement varies across earnings

[2] One can assume a representative agent because the marginal and average propensities to save from lifetime income are identical for all individuals in the economy. See Caselli and Ventura (1999) for a more general model in which individual consumption is a linear function of income and wealth, thus retaining desirable aggregation properties.

[3] See, for example, Stoker (1986).

groups. Fourth, the incidence and effectiveness of reform proposals that shift taxation away from saving (such as value-added taxes, consumption taxes, flat taxes, and expanded IRAs) depend on how much saving is done by each income group. Finally, the question of whether higher income households save at higher rates than lower income households has important implications for the distribution of wealth, both within and across cohorts.

We find first, like previous researchers, a strong positive relationship between current income and saving rates across all income groups, including the very highest income categories. Second, and more important, we continue to find a positive correlation when we use proxies for permanent income such as education, lagged and future earnings, the value of vehicles purchased, and food consumption. Estimated saving rates range from less than 5 percent for the bottom quintile of the income distribution to more than 40 percent of income for the top 5 percent. The positive relationship is more pronounced when we include imputed Social Security saving and pension contributions. Even among the elderly, saving rates may rise with income. In sum, our results suggest strongly that the rich do save more, whether the rich are defined to be the top 20 percent of the income distribution (following the Department of Treasury -- Pines, 1997), or the top 1 percent. And, more broadly, we find that saving rates increase across the entire income distribution.

These basic patterns of saving are not consistent with the predictions of standard homothetic life-cycle models. Nor, as we show below, are they consistent with explanations that range from differences in time preference rates or subsistence parameters to variation in Social Security replacement rates. Rather, we conclude that the data are consistent with a model that emphasizes the dual role for saving later in life: money is set aside for catastrophic expenditures such as a costly illness or other contingency, and, in the likely case that the money is not needed for such an event, it is passed along to heirs (see also Smith, 1999a). This combination of precautionary and bequest motives stimulates saving most for higher income households, and has less effect on lower income households, perhaps because of asset-based means tested social insurance programs, like Medicaid, or less desire to leave financial bequests to subsequent generations (e.g. Becker and Tomes, 1986 and Mulligan, 1997). As well as explaining the cross-sectional pattern in saving, such a model also implies that steady-state saving rates should remain constant over time despite long-term income growth.

In the next section, we consider models of consumption that allow for systematic differences in saving behavior by lifetime income group. Section III describes the empirical methodology, focusing on the key issue of identification of permanent income. In Section IV, we describe the three data sets used for the analysis. Our empirical results are in Section V, and Section VI concludes.

II. The Empirical and Theoretical Background

Many economists in previous generations used both theory and empirics to assess whether people with high incomes save more than people with low incomes. Early theoretical contributions include Fisher (1930), Keynes (1936), Hicks (1950), and Pigou (1951); early empirical work includes Vickrey (1947), Duesenberry (1949), Friedman (1957), Friend and Kravis (1957), Modigliani and Ando (1960), and many more.

In his work on the permanent income hypothesis, Friedman (1957) noted that cross-sectional data show a positive correlation between income and saving rates, but argued that this result reflected individuals changing their saving in order to keep consumption smooth in the face of temporarily high or low income. He contended that individuals with high permanent income consume the same fraction of permanent income as individuals with low permanent income, and he emphasized empirical regularities that appeared to support this proportionality hypothesis. Many studies of this hypothesis followed, some supporting Friedman and some not. Evans (1969) summarized the state of knowledge about consumption in 1969, concluding "it is still an open question whether relatively wealthy individuals save a greater proportion of their income than do relatively poor individuals" (p. 14).

In a comprehensive examination of the available results and data, Mayer (1972) disagreed, claiming strong evidence against the proportionality hypothesis. For example, when he proxied for permanent income and consumption with five-year averages from annual Swiss budget surveys, he found the elasticity of consumption with respect to permanent income to be significantly different from one (0.905), and not much different from the elasticity based on one year of income. Mayer interpreted this result as a rejection of the proportionality hypothesis.

Despite the abundance of early studies on this important question, little work has been done since. The relative lack of interest in part reflects the influential work of Lucas (1976) and Hall (1978), which shifted work away from learning about levels of consumption or saving toward "Euler Equation" estimation techniques that implicitly examine first differences in consumption.[4]

Some studies have found that *wealth* levels are disproportionately higher among households with high lifetime income (Diamond and Hausman,1984; Bernheim and Scholz, 1993; Hubbard, Skinner, and Zeldes, 1995). While this result could be explained by higher saving rates among higher income households, it could also be explained by higher rates of return (on housing or the stock market, for example) or the receipt of proportionately more intergenerational transfers by these households. Others have argued that wealth levels when properly measured are not disproportionately higher among high income households. Gustman and Steinmeier (1999) and Venti and Wise (1998) augmented conventionally measured wealth with imputed Social Security and pension wealth from the Health and Retirement Survey; they found that the ratio of this augmented wealth to lifetime earnings (based on lengthy Social Security records) was constant or even declining with lifetime earnings. As we show below, these seemingly contradictory results illustrate the importance of how one measures lifetime income and the distinction between flows (saving) and stocks (wealth).

To help make the question more precise, consider a life-cycle / permanent income model with a bequest motive. At each age t, households maximize expected lifetime utility

$$\boldsymbol{U_{it}} \equiv E_t \sum_{s=t}^{T} \left[\frac{U(C_{is}^{*})\ D_{is}}{(1+\delta_i)^{s-t}} + \pi_{is} V(B_{is}) \right] , \qquad \textbf{(1)}$$

where E is the expectation operator, C^{*}_{is} is non-medical consumption for household i at

[4] See Browning and Lusardi (1996) for a survey of recent micro-level empirical research on saving.

time s, δ_i is the household-specific rate of time preference, B_{is} is the bequest left in the event of death, and $V(\cdot)$ is the utility of leaving a bequest. To allow for mortality risk, π_{is} is the probability (as of time t) of dying in period s, D_{is} is a state variable that is equal to one if the household is alive through period s and zero otherwise, and T is the maximum possible length of life.

The family begins period s with net worth (exclusive of human wealth) $A_{is-1}(1+r_{is-1})$, where r_{is-1} is the real after-tax rate of return on non-human wealth between s-1 and s. We assume that there are no private annuity markets. The family first learns about medical expenses (M_{is}), which we treat as necessary consumption that generates no utility. It next receives transfers (TR_{is}) from the government. It then learns whether it survives through the period. If not, it leaves to heirs a non-negative bequest,

$$B_{is} = A_{is-1}(1+r_{is-1}) - M_{is} + TR_{is} . \qquad \textbf{(2)}$$

If it survives, the household receives after-tax earnings (E_{is}) and chooses non-medical consumption. We define total consumption as $C_{is} \equiv C^*_{is} + M_{is}$. End of period wealth ($A_{is}$) is thus:

$$A_{is} = A_{is-1}(1+r_{is-1}) + TR_{is} + E_{is} - C_{is} . \qquad \textbf{(3)}$$

We define real annual income $Y_{is} \equiv r_{is-1} A_{is-1} + E_{is} + TR_{is}$, and saving as $S_{is} \equiv Y_{is} - C_{is} = A_{is} - A_{i\,s-1}$.[5]

Define lifetime resources (as of period s) as period s non-human wealth plus the expected present value of future earnings and transfers. Under what circumstances will consumption (and saving) be proportional to lifetime resources? In a world with no uncertainty and no bequest motive, two sets of assumptions will generate proportionality in consumption. First, if the rate of time preference (δ_i) and the rate of return (r_{is}) are constant and equal to each other, *any* separable utility function will yield constant consumption over the lifetime, equal to the appropriate annuity factor

[5] Note that since r includes the total return to non-human wealth including capital gains, saving measured as income minus consumption is identical to saving measured as the change in wealth. We return to this issue below.

multiplied by lifetime resources. Second, if preferences are homothetic, i.e. the utility function is isoelastic: $U(C) = (C^{1-\gamma} -1)/(1-\gamma)$, consumption will be proportional to lifetime resources. If all households have the same preference parameters and face the same interest rates, then the constant of proportionality will be the same for all households. If one further assumes that the initial wealth and the age-earnings (and age-transfers) profiles of rich households are simply scaled-up versions of those for poor households, then the proportionality in consumption implies that saving rates will be identical across households.[6]

How then could saving rates differ across income groups? We consider three general classes of models: one encompasses certainty models without a bequest motive, the second allows for uncertainty with respect to future income or health expenses (but no bequest motive), and the third includes an operative bequest motive.[7]

To provide illustrative calculations of how saving rates differ across income groups in these classes of models, we present results from a simple three-period version of the model above. We think of period one ("young") as ages 30-60, period two ("old") as ages 60-90, and period three as the time around death (when old) when medical expenditures are paid and bequests are left.[8] We assume an isoelastic utility function with $\gamma = 3$, a value consistent with previous studies. Further details are provided below.

A. Consumption models with no uncertainty and no bequest motive

We begin with a model with no bequest motive and no uncertainty other than

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[6] Adding uncertainty complicates the model, but again two sets of assumptions will generate the result that consumption rises proportionately with the scale factor for earnings. First, if the utility function is quadratic and δ_i and r_{is} are constant and equal to each other, consumption will be proportional to the expected value of lifetime resources, as defined above. If the utility function is not quadratic then there is no single summary statistic that defines consumption. However, if one assumes the utility function is isoelastic and initial wealth and all possible realizations of earnings are scaled up by a constant factor, then consumption will also be scaled up by that factor and saving rates will be identical (Bar-Ilan, 1995).

[7] Our discussion and empirical estimates focus on differences in the average propensity to save across income levels. Some, but not all, of the explanations below would also generate differences in the marginal propensity to save.

[8] The only purpose of the third period is to allow for medical expenses late in life – we assume no non-medical consumption in this period.

about the length of life.[9] We examine two income groups, low income and high income, with assumed average first-period income of $16,116 and $75,000, based on the 20th and 80th percentile of the income distribution in 1998 (U.S. Census, 1999). We assume that in the second period Social Security and pension income replace 60 percent of pre-retirement (or first-period) income, consistent with the overall replacement rate in Gustman and Steinmeier (1999). The (annual) rates of time preference and interest are 0.02 and 0.03, respectively, which, together with uncertain lifespan, result in a roughly flat pattern of non-medical consumption over the lifetime.

In table 1, we present the predicted saving rates for working age (young) and retirement age (old) households. The results are identical for the low income and high income groups, with saving rates while young equal to 12.5 percent in addition to pensions and Social Security, and dissaving rates while old equal to 16.0 percent.

In the standard life cycle model, there are two approaches to generating higher saving rates for higher income households: differences in the timing of income for these households and differences in the timing of consumption. We consider each in turn.

Differences in the timing of earnings and transfers across lifetime income groups will yield different patterns of saving despite identical slopes of the consumption paths. For example, Social Security programs typically provide a higher replacement rate for low income households and thus reduce the need for these households to save for retirement (e.g., Huggett and Ventura, 2000; Smith, 1999a).[10] We consider the effects in our model of increasing the replacement rate for the low income households from 60 percent to 75 percent (and increasing first period Social Security taxes for these households such that the present value of lifetime resources is unaffected). Table 1 shows that the saving rate while young falls, to just 6.7 percent. Saving rates while old

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[9] We set the probability of living to old age (period 2) at 82 percent, based on statistics from the Berkeley mortality database; http://demog.berkeley.edu/wilmoth/mortality/overview.html. Since period 3 represents the very end of life, all households that survive to period 2 die in period 3.

[10] Other examples (for which similar exercises could be performed) include: 1) differences in the timing of earnings (higher income households tend to have a steeper age-earnings profile, inducing them to save less when young than lower income households), 2) differences in life expectancy (higher income households tend to live longer, inducing them to save more when young than lower income households), or 3) differences in retirement age (higher income households tend to retire later, inducing them to save less when young).

Table 1: Simulated Saving Patterns

		Saving Rate of Young	Saving Rate of Old
Benchmark	Low income	12.5	-16.0
	High Income	12.5	-16.0
Income Replacement Rate: 75 Percent for Low Income 60 Percent for High Income	Low Income	6.7	-7.5
	High Income	12.5	-16.0
Time preference rate: 5 Percent for Low Income 2 Percent for High Income	Low Income	5.4	-8.0
	High Income	12.5	-16.0
Income and Medical Care Uncertainty	Low Income	14.8	-15.1
	High Income	14.0	-16.8
Income and Medical Care Uncertainty with Consumption Floor ($12,500)	Low Income	0.0	0.0
	High Income	14.0	-16.8
Bequest Motive (μ=1)	Low Income	12.5	-16.1
	High Income	15.4	-7.9
Income and Medical Care Uncertainty, Consumption Floor, and Bequest Motive	Low Income	0.0	0.0
	High Income	16.4	-7.6

Default parameters: 2 percent time preference rate, 82 percent chance of surviving to be “old,” 60 percent replacement rate, 3 percent interest rate.

increase to -7.5 percent. In other words, if lower income households have higher retirement replacement rates then they will save less while working, and *dissave* less while retired. Suppose that we were to instead construct a more comprehensive saving rate inclusive of "Social Security saving".[11] This saving rate would equal 12.5 percent, identical to the saving rate for high income households.[12] In other words, if a Social Security program of the type presented here is causing saving rates to decline with income, the comprehensive saving rate would show no such decline. We construct this comprehensive saving measure in our empirical work below. Note that if we were to change the model so that the Social Security program provided future benefits to low income households greater (in present value) than the contributions (making it progressive), then the comprehensive saving measure would show saving rates of the low income working households that were *greater* than saving rates of the high income households.

Next consider differences in the timing of consumption. If high income households choose more rapid growth rates in consumption, they will have higher saving rates, at least at younger ages.[13] For example, a negative relationship between the time preference rate δ and the level of income could lead higher income households to have steeper consumption paths. This might happen in a world with imperfect capital markets because households with lower time preference rates would have a greater inclination toward saving (when young) and would also be more likely to have higher earnings because of greater investment in education and other forms of

[11] Define Social Security saving equal to the present value of future Social Security benefits accrued as a result of Social Security contributions in period 1. The modified saving rate adds Social Security saving to both the numerator (saving) and the denominator (income).

[12] This assumes that consumption would be unaffected by the change. If this "forced saving" lowered the consumption while young, it would raise the comprehensive saving of low income households.

[13] Lawrance (1991) offers empirical evidence to this effect, although Dynan (1994) shows that the patterns are not pronounced after controlling for ex-post shocks to income. See also Bernheim, Skinner, and Weinberg (1997).

human capital.[14,15] Alternatively, Becker and Mulligan (1997) suggest that the causality may run the other way, with a higher level of income encouraging people to invest resources that make them more farsighted. In either case, the level of lifetime earnings would be positively correlated with both the growth rate of consumption and saving rates while young.[16]

Turning back to our model, suppose that low income households have an (annual) time preference rate of 0.05, instead of 0.02. Table 1 shows that the resulting saving patterns look very much like those when the income replacement rate is higher for these households. For low income households, the saving rate while young drops to 5.4 percent, and the saving rate while old falls to -8.0 percent. Once again, we see higher saving by higher income households while young but more dissaving while old.

One can also generate income-based differences in consumption growth rates by assuming a "subsistence" or necessary level of consumption. Informal arguments are sometimes made that subsistence levels imply that poor households have lower saving rates because they cannot "afford to save" after buying the necessities. However, this result requires that $r > \delta$; if $r < \delta$, a subsistence level of consumption causes rich households to save *less* than poor households.[17] Closely related are

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[14] With perfect capital markets, households with high time preference would borrow to finance their education, yielding no relationship between time preference and years of schooling or earnings. See, for example, Cameron and Taber (2000).

[15] In this type of model, a third factor (the rate of time preference) is causing both the higher permanent income and the higher saving rate. (See, for example, Evans and Montgomery, 1995, on the correlation between different types of forward-looking behavior.) Therefore, exogenously raising the permanent income of a given household would not raise its saving rate. See Mayer (1972) for further discussion.

[16] Differences across lifetime income groups in the number and/or timing of children could also generate differences in the timing of consumption. See Attanasio and Browning (1995) for work relating consumption and family size.

[17] Although the need to meet the current subsistence level depresses the saving rate of lower income households, the need to meet future requirements boosts the saving rate of those households. The net effect depends (in a certainty model) on the relative magnitudes of r and δ. Because of the subsistence level, poor households will be on a more steeply sloped portion of their utility functions than rich households. As a result, they will be less willing to substitute consumption over time and will have flatter consumption paths. If $r > \delta$, the consumption paths of both rich and poor households will slope upward, and the flatter paths of poor households will be associated with lower saving rates when young. If $r < \delta$, the reverse is true: consumption paths will slope downward, and the flatter path of the poor will be associated with a higher saving rate when young. A different way to generate the result that higher

models in which the intertemporal elasticity of substitution is larger for high income households (Attanasio and Browning,1995; Atkeson and Ogaki, 1996; and Ogaki, Ostry, and Reinhard, 1996).

Finally, the pattern could arise if higher income households enjoy better access to investment opportunities, such as equity markets, pensions, and housing. This may provide them with a higher rate of return (Yitzhaki, 1987),[18] or a better mechanism to overcome their preferences for immediate gratification, as in Thaler (1994) and Laibson (1997).[19] In sum, differences in the timing of income and differences in the timing of consumption can explain higher saving among higher income households while young, but they also imply that these households have higher dissaving rates when old.

B. Consumption models with uncertainty but no bequest motive

Does the precautionary motive for saving imply that high income households should save more? To answer this question, we incorporate two additional sources of uncertainty in the model. First, we allow for risk to second-period income that might be associated with earnings shocks, forced early retirement, or the loss of a spouse. We assume a discretized distribution with an equal chance of earnings either one-quarter higher or one-quarter lower than in the case of perfect certainty.[20]

Second, we allow for the possibility of large medical expenses, especially near death. For example, Hurd and Wise (1989) found a decline in median wealth of $103,134 (in 1999 dollars) for couples suffering the death of a husband, and Smith (1999b) found that wealth fell following severe health shocks, by $25,371 for households above median income and by $11,348 for families below median income. Covinsky et al (1994) found that 20 percent of a sample of families experiencing a

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income households have higher saving rates is to assume that subsistence levels decline with age.

[18] This result presumes that substitution effects dominate income effects; see Elmendorf (1996). Note also that higher income households face higher marginal tax rates, lowering their after-tax return.

[19] Thaler (1994) and Laibson (1997) describe a class of models in which preferences are dynamically inconsistent. Consumers' desire for a high saving path is undermined by a preference for immediate gratification. The illiquidity of housing equity and pensions allows consumers to commit to higher saving rates.

[20] This degree of uncertainty is consistent with empirical parameterizations of earnings variability (e.g., Hubbard, Skinner, and Zeldes, 1994).

death from serious illness reported that the illness had essentially wiped out their assets.[21]

For simplicity, we subtract medical expenditures from earnings (so that our earnings are net of health care expenditures) in the first two periods, and focus on uncertainty about health care expenditures only in the final period, at the very end of life. We assume health expenditures of $60,000 with 20 percent probability, and $0 otherwise.[22] We compute the average saving rate in period 2 as average saving divided by average income.

Table 1 shows that when these types of uncertainty are added, saving rates for low income households are *larger* than for high income households. This is because the income uncertainty is proportional to income (raising saving rates equally for both groups) and the health expenditures represent a higher fraction of lifetime income for these households. Thus, the introduction of these factors *alone* cannot explain why the rich save more.

More realistically, asset-based means-tested programs such as Medicaid or SSI may reduce the necessity of saving against such contingencies for lower income households (Hubbard, Skinner, and Zeldes, 1995). Higher income households find the consumption floor less palatable and thus continue to save against future contingencies. To see the implications, we add a $12,500 means-tested consumption floor to the model: transfers in period 2 are adjusted so as to insure that the household will, after exhausting its other resources, be able to consume $12,500 in the second period and pay for medical expenditures in the final period. Because the household receives these transfers only after spending all other assets, a high chance of becoming eligible for transfers translates into low saving rates while young. Table 1 shows that these programs lead low income households to have zero saving when young (despite the fact they may well not end up on welfare), and dissave nothing when older. In short, the precautionary saving model with asset-based means testing implies

[21] On the other hand, Hurd and Smith (1999) find smaller median changes in wealth near death.

[22] We assume that the household learns about the size of medical expenses prior to choosing second-period consumption, but does not pay the expenses until period 3.

low saving rates among lower income households at all ages, with conventional (and substantial) saving rates among high income households.

C. Consumption models with a bequest motive

Thus far, our model has produced only bequests that do not generate utility for the household -- sometimes referred to as unintended or accidental bequests. Here we consider an operative bequest motive as in Becker and Tomes (1986) or Mulligan (1997). Suppose that individuals value the utility of their children and that earnings are mean-reverting across generations. In this case, Friedman's permanent income hypothesis effectively applies across generations: a household with high lifetime income will save a higher fraction of its lifetime income in order to leave a larger bequest to its offspring who are likely to be relatively worse off.[23]

We implement this model by specifying an operative bequest function $V(B_{is}) = \mu((B_{is} + YL^{c}_{is})^{1-\gamma} - 1)/(1-\gamma)$, where μ is the tradeoff parameter between own consumption and bequests, and YL^{c}_{is} is the value of the next generation's lifetime earnings. We assume complete mean reversion of earnings, so that earnings of the children are equal to the average earnings of parents, and μ = 1.0.

Saving rates in this bequest model (without income or medical care uncertainty) are shown in Table 1. Saving rates while young and old are higher for the higher income group, where the bequest motive is operative. By contrast, lower income households expect their children to have earnings higher than theirs, and so consume their overall resources, yielding saving rates that are the same as for the life cycle model.

Finally, we consider a model with income and medical care uncertainty, a consumption floor, and an operative bequest motive. Here, bequests are conditional on the health and income draws, so in the good states of the world, the family leaves a much larger bequest than in the bad states of the world. For the high income household, the saving rate is 16.4 percent when young and -7.6 percent when old. For the low income household, the saving rate is essentially zero for both periods because

[23] An alternative model is one in which wealth *per se* gives utility above and beyond the flow of consumption it enables (Carroll, 2000).

of the asset-based means testing. Note that high-income saving rates with both precautionary saving and a bequest motive are not that much larger than either in isolation; this is because the saving is used for bequests in the good state of the world, and for health expenses in the (uncommon) bad state of the world.

III. Empirical Methodology

Three key issues arise in designing and implementing empirical tests. The first is how to define saving. One approach is to consider all forms of saving including realized and unrealized capital gains on housing, financial assets, owner-occupied businesses, and other components of wealth. (These capital gains should also be added to income to be consistent with the Haig-Simon definition of full income.) An alternative is to examine a definition of saving that focuses on the "active" component -- that is, the difference between income *exclusive of capital gains*, and consumption. This would be the relevant one if households do not entirely "pierce the veil" of their saving through capital gains, or if all capital gains are unanticipated at the time the saving decision is made.

Unfortunately, neither definition of saving is clearly superior -- it depends on the question of interest. For example, capital gains should be included when measuring the adequacy of saving for retirement, but excluded when measuring the supply of loanable funds for new investment. We thus construct several measures of saving: the flow of disposable income less consumption from the CEX, the change in wealth from the SCF and PSID, and the change in wealth exclusive of capital gains and (sometimes) inclusive of imputed Social Security and pension saving from the PSID.

The second and third key issues are how to distinguish those with high lifetime income from those whose income is high only transitorily and how to correct for measurement error in income. As Friedman pointed out, these issues are intertwined: "in any statistical analysis errors of measurement will in general be indissolubly merged with the correctly measured transitory component" of income (Friedman, 1957, p. 29). When we measure saving as the residual between income and consumption, measurement error in income (Y) will, by construction, show up as measurement error of the same sign in saving (Y - C).[24] Therefore, measurement error in income, like transitory income, can induce a positive correlation between measured income and saving rates even when saving rates do not actually differ across groups with different lifetime resources. A bias arises in the other direction when we define saving as the change in wealth: measurement error in income enters only in the denominator, inducing a negative correlation between measured income and the saving rate.

To reduce the problems associated with measurement error and transitory income, we use proxies for permanent income -- an approach with a long history (Mayer, 1972). We consider four instruments: consumption (total or some components), lagged labor income, future labor income, and education. A good instrument for permanent income should satisfy two requirements. First, it should be highly correlated with true "permanent" or anticipated lifetime income at the time of the saving decision. Second, the instrument should be uncorrelated with the error term, which includes measurement error and transitory income, so that it affects saving rates only through its influence on permanent income.

All of our instruments are likely to satisfy the first requirement. What about the second requirement? The longer the lags used and the less persistent is transitory income, the more likely that lagged and future labor income will be uncorrelated with transitory income. Education is appealing in this regard, because it is well measured and stays constant over time, which minimizes its correlation with transitory income. It may, however, be correlated with tastes toward saving (another possible component of the error term), or have an independent effect on saving (e.g. people may learn how to plan or about the merits of using tax-deferred saving vehicles).[25] Since consumption reflects permanent income in standard models, it should be uncorrelated with transitory income, and thus be an excellent instrument (see, e.g., Vickrey, 1947).[26] Measurement

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[24] Assuming a degree of independence of the measurement errors in Y and C.

[25] For early analyses using education as a proxy for permanent income, see Zellner (1960) and Modigliani and Ando (1960). See Mayer (1972) for a discussion of how heterogeneity in tastes for saving can affect tests of the proportionality hypothesis.

[26] If some households face binding liquidity constraints, however, consumption may be correlated with transitory income.

error in consumption and transitory consumption will bias the estimated relationship between saving rates and permanent income toward being negative. However, this bias need not invalidate our findings. A finding that measured saving rates rise with measured consumption, despite the induced bias in the opposite direction, would represent strong evidence that saving rates rise with permanent income.

Most of our results are based on a two-stage estimation procedure. In the first stage, we regress current income on proxies for permanent income and age dummies. We then use the fitted values from the first-stage regression to place households into predicted permanent income categories (typically quintiles). In the second stage, we estimate a median regression, with the saving rate as the dependent variable and the predicted permanent income quintiles and age dummies as the independent variables. We use this procedure in order to allow for non-linearities in the relationship between saving rates and lifetime income. We construct standard errors for the estimated saving rates by bootstrapping the entire two-step process. Separately, we also use fitted permanent income (instead of fitted quintiles) as the independent variable in the second stage, both to summarize the relationship between the variables and to provide a simple test of whether it is positive.

IV. Data

Using the CEX, the SCF, and the PSID not only allows for different measures of saving, but also ensures that our conclusions are not unduly influenced by the idiosyncracies of a single data source. For our pre-retirement analysis, we focus on households between the ages of 30 and 59 (as of the midpoint of their participation in each sample), with younger households excluded because they are more likely to be in transitional stages or students. To analyze the saving behavior of older households, we focus, in the CEX and SCF, on households aged 70 to 79. This reduces the potential problems associated with comparing households before and after retirement as well as the complications that arise for much older households. For the PSID, we examine households ages 62 and older, but also consider a subset of retired households.

A. Consumer Expenditure Survey (CEX)

The CEX has the best available data on total household consumption.[27] In each quarter since 1980, about 5000 households have been interviewed; a given household remains in the sample for four consecutive quarters and then is rotated out and replaced with a new household. The survey asks for information about consumption, demographics, and income.

We define the saving rate for a CEX household as the difference between consumption and after-tax income, divided by after-tax income (all in 1989 dollars). Consumption equals total household expenditures *plus* imputed rent for homeowners *minus* mortgage payments, expenditures on home capital improvements, life insurance payments, and spending on new and used vehicles. This definition includes expenditures for houses and vehicles as part of saving, in part in order to make the measure of saving in the CEX closer to those in the PSID and SCF. We use Nelson's (1994a) reorganization of the CEX, which sums consumption across the four interview quarters for households in the 1982 through 1989 waves. After-tax income equals pre-tax income for the previous year less taxes for this period, as reported in each household's final interview.[28] We deflate both income and consumption with price indexes based in 1989. Appendix A includes the definitions of all other variables we use.

We exclude households with nonpositive disposable income so that negative saving rates occur only when consumption exceeds income. We also exclude households with income below $1000, as well as households with invalid income or missing age data, and households who did not participate for all of the interviews. We are left with 14,180 households for our analysis.

B. Survey of Consumer Finances (SCF)

The 1983-1989 SCF panel contains information on 1479 households who were

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[27] Attanasio (1994) provides a comprehensive analysis of U.S. saving rate data based on the CEX.

[28] Sabelhaus (1992) and Nelson (1994b) warn that the data on household tax payments are quite poor. Sabelhaus (1992) suggests estimating these payments with income and demographic information, but we did not attempt to do so. Inaccurate tax data will only bias our results if the degree of inaccuracy is correlated with our instruments for permanent income.

surveyed in 1983 and then again in 1989. The sample has two parts: households from an area-probability sample and households from a special high-income sample selected based on tax data from the Internal Revenue Service. The SCF contains very high quality information about assets and liabilities, as well as limited data on demographic characteristics, and income in the calendar year prior to the survey.

The saving rate variable used for the SCF calculations equals the change in real net worth between 1983 and 1989 divided by six times 1988 total real household income (all variables measured in 1989 dollars). Because it spans several years, this variable is likely to be a less noisy measure of average saving than a one-year measure. Net worth is calculated as the value of financial assets (including the cash value of life insurance and the value of defined contribution pension plans), businesses, real estate, vehicles and other nonfinancial assets, *minus* credit card and other consumer debt, business debt, real estate debt, vehicle debt and other debt. Although, in principle, one could calculate the value of defined benefit pension plans and add them to net worth, we do not attempt to do so.[29]

We restrict the SCF sample in several ways. First, we exclude households with 1982 or 1988 income less than $1000. Second, we eliminate households where the head or spouse changed between 1983 and 1989 because such changes tend to have dramatic and idiosyncratic effects on household net worth. The resulting sample contains information on 881 households.[30]

C. Panel Study of Income Dynamics (PSID)

The PSID is the longest running U.S. panel data set, and, as such, it provides a valuable resource unavailable to researchers in the 1950s and 1960s. The long earnings history for each household helps us disentangle transitory and permanent

[29] We had some concern that the mix of defined benefit versus defined contribution pension saving could vary with income, so that omitting one but including the other might bias our results. We therefore also examined net worth exclusive of defined contribution pension plans, and the results were similar.

[30] Our SCF data set actually contains 2643 observations because each household's data is repeated three times with different random draws of imputed variables, in order to more accurately represent the variance of the imputed variables. Thus, the standard errors in our analysis must be corrected for the presence of replicates. We do so by multiplying them by 1.73 — the square root of the number of replicates (three).

income shocks, thus facilitating the key issue of identification.

For the asset supplements in 1984 and 1989, net worth is calculated as the sum of the value of checking and savings accounts, money market funds, CDs, government saving bonds, T-bills, and IRAs; the net value of: stocks, bonds, rights in a trust or estate, cash value of life insurance, valuable collections, and other assets; the value of main house, net value of other real estate, net value of farm or business, and net value of vehicles; *minus* remaining mortgage principal on main home and other debts. Net worth does not include either defined benefit or defined contribution pension wealth.

We consider three different measures of the saving rate for the five-year period between 1984 and 1989. First, we use the change in real net worth (1989 dollars) divided by five times average real after-Federal-tax money income for 1984 through 1988. Second, we use an "active saving" measure designed by the PSID staff -- the nominal change in wealth *minus* capital gains for housing and financial assets, inheritances, and the value of assets less debt brought into the household; *plus* the value of assets less debt taken out of the household.[31] This measure should more closely match the traditional income minus consumption measure of saving. The saving rate is computed by dividing active saving by five times the average real income measure described above.

Our third PSID saving measure adds estimates of saving through Social Security and private pensions to active saving. Feldstein and Samwick (1992) used then-current (1990) Social Security legislation to determine how much of the payroll tax is reflected in higher marginal benefits at retirement, and how much constitutes redistribution. We count the former part as the implicit saving component of the 11.2 cents in total Social Security (OASI) contributions per dollar of net income. In addition, if a household worker is enrolled in a defined contribution plan, we count their own contribution as saving (we have no data on employer contributions). If a household worker is enrolled

[31] Capital gain in housing is the difference in net equity in the main home between 1984 and 1989 less the cost of additions and repairs made to the home between 1984 and 1989. These gains are restricted to those years in which the family did not move. Financial capital gain equals the change in the value of other real estate, farms, businesses, and stocks between 1984 and 1989 less net financial investment (i.e. the net amount invested in these assets over this period.) We do not correct the active saving variable for inflation.

in a defined benefit plan, we include imputations of saving for representative defined benefit plans, as provided by Gustman and Steinmeier (1989) (see Appendix A).

We drop households who had active saving greater than $750,000 in absolute value, and households who, during any year between 1984 and 1988, had missing data, a change in head or spouse, or real disposable income less than $1000. For the regressions that include lagged or future earnings, we drop households for which there was a change in head or spouse during the relevant years.

D. Summary statistics from the three data sources

Table 2 shows summary measures of saving and income from the CEX, SCF, and PSID. All saving rates are on an annual basis, and all income figures are in 1989 dollars. To avoid undue influence from extreme values of the saving rate when income is close to zero, the "average" saving rates were calculated as average saving for the group divided by average income for the group.

The PSID "active" saving rates are generally the lowest in the table. By contrast, the estimates from the CEX — where saving is also based on the "active" concept — are among the highest. The high levels of CEX saving have been noted by previous authors (e.g. Bosworth, Burtless, and Sabelhaus, 1991) and probably reflect measurement error: both income and consumption are understated by respondents but consumption is thought to be understated by a greater amount, lending an upward bias to saving.[32] The PSID change in wealth (excluding pensions) saving measure, which includes capital gains and losses and adjusts for transfers in and out of the household, is generally higher than the PSID active saving measure and in the same ballpark as the similarly defined SCF measure.

We also calculate the saving rate averaged over the entire sample in each data set, including younger and older respondents, to correspond most closely to an aggregate rate of saving. For comparison, the average NIPA saving rate is shown in

[32] Branch (1994) finds that the CEX income covers 85 to 90 percent of actual income (as measured by the Current Population Survey) whereas the coverage ratios of most categories of expenditures (relative to the NIPA aggregates) fall below that amount, with some ratios (e.g. purchases of alcoholic beverages) well below 50 percent.

Table 2: Summary Saving and Income Measures

		CEX	SCF	PSID		
		Y-C	ΔWealth	ΔWealth	Active	Active + pension
Age 30-39	Median saving rate	.27	.05	.04	.04	.12
	Average saving rate	.30	.03	.17	.15	.23
	Median income	29,220	35,027	31,878	31,878	33,814
Age 40-49	Median saving rate	.26	.08	.03	.04	.15
	Average saving rate	.30	.29	.33	.15	.24
	Median income	33,510	36,495	41,820	41,820	45,263
Age 50-59	Median saving rate	.26	.05	.07	.04	.19
	Average saving rate	.30	.24	.32	.11	.24
	Median income	29,515	31,723	36,028	36,028	39,620
Aggregate average saving rate (all ages)		.25	.18	.17	.08	n.a. (for elderly)
Memo: NIPA saving rate over corresponding period		.09 (1982-89)	.09 (1983-89)	.08 (1984-89)		

Notes:

1. The CEX figures correspond to after-tax income; the SCF figures correspond to pre-tax income; the PSID “change in wealth” and “active” figures correspond to after-tax income; the PSID “active+pension” figures correspond to the sum of after-tax income augmented by employer contributions to Social Security and pensions. All income data are expressed in 1989 dollars.
2. Median saving rate equals median of the ratio of saving to income.
3. Average saving rate equals average saving divided by average income.

the final row -- conceptually, this rate is closest to the average “active” saving rate.[33]

V. Empirical Results

A. Saving Rates and Current Income

We begin our empirical inquiry by documenting the well-accepted fact that saving rates increase with current income. Table 3 summarizes how the saving rate varies with respect to current income quintile for households between the ages of 30 and 59.[34] We estimate median regressions, with the saving rate as the dependent variable and dummies for income quintiles and age categories as independent variables. In each case, we suppress the constant term and include dummies for all five income quintiles and the 30-39 and 50-59 age groups so that the estimated coefficient for a given income quintile corresponds to the saving rate for households in that quintile with heads between 40 and 49 years old. (Regressions that include interaction terms between age and income variables are similar.) Bootstrapped standard errors for the coefficients, based on 500 replications, are shown in parentheses.

The first column of Table 3 shows that the saving rate increases dramatically with measured current income in the CEX. Among households with heads between 40 and 49, median saving rates range from -23 percent in the lowest income quintile to 46 percent in the highest. We also calculate (but do not report) bootstrapped standard errors for the difference in the saving rate of quintiles i and i-1, and use the symbol “†” to indicate a statistically significant difference, based on a 95% confidence level and a one-sided test. All of the differences in this column are statistically significant. To summarize the quintile effects, we also report the coefficient from a regression of saving rates on the level of income. This coefficient suggests that a $10,000 increase in income is associated with an 8 percentage point increase in the saving rate.

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[33] Note, though, that our saving measures include purchases of motor vehicles, which should boost them relative to the NIPA concept.

[34] Income quintiles were calculated (on a weighted basis for the SCF and PSID) for each age group separately to ensure comparability across data sets and within the U.S. population. We did not use population weights in the regression analysis because the SCF weights — especially those for the top of the income distribution — ranged by orders of magnitude, causing considerable instability in the estimated coefficients. For example, just three of the 107 households in the top 1 percent of the income distribution accounted for 38 percent of the total population weights among the replicated sample.

Table 3: Median Regressions of Saving Rate on Current Income

Data Set -->	CEX	SCF	PSID		
saving measure -->	Y - C	ΔWealth	ΔWealth	Active	Active + pension
Income Quintile 1	-.226 (.018)	-.015 (.035)	.000 (.003)	.000 (.004)	.086 (.007)
Income Quintile 2	.151 † (.008)	.095 † (.039)	.013 † (.007)	.019 † (.006)	.129 † (.008)
Income Quintile 3	.269 † (.006)	.087 (.025)	.052 † (.009)	.048 † (.006)	.163 † (.008)
Income Quintile 4	.348 † (.006)	.144 (.034)	.071 (.011)	.054 (.009)	.180 † (.008)
Income Quintile 5	.455 † (.006)	.265 † (.032)	.179 † (.019)	.106 † (.009)	.230 † (.009)
Top 5%	n.a.	.368 (.096)	n.a.	n.a.	n.a.
Top 1%	n.a.	.494 (.051)	n.a.	n.a.	n.a.
Age 30-39	.006 (.005)	-.034 (.032)	.000 (.004)	.000 (.004)	-.031 (.007)
Age 50-59	-.002 (.007)	-.016 (.033)	.000 (.004)	.000 (.004)	.009 (.009)
Pseudo R^2	.143	.041	.032	.028	.050
Coefficient on income / 10^4	.079 (.001)	.017 (.003)	.024 (.002)	.013 (.001)	.020 (.002)
Sample Size	13050	727	2868	2868	2868

- Bootstrapped standard errors shown in parentheses.
- SCF and PSID quintiles are weighted; all regressions are unweighted.
- Definitions of income: CEX: current income; SCF: income in 1988; PSID: average income 1984-88.
- † indicates that coefficient is significantly greater than that for previous quintile, based on 1-sided 5% test.

Consistent with previous research based on the CEX, we estimate an extremely low saving rate for the lowest income quintile; we believe this reflects appreciable bias from measurement error in income and/or transitory income, as households in this quintile presumably cannot sustain such a high rate of dissaving for very long (see Sabelhaus, 1993).

The second column shows results from similar regressions using SCF data, including (annualized) saving rate estimates for households in the 95th and 99th percentile of the income distribution.[35] The slope of the relationship between the saving rate and measured current income is smaller than in the CEX. This result is not surprising – the change-in-wealth saving rate is not subject to the upward bias associated with measurement error in income, and many transitory movements in income likely wash out over the five-year period covered by the SCF panel. Nevertheless, we see the estimated median saving rate rising significantly from -2 percent for households in the bottom quintile to 27 percent for households in the top quintile. Saving rates are even larger for the richest households: 37 percent for those in the top five percent of the income distribution and 49 percent for those in the top one percent.[36]

Columns 3 through 5 show the relationship in the PSID between income and three saving-rate measures: the (annualized) total change in wealth (Column 3), active saving (Column 4), and active saving plus imputed pension and Social Security saving (Column 5). As in the SCF, the five-year period over which saving is measured reduces the importance of transitory income (also note that we are able to average five annual observations for income). In all cases, we estimate a monotonic positive relationship between saving and income, with differences of as much as 18 percentage points between the highest and lowest income quintiles.

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[35] We are able to estimate fairly precise saving rates for households in the highest part of the income distribution because the SCF disproportionately samples high-income households – out of a total of 727 households in the age 30-59 sample, 201 have income above the 95th percentile and 107 have income above the 99th percentile.

[36] The top quintile includes the top 5 percent, and the top 5 percent includes the top 1 percent. We do not test whether the saving rates for the top 5 percent or the top 1 percent are different from the saving rates for the top quintile.

Note that the differences in saving rates by income group for active saving augmented by imputed pension and Social Security contributions (Column 5) are even larger than those for active saving (Column 4). This may appear surprising, given the higher Social Security rates of return and replacement rates among households with lower earnings. There are two factors that explain this. First, while imputed Social Security saving rates as a percent of earnings are decreasing across income quintiles, when Social Security saving rates are calculated as a percent of earnings plus income transfers such as AFDC, disability and unemployment insurance, the decrease is somewhat smaller.[37] Second, saving through private pensions increases across income quintiles, and this increase more than offsets the decline in Social Security saving, so that median Social Security plus pension saving is generally higher in the top quintile than in the bottom quintile.[38] Thus it is unlikely that low rates of financial saving and wealth accumulation among lower income households can be explained by higher implicit Social Security and/or pension wealth accumulation.[39,40]

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[37] Among households aged 40-49 with any positive earnings, median Social Security saving as a percent of pre-tax earnings ranges from 10.1 percent in the bottom income quintile to 4.2 percent in the top quintile. But when calculated as a percent of pre-tax earnings plus transfer income, median rates range from 8.2 percent in the bottom income quintile to 4.1 percent in the top quintile. (If we do not exclude the zero-earnings households, the latter range is 7.8 percent to 4.1 percent.)

[38] For example, among households 40-49, median Social Security saving as a percentage of disposable income ranges declines from 6.5 percent for the lowest income quintile to 3.9 percent for the highest income quintile. However, Social Security plus pension saving ranges rises from 7.6 percent in the lowest income quintile to 11.1 percent in the highest income quintile.

[39] As mentioned previously, Gustman and Steinmeier (1997, tables 9 and 12, and 1999) use the HRS to construct, for 51-61 year olds, a comprehensive measure of wealth that includes pension and Social Security wealth. They find that the ratio of the average comprehensive *stock* of wealth to average lifetime earnings declines with lifetime earnings; this is surprising in light of our results that ratios of saving *flows* with respect to income rise with income. In part, the difference can be explained by the fact that transfer income, an important source of income for low earnings households, is included in our income measure, but not included in theirs (see our footnote 37 above). Another reason may be that very long averages of lagged earnings could be imperfect measures of permanent income – as predictors of future earnings, these averages likely overweight the distant past. The finding in Gustman and Steinmeier (1997) that even the ratio of *financial* wealth to lifetime earnings does not increase with lifetime earnings deciles suggests mismeasurement of permanent income.

[40] Moreover, Coronado, Fullerton, and Glass (1999), Liebman (1999), and Gustman and Steinmeier (2000) show that Social Security is less progressive when the calculations are based on additional features not included in our model, such as life expectancies that are positively related to income.

B. Saving Rates and Permanent Income

We now turn our attention to the relationship between saving rates and permanent income, using the two-stage procedure described earlier. We first focus on consumption as an instrument. Recall that the presence of measurement error (in the case of the CEX) or transitory consumption (in all three data sets) will bias the estimated slope toward a negative number.

Column 1 of Table 4 shows results from the CEX. The estimated median saving rate rises from the predicted first to second quintile, but then remains fairly flat. One interpretation is that the results favor the Friedman proportionality hypothesis; the more likely is that the negative correlation induced by measurement error in consumption and transitory consumption is approximately offset by a positive correlation between saving rates and permanent income.

We next consider data from the SCF and PSID, where saving is derived from the change in wealth and is thus likely uncorrelated with consumption measurement error. The SCF does not contain direct consumption flow measures, but it does include estimates of the value of vehicle stocks. We use the value in 1983 as an instrument. As shown in column 2, the results based on this instrument are surprisingly similar to those in the previous table, with saving rates rising from 3 percent in the lowest quintile to 25 percent in the top quintile. Saving rates in the top 5 percent are 44 percent of income, and in the top 1 percent are nearly *half* of income. These results suggest that the positive relationship between saving rates and income is even stronger for the highest-income households. The estimated linear impact of income on saving rates (near the bottom of the table) is roughly 5 percentage points per $10,000 in income, but is not statistically significant.[41]

Although the PSID contains data on food consumption only, previous work using other data sets has generally shown a monotonic relationship between total consumption and food consumption. Columns 3, 4, and 5 in Table 4 show that when PSID food consumption is used as an instrument, the estimated saving rates

[41] Because of non-linearities at very high levels of income, this regression excluded households with income in excess of $500,000.

Table 4: Median IV Regressions of Saving Rate on Income using Consumption as an Instrument

Data Set -->	CEX	SCF	PSID		
saving measure -->	Y - C	ΔWealth	ΔWealth	Active	Active + pension
Instruments ---->	Non-auto consumption	Vehicles	Food consumption	Food consumption	Food consumption
Income Quintile 1	.210 (.010)	.025 (.027)	.000 (.006)	.010 (.006)	.107 (.008)
Income Quintile 2	.288 † (.009)	.133 † (.043)	.022 † (.009)	.030 † (.007)	.129 † (.010)
Income Quintile 3	.277 (.008)	.131 (.039)	.036 (.009)	.037 (.006)	.147 (.010)
Income Quintile 4	.283 (.007)	.163 (.037)	.055 † (.010)	.040 (.008)	.150 (.010)
Income Quintile 5	.246 (.007)	.248 (.043)	.131 † (.019)	.072 † (.010)	.193 † (.011)
Top 5%	n.a.	.443 (.105)	n.a.	n.a.	n.a.
Top 1%	n.a.	.496 (.127)	n.a.	n.a.	n.a.
Age 30-39	.006 (.006)	-.052 (.032)	.002 (.007)	-.003 (.006)	-.023 (.008)
Age 50-59	-.000 (.006)	-.009 (.032)	.000 (.008)	-.010 (.006)	.011 (.011)
Pseudo R^2	.003	.026	.013	.010	.016
Coefficient on income / 10^4	-.003 (.002)	.052 (.038)	.024 (.003)	.013 (.002)	.015 (.002)
Sample Size	13050	727	2805	2805	2805

- Bootstrapped standard errors shown in parentheses.
- SCF and PSID quintiles are weighted; all regressions are unweighted.
- † indicates that coefficient is significantly greater than that for previous quintile, based on 1-sided 5% test.

consistently rise with income.[42] Indeed, the saving rate shows a significant step-up for roughly half of the quintiles. The linear results at the bottom of the table are statistically significant and quantitatively important, pointing to a 1-1/4 to 2-1/2 percentage point increase in the saving rate for each $10,000 increment to predicted income.

Our next approach uses as instruments lagged and future earnings. For the CEX, we have no data on lagged or future earnings. For the SCF, we have only one observation on earnings from outside the measurement period for saving: 1982 income. Column 1 of Table 5 shows that when this variable is used as an instrument for 1988 income, there is a very strong relationship between predicted income and saving rates, with the very highest income groups saving half of their after-tax income. Only one of the differences is statistically significant, but the estimate from the linear equation (a 2 percentage point increase for each $10,000 in predicted income) is statistically significant.

For the PSID, we use as instruments labor earnings of the head and wife (combined) for each year from 1974 to 1978, or effectively 10 years before the period over which saving is measured.[43] Columns 2, 3, and 4 of Table 5 show the results of this approach for the three PSID saving measures. In all cases, saving rates rise with predicted permanent income. The magnitude of the differences are in fact quite close to those from the uninstrumented results in Table 3, suggesting that the simple five-year average of current income eliminated transitory income quite effectively.

The last three columns of Table 5 show that when future earnings (1989-91) are used as instruments, we again see saving rates increasing with predicted income. This is true whether one looks at the quintile coefficients (ranging, for the active plus pension saving measure, from 8 percent to 23 percent) or the coefficient from the regression on predicted income (suggesting an increase of between 1-1/2 percentage points and 2-3/4 percentage points for each $10,000 increase in predicted income, with standard errors around 1/4 percentage point).

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[42] In the first stage, we regress average current disposable income (1984-1988) on food consumption in each of the years 1984-1987.

[43] In fact, we had earnings information back to 1967, but, conditioning on earnings in more recent years, those earlier readings had little or no predictive power for income in 1984-88.

Table 5: Median IV Regressions of Saving Rate on Income using Lagged and/or Future Earnings as Instruments

Data Set -->	SCF	PSID			PSID		
saving measure -->	ΔWealth	ΔWealth	Active	Active + pension	ΔWealth	Active	Active + pension
Instruments ---->	Lagged Income	Lagged Earnings	Lagged Earnings	Lagged Earnings	Future Earnings	Future Earnings	Future Earnings
Income Quintile 1	.018 (.022)	.000 (.005)	.000 (.004)	.090 (.010)	.000 (.003)	.004 (.004)	.077 (.009)
Income Quintile 2	.080 † (.024)	.016 (.011)	.019 † (.008)	.121 † (.012)	.023 † (.008)	.026 † (.007)	.136 † (.009)
Income Quintile 3	.090 (.032)	.063 † (.018)	.043† (.010)	.169 † (.016)	.066 † (.010)	.047 † (.007)	.163 † (.011)
Income Quintile 4	.152 (.032)	.075 (.017)	.055 (.013)	.193 (.014)	.070 (.012)	.053 (.009)	.182 (.010)
Income Quintile 5	.234 (.033)	.111 (.033)	.080 (.013)	.205 (.017)	.161 † (.016)	.093 † (.009)	.225 † (.011)
Top 5%	.436 (.094)	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
Top 1%	.502 (.045)	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
Age 30-39	-.043 (.026)	.000 (.008)	.000 (.005)	-.033 (.012)	.000 (.003)	-.004 (.004)	-.030 (.008)
Age 50-59	-.006 (.027)	.000 (.007)	.001 (.005)	.020 (.014)	.000 (.005)	-.004 (.005)	.013 (.012)
Pseudo R^2	.040	.014	.019	.035	.028	.026	.052
Coefficient on income / 10^4	.021 (.006)	.015 (.002)	.012 (.002)	.020 (.003)	.028 (.003)	.016 (.002)	.022 (.003)
Sample Size	727	1365	1365	1365	2487	2487	2487

- Bootstrapped standard errors shown in parentheses.
- SCF and PSID quintiles are weighted; all regressions are unweighted..
- SCF results use 1988 income as current income and 1982 income as lagged income.
- PSID results use 1974-1978 for lagged earnings and 1989-1991 for future earnings.
- † indicates that coefficient is significantly greater than that for previous quintile, based on 1-sided 5% test.

One objection to our results in Table 5 is that even long lags (e.g. ten years) of earnings could be tainted with transitory components if transitory effects are highly persistent, with half-lives of two decades or more (for example, if the AR(1) component of the error term is on the order of 0.90 or above). We thus turn to education as an instrument — a proxy for permanent income that is generally constant for adult households. Table 6 presents results from median regressions of saving rates on education group. For the top of the table, we do not use a two-stage procedure but simply report the "reduced form" estimates of saving rate by education group. We suppress the constant and include dummies for two age groups (30 to 39 and 50 to 59) and all education groups; the excluded age group is 40-49. At the bottom of the table, we report the coefficient on predicted income from a two-stage regression.

As shown in column 1 of Table 6, estimated median saving rates in the CEX range from 16 percent for high school dropouts to 34 percent for college graduates, with the differences statistically significant. The range for the SCF (column 2) is 6 percent to 29 percent. The positive correlation is also present in the PSID, with the range depending on the saving rate measure; for example, the saving rate with imputed Social Security and pension income ranges from 11 percent for high school dropouts to 20 percent for college graduates. The differences between education groups are all statistically significant. The coefficients on predicted income for the PSID runs indicate that the saving rate rises by between 2 and 3 percentage points for each $10,000 increase in income.

We summarize the results presented so far in figures 1A-1D. For each fitted income quintile or education group we plot the median saving rate against median income.[44] The results are striking. While the CEX shows considerable dispersion in the relationship between saving rates and income (depending on how the income groups were formed), for the PSID and the SCF, we see upward sloping lines that are essentially the same across all choices of instruments and when no instrumenting is done. In sum, the results presented thus far strongly suggest that saving rates rise with

[44] The median saving rate numbers plotted are the coefficients from the regressions in Tables 3 to 6. The median income numbers are coefficients from median regressions of current income on income quintiles and age dummies.

Table 6: Median Regressions of Saving Rate on Education

Data Set -->	CEX	SCF	PSID		
saving measure -->	Y - C	ΔWealth	ΔWealth	Active	Active + pension
No High School Degree	.156 (.009)	.058 (.037)	-.001 (.004)	.016 (.006)	.107 (.005)
High School Degree	.284 † (.006)	.118 (.032)	.039 † (.006)	.038 † (.006)	.145 † (.007)
College Degree +	.342 † (.007)	.290† (.037)	.113 † (.013)	.080 † (.011)	.196 † (.009)
Age 30-39	-.005 (.007)	-.065 (.034)	.001 (.006)	-.008 (.007)	-.028 (.006)
Age 50-59	.017 (.009)	.012 (.043)	.001 (.008)	-.010 (.007)	.012 (.011)
Pseudo R^2	.017	.019	.014	.010	.0200
Coefficient on income / 10^4	.068 (.003)	.008 (.002)	.032 (.003)	.018 (.003)	.023 (.002)
Sample Size	13050	727	2853	2853	2853

- Bootstrapped standard errors shown in parentheses.
- Regressions are unweighted.
- Definitions of income: CEX: current income; SCF: income in 1988; PSID: average income 1984-88.
- † indicates that coefficient is significantly greater than that for next lower education, based on 1-sided 5% test.

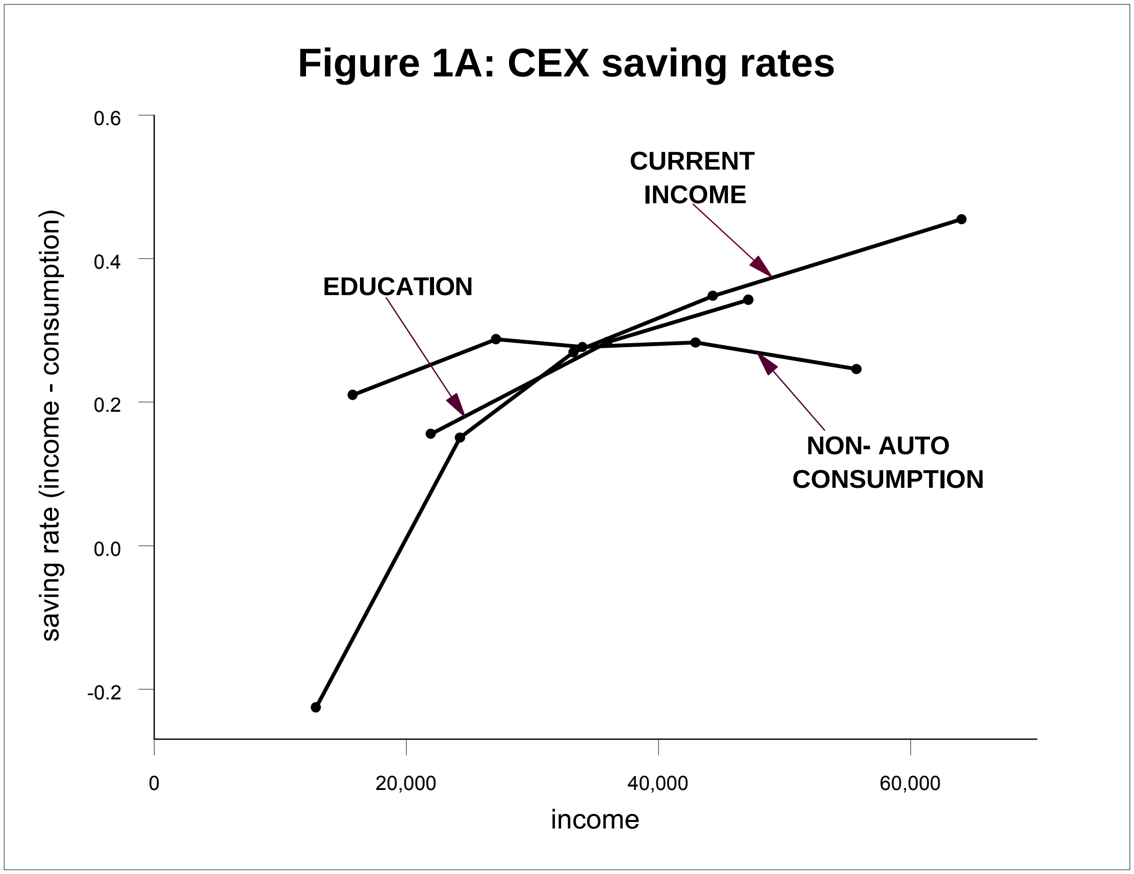
Figure 1A: CEX saving rates
0.6
0.4
0.2
0.0
-0.2
saving rate (income - consumption)
CURRENT
INCOME
EDUCATION
NON- AUTO
CONSUMPTION
0
20,000
40,000
60,000
income

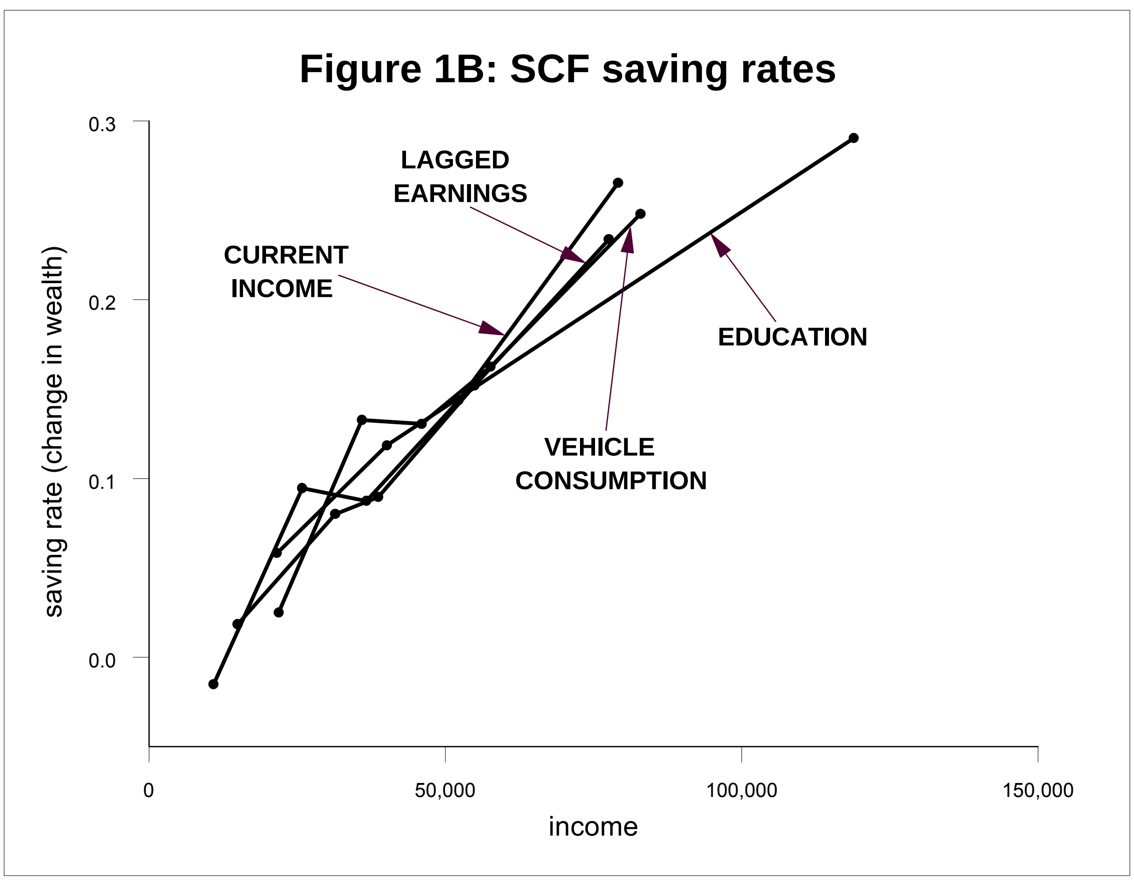
Figure 1B: SCF saving rates
0.3
0.2
0.1
0.0
saving rate (change in wealth)
LAGGED
EARNINGS
CURRENT
INCOME
EDUCATION
VEHICLE
CONSUMPTION
0
50,000
100,000
150,000
income

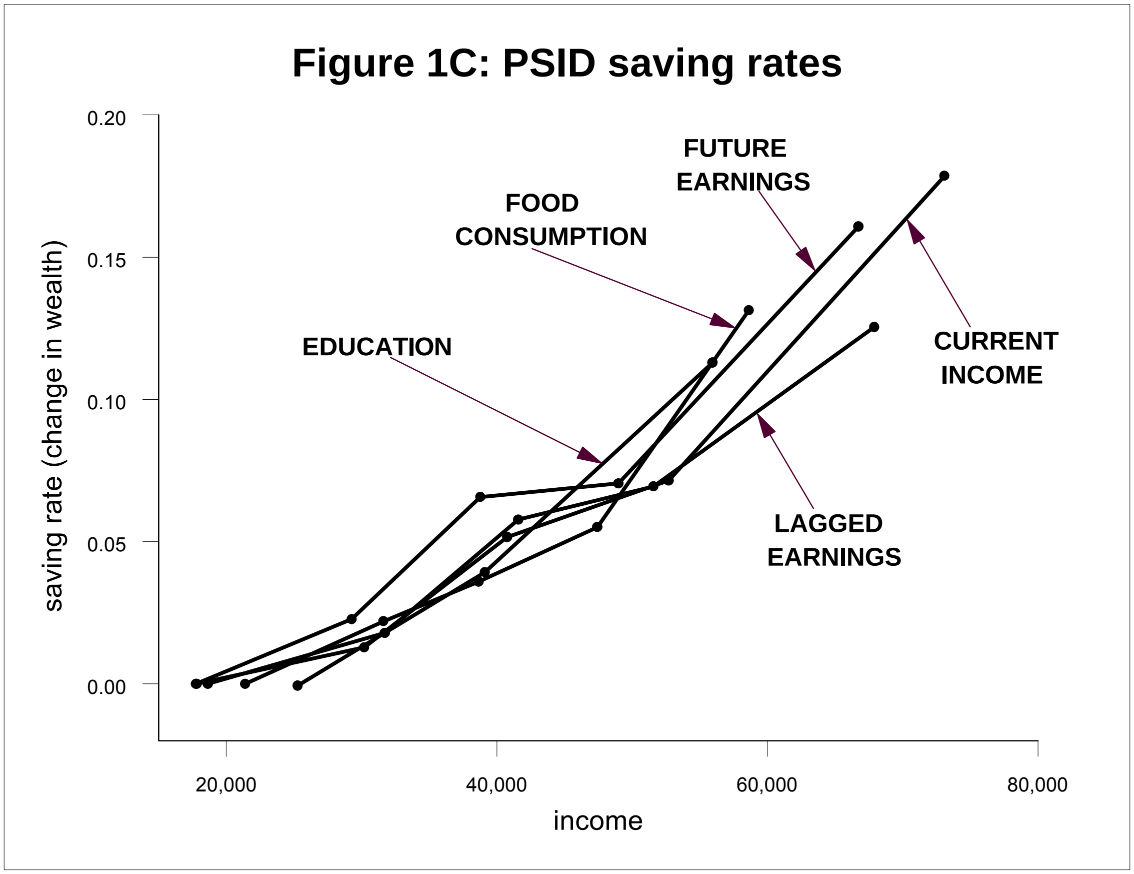

Figure 1C: PSID saving rates
0.20
0.15
0.10
0.05
0.00
saving rate (change in wealth)
20,000
40,000
60,000
80,000
income
FUTURE EARNINGS
FOOD CONSUMPTION
EDUCATION
CURRENT INCOME
LAGGED EARNINGS

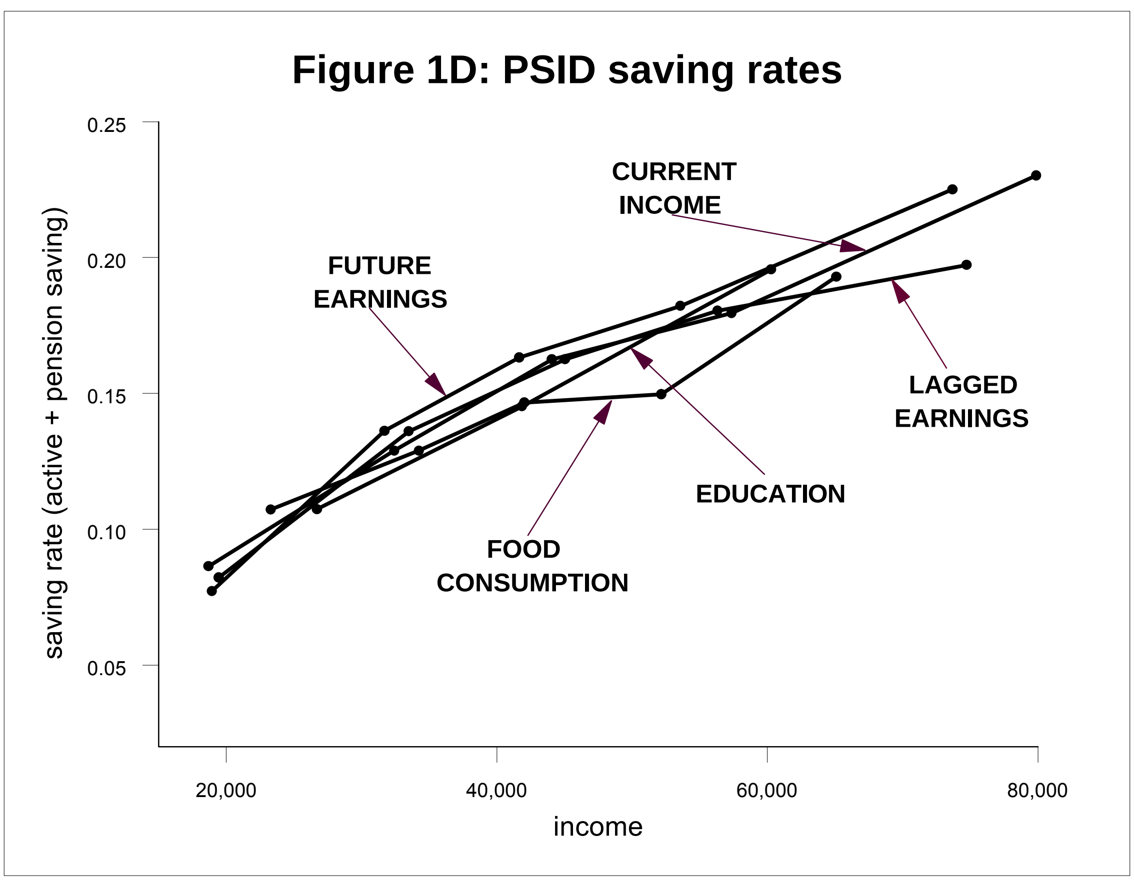

Figure 1D: PSID saving rates
0.25
0.20
0.15
0.10
0.05
saving rate (active + pension saving)
20,000
40,000
60,000
80,000
income
CURRENT INCOME
FUTURE EARNINGS
LAGGED EARNINGS
EDUCATION
FOOD CONSUMPTION

lifetime income among working-age households.

C. Saving rates among older households

In this section, we consider how the relationship between saving and permanent income changes at older ages. Examining the question for older households is difficult because observable measures of income may not be good indicators of lifetime income, particularly if we pool together people who are still working and those who have already retired. For the CEX and SCF, we attempt to get around these problems by restricting the sample to just the age group 70-79, where fewer than 15% of households have heads or spouses that are still working more than 20 hours a week. For the PSID, we use a larger sample of households age 62 and older and directly restrict the sample to just retirees; we also investigate how sensitive the results are to adding working households to the sample.

Table 7 presents median saving rates by quintiles of current income and by education. Not surprisingly, there is a strong correlation between saving rates and current income in the CEX (Column 1); what is more striking is the large and significant correlation of saving rates with education (Column 2). We use pension and Social Security income to determine income quintiles in the SCF (Column 3). The saving rates are much less precisely estimated than those for younger households owing to the smaller sample size. There is no obvious pattern in saving rates among the bottom 4 quintiles, and even the 5th quintile coefficient is not significantly different from zero. The estimated coefficient for the top 1 percent of the income distribution, however, remains very high, with saving equal nearly half of income. The SCF results based on education (Column 4) show a rising saving rate with education, but the results are not statistically significant.

Turning next to the larger sample in the PSID of people over age 62, we control for the different range of ages, with the excluded age 70-79. Column 5 restricts the sample to retirees, with quintiles based on household income from pensions, Social Security, and government welfare payments. We see a modest but significant positive correlation between income and saving rates, with no evidence of dissaving among any

Table 7: Median Regressions of Saving Rate on Income and Education for Older Households

Data Set -->	CEX (Age 70-79)		SCF (Age 70-79)		PSID (Age 62 +)		
saving measure -->	(1) Y - C	(2) Y - C	(3) ΔWealth	(4) Δ Wealth	(5) Active	(6) Active	(7) Active
Quintile 1	-.494 (.036)	...	.127 (.310)	...	.0 (.004)	.007 (.007)	...
Quintile 2	-.337 † (.029)	...	.339 (.362)	...	.0 (.005)	-.008 (.006)	...
Quintile 3	-.137 † (.018)	...	-.027 (.120)	...	.032 (.021)	.004 (.014)	...
Quintile 4	.049 † (.018)	...	-.110 (.148)	...	.024 (.029)	.048 † (.018)	...
Quintile 5	.319 † (.012)	...	.116 (.130)	...	.061 (.029)	.060 (.023)	...
Top 5%	...	...	.153 (.251)	...	...	...	...
Top 1%	...	...	.448 (.260)	...	...	...	...
No High School	...	-.069 (.015)	...	.010 (.035)	...	...	.0 (.004)
High School Graduate	...	.027 † (.032)	...	.118 (.170)	...	...	.020 (.016)
College Graduate +	...	.128 (.046)	...	.228 (.160)	...	...	.053 (.046)
Age 62-69	...	...	...	...	.0 (.004)	.008 (.007)	.0 (.006)
Age 80+	...	...	...	...	-.010 (.024)	-.014 (.019)	-.008 (.020)
Pseudo R^2	.117	.092	.014	.005	.006	.012	.002
Coef. on income / 10^4	.167 (.009)	.099 (.018)	.035 (.025)	.063 (.060)	.025 (.010)	.032 (.008)	.013 (.008)
Sample Size	2969	2969	154	154	636	938	630

- Bootstrapped standard errors shown in parentheses.
- CEX: unweighted; SCF and PSID: quintiles are weighted, regressions are unweighted.
- Definitions of income: CEX: current income; SCF: pension and Social Security income in 1988; PSID: pension, Social Security, and welfare income, 1984-88.
- Columns (5) and (7) based on retired PSID households; column (6) based on all PSID households in age range.
- † indicates that coefficient is significantly greater than that for next lower quintile or education group, based on 1-sided 5% test.

group.[45] Column 6 considers median saving rates for the same age group, but includes those who are still working, as retirees may represent a select group of savers. Income quintiles were determined again by transfer income rather than total income.[46] The results are very similar to those seen in the more restricted sample; a modest increase in the saving rate from zero in the lowest income quintiles to about 6 percent in the top quintile. The relationship between education and saving rates is also positive in the PSID (Column 7) but insignificant and less pronounced than in the CEX and SCF. Taken together, the results provide no evidence that older high lifetime income households dissave at a faster rate than older low lifetime income households; if anything they may continue to save more.[47]

VI. Discussion

This paper revisits an old question: Do high lifetime income households save a larger fraction of their income than low lifetime income households? This question was the topic of heated and largely inconclusive debates in the 1950s and 1960s. We have approached it with three data sources: the Consumer Expenditure Survey, the Survey of Consumer Finances, and the Panel Study of Income Dynamics. For households aged 30-59, we consistently find that higher lifetime income households save a larger fraction of their income than lower income households. Also, there is no evidence that high lifetime income households dissave more at post-retirement ages.

Which model is right?

Our results clearly rule out models that imply saving is proportional to permanent income. But, as shown in Section II, a variety of economic models deliver the prediction

[45] We do not attempt to impute dissaving from pension and Social Security wealth, although we suspect that these sources of dissaving are small. Indeed, Bernheim (1987) argued that for life cycle consumers who carry positive wealth in other forms and are reasonably far from the maximum length of life, annuities should be discounted roughly at the interest rate, without any reference to life expectancy. Under this approach, the present value of Social Security and pension benefits does not decline over time, implying *no* dissaving from these sources.

[46] For this sample, using transfer income to create quintiles imparts a downward bias on the estimated correlation between income and saving rates because people who haven't retired will be receiving earnings (and presumably saving some of those earnings for retirement) but will likely receive below-normal Social Security and pension benefits.

[47] See also Alessie, Lusardi, and Kapteyn, 1995, Hurd, 1990, and Feinstein and Ho (2000).

that saving rates are positively related to permanent income. Is there any way to distinguish among these?

First, our results are not consistent with life-cycle explanations based on differences in the timing of income or consumption. With regard to the former, we find that including imputed Social Security and pension saving does not alter our basic result that high income households save a larger fraction of their income. The decline in Social Security saving rates as income rises is more than offset by a rise in pension saving rates, so that including imputed Social Security and pension saving leads to a *steeper* relationship between saving rates and income. Because we find that saving rates rise with income even after controlling for age and Social Security, we argue that models such as Huggett and Ventura (2000) that rely primarily on differences in Social Security replacement rates are not capable of fully explaining why high income households save more.[48]

More generally, we find no evidence of a "switching" pattern at later ages; that is household types with higher saving rates while young are not more likely to have higher dissaving rates while old. If anything, our point estimates suggest that higher income households continue to save more than low income households while retired, albeit with a smaller differential.

Precautionary saving models with uncertain medical expenses cannot explain the evidence either, since lower income households typically face more uncertainty about health costs relative to their income. However, adding means-tested social insurance yields predictions that are more consistent with empirical patterns, particularly if the medical expenditures are large and are associated with poor health very late in life. In this case, the dissaving of the old would either occur very late in life or not at all (accidental bequests).

Higher saving rates for higher income groups are also consistent with an operative bequest motive as in Becker and Tomes (1986); indeed, the very high saving

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[48] Huggett and Ventura (2000) show that a life-cycle model with homothetic preferences, earnings uncertainty, and a realistic Social Security system can generate saving rates that rise with income, matching the patterns found in U.S. data by early researchers. The variation in saving rates in their model is due primarily to differences in Social Security replacement rates across earnings groups and differences in earnings **across** age groups.

rates of the top 1 percent or top 5 percent are difficult to explain any other way. However, while our model with bequests *alone* might explain the saving of the rich, it predicts life cycle saving for low income households, which is at odds with the very low observed levels of saving (and dissaving) in the lowest income quintiles.[49] We thus suggest a general model that includes a precautionary saving motive tempered by the presence of a safety net, coupled with a bequest motive. The different motives need not be exclusive: households may save for precautionary reasons but with a reasonable expectation that they will be able to pass along unspent balances to their children (also see Smith, 1999a).

This view of saving behavior can potentially reconcile seemingly inconsistent survey results on bequest behavior. For example, 43 percent of *retired* households in the 1983-89 SCF panel cited either "in case of illness" or "emergencies" as their most important reasons for saving, while fewer than 5 percent mentioned "for the children."[50] At the same time, 20 percent of the retired sample said it was likely that they would leave a "sizable" estate to their heirs (also see Laitner and Juster, 1996), and 55 percent of retirees responded that leaving an inheritance was either very important or important. In Horioka, et al (2000), 46 percent of U.S. households with children indicated that they wanted to make efforts to leave a bequest behind, while 51 percent indicated they would leave to children "whatever assets happen to be left over." Together, this suggests that households would like to leave money to their children, but recognize that the primary motive is to ensure their own (and their spouse's) financial solvency until death.

Returning to a stylized fact noted in the introduction, our results can be consistent with the lack of times-series increase in the aggregate saving rate, as our

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[49] See Bernheim, Skinner, Weinberg (1997). Mulligan (1997) has also criticized this simple "bequest-smoothing" explanation for another reason; he found no evidence suggesting that households giving (or receiving) bequests are more likely to smooth consumption across generations. The Mulligan model treats the bequest motive as endogenous; parents who spend more time with their children (and less time working for pay) develop stronger altruistic feelings towards their children. Thus our finding that the rich save more and bequeath more is consistent with the Mulligan model to the extent that the income effect (higher wage households have more money to leave to their children) offsets the endogenous taste effect (higher wage parents spend less time with their children).

[50] This ranking of priorities is also generally consistent with stated motives for saving in Japan (Horioka and Watanabe, 1997) and in the Netherlands (Wärneryd, 1995).

preferred theoretical model implies that saving rates are invariant to increases in income, health care expenditures, anticipated income of heirs, and the size of the consumption floor over time, *as long as* all variables rise proportionately.

What are the policy implications?

Our results have implications for the "choice versus chance" question first raised by Milton Friedman (1953) and more recently by Venti and Wise (1998). Is the considerable variation in accumulated wealth the consequence of choice (preferences and tastes) or chance? Venti and Wise argue that much of the variation in wealth within lifetime income groups is due to saving decisions (choice). Our findings suggest that differences in saving behavior *across* income groups are also an important source of the overall variation in wealth of the U.S. population.[51]

In addition, our results have implications for the progressivity of consumption taxes. There are two reasons that the progressivity of a consumption tax might differ from that of an income tax. First, even in a life-cycle model in which everyone ends life with zero wealth, if high income households save more when young (and dissave more when old), they will have higher interest income over their lifetimes. Therefore, on a lifetime basis, a flat rate consumption tax will be less progressive (or more regressive) than a flat rate income tax.[52] A simple simulation by education group that uses our estimated median active saving rates from Table 6 (as in footnote 51) to generate education-specific wealth and interest income profiles suggests that, through age 80, the ratio of interest income taxes paid to lifetime resources is four times larger for college-educated households than for high school dropouts.

Second, bequests are effectively exempt from a consumption tax (at least for the current generation), but are not exempt from an income tax. If high income households

[51] As an illustration, we calculate wealth levels at age 60 by dividing our sample into the three education groups, and using the estimated age-specific active saving measures from Table 6, an interest rate of 3 percent, and perfect certainty education-specific earnings profiles from Hubbard, Skinner, and Zeldes (1994). For high school dropouts, with a present value of lifetime earnings equal to $490,750, the ratio of wealth to average income at ages 56-60 is 0.72; for high school graduates, the ratio is 1.90; and for college graduates with lifetime earnings of $953,630, the ratio is 3.54.

[52] See, for example, Mieszkowski and Palumbo (2000) and Chernick and Reschovsky (1997). We ignore behavioral effects of the tax reform. Note that the regressivity on a lifetime income basis will be less than that calculated on an annual basis. See, for example, Poterba (1989).

leave proportionately more bequests than low income households, this will further decrease the progressivity of a consumption tax relative to an income tax. Menchik and David (1982), found a U-shaped relationship between the fraction of resources bequeathed and lifetime income; indeed bequests were the largest share of lifetime resources for the *lowest* income decile. When Metcalf (1994) used this bequest pattern, he found that the adjustment for bequests increased slightly the progressivity of a consumption tax.[53] By contrast, our results suggest that elevated levels of bequeathable wealth (as a fraction of income) among high income elderly people are likely to translate into higher bequest-to-income ratios as well, making a consumption tax more regressive.

There is much that remains to be learned about household saving behavior. In particular, future research should be targeted at improving our understanding of the saving behavior of elderly households, especially following serious illness or the death of a spouse. Still, we believe that our work has established one fact: the rich do, indeed, save more.

[53] The Menchik and David (1982, 1983) U-shaped pattern may be the consequence of using Wisconsin probate records matched with tax returns; farmers are more likely to show low or zero after-tax income but leave sizeable farms. The Menchik and David bequest assumptions are also used in Fullerton and Rogers (1993) and Altig et al (1997), implying that these highly sophisticated tax incidence models do not allow higher income households to save a higher fraction of income over their lifetime.

Appendix A: Data Description

I. CEX Data

We used data from Nelson's (1994a) reorganization of the CEX, which provides expenditure, income, and demographic information for a cross-section of households. The extract contains the 1980-89 waves, but we excluded the first two years because of concerns about data quality. We were left with a sample of households whose final interviews fell between the first quarter of 1982 and the final quarter of 1989.

The CEX is conducted on a quarterly basis. Nelson aggregated the expenditure information so that each household's data correspond to spending for the full year of participation. The demographic information (and income information) in the Nelson data set generally pertain to each household's final survey. See Nelson (1994a) for a detailed discussion of her data extracts as well as the limitations of the CEX data.

A. Deflating

All expenditure and income variables were deflated using the chain-type price index for personal consumption expenditures (*Economic Report of the President* 1997, table B3), adjusted to have a base year of 1989.

B. Constructed Variables

1. *Consumption.* We defined consumption as total household expenditures plus imputed rent for homeowners minus mortgage payments, expenditures on home capital improvements, life insurance payments, and spending on new and used vehicles. The measure is similar to the National Income and Product Accounts concept, except that it excludes purchases of new cars and life insurance payments and includes property tax payments. Also note that medical care consumption equals only out-of-pocket spending (less reimbursements).

2. *After-tax Income.* Following Nelson, gross (pre-tax) income equals the sum of workman's compensation, veteran's benefits, dividends, royalties, estate and trust income, pension and annuities, welfare and public assistance, food stamps, interest on savings accounts and bonds, net income or loss from boarders, net income or loss from other rental units, alimony or child support, other money income, salary income, nonfarm business income, farm income, Social Security and railroad retirement income, and supplemental security income. The figures correspond to the 12 months preceding each household's final interview.

   After-tax income equals gross income minus taxes paid (federal, state and local, personal property and other taxes, net of refunds). Nelson cautions that the tax data are even less reliable than the income data.

   The after-tax income of fewer than 1 percent of the households in Nelson's extract was topcoded, with one or more of the underlying components of income exceeding $75,000 (if the final interview occurred before the end of

1982) or $100,000 (if the final interview occurred later). We included these cases in our sample, setting nominal after-tax income to the topcoding cut-offs.

3. *Saving Rate*. The saving rate equals the difference between real after-tax income and real consumption, all divided by real after-tax income.

4. *Age*. The age variable pertains to the male head of household if present; otherwise it pertains to the female head of household.

5. *Education*. The education variables are based of the number of years of education reported by the male head of household if present; otherwise, those reported by the female head. Households were put in the "no high school degree" group, the "high school degree only" group, or the "college degree" group, depending on whether the head reported less than twelve years of schooling, at least twelve but less than sixteen years of schooling, or at least sixteen years of schooling, respectively.

C. Weights

The CEX includes probability weights in the quarterly samples, but Nelson (1994a, Section V) warns that “When using observations from a period other than a calendar quarter (or after having subjected the observations to demographic or data quality selection criteria), use of these weights is not clearly justifiable. Most household-level analysis will ignore these weights”. Accordingly, we do not use the CEX weights.

D. Sample Selection

After excluding the early waves from Nelson's reorganization, we were left with 32606 households. We then eliminated 10670 households whose heads were less than 30 years old, between 60 and 69 years old, or over 79 years old. We next dropped 3156 households whose members did not participate in the complete set of surveys. We then removed 419 households for whom some key expenditure data were missing, 2163 households whose income data were coded as unreliable, 175 households whose real after-tax income was less than $1000 and 4 households for whom real after-tax income was missing. (Often missing data was simply entered in the survey as a zero, see Nelson, 1994a). We were left with 16019 households in our non-retired sample.

II. SCF Data

We use data from the 1983-89 SCF panel. Households were interviewed about their assets and liabilities, employment, income, and demographics in 1983 and then again in 1989. Respondents fall into one of two groups: the area-probability sample, which was designed to provide good coverage of assets and liabilities that are broadly distributed in the population, and the "list" sample, which was compiled from IRS tax records and designed to provide estimates of assets and liabilities held by relatively wealthy households. Our analysis includes both groups so we were able to obtain relatively precise estimates for households at the top of the income distribution.

A. Deflating

All wealth and income variables were deflated using the chain-type price index for personal consumption expenditures (*Economic Report of the President* 1997, table B3), adjusted to have a base year of 1989.

B. Constructed Variables

1. *Saving Rate*. The (annualized) saving rate equals real net worth in 1989 less real net worth in 1983, all divided by six times real income in 1988.

2. *Net Worth*. Net worth equals the value of checking accounts, savings accounts, certificates of deposit, savings bonds, money market accounts, cash/call money accounts, trusts, life insurance (cash value), homes, land contracts, other real estate, vehicles, thrift plans, IRAs, stocks, bonds, loans owed to the household, business assets, and "other" financial and nonfinancial assets, minus the value of credit card debt, lines of credit debt, vehicle debt, mortgage debt, other real estate debt, consumer debt, business debt, and "other" debt.

3. *Income*. Household income equals the sum of wages and salaries, net business income, income from non-taxable investments, other interest income, dividends, capital gains from the sale of stocks, bonds or real estate, rental income, trust income, royalties, unemployment insurance, worker's compensation, child support, alimony, income from AFDC, SSI and other forms of assistance, Social Security income, other pension income, and "other" income. The SCF contains no information about taxes paid.

4. *Age*. The age variable pertains to the age of the "head" of household in 1986. In the SCF, the head is defined as the respondent (selected as the person "most knowledgeable" about household financial affairs) unless the respondent was female and had a male spouse present in the household. In this case, the "head" is defined as the respondent's spouse.

5. *Education*. All education groupings were done according to the number of years of education reported by the head in 1989. Households were put in the "no high school degree" group, the "high school degree only" group, or the "college degree" group, depending on whether the head reported less than twelve years of schooling, at least twelve but less than sixteen years of schooling, or at least sixteen years of schooling, respectively.

C. Weights

All calculations were weighted with the variable WGT0296, which was developed explicitly for the purpose of estimating changes in wealth between 1983 and 1989.

D. Sample Selection

The SCF panel data set contains information from 1479 households. The data set has 4437 observations because each household's data was repeated 3 times with noise added to any imputed variables, in order to more accurately represent the variance of these imputed variables. We excluded 1260 observations (i.e. information about 420 households) because the heads were younger than 30, between the ages of 60 and 69, or over 79. We then eliminated another 573 observations (i.e. information about 191 households) because the head or spouse had changed between the 1983 and 1989 interviews. Finally, we removed 12 observations (i.e. information about 4 households) because their incomes in 1982 or 1988 were less than $1000. We were left with 2643 observations with information from 881 households.

In order to correct our standard errors for the presence of the replicates in the data set, we multiplied them by 1.73--the square root of the number of replicates (3).

III. PSID Data

We use data from the PSID from 1968-92 in final release format. The 1989 survey contains a wealth supplement which gives detailed information on wealth accumulation from 1984-89.[54]

A. Deflating

All variables except the food consumption variables and the active saving variable are deflated using the chain-type price index for personal consumption expenditures (*Economic Report of the President* 1997, table B3), adjusted to have a base year of 1989. We deflate food consumed at home and food consumed out of the home with the CPI-U's for food consumed at home and for food consumed out of the home, both adjusted to have a base year of 1989. The CPI's correspond to the first quarter of the relevant year, as we assume that households base their responses on current food consumption (as opposed to that in the previous year).

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[54] The PSID has released a 1994 wealth supplement data file. This contains information on 1994 wealth, as well as a revised version (with new imputations) of the 1984 and 1989 wealth numbers. We do not use the 1994 wealth numbers because the 1994 family and individual files are still in early release form, and many of the variables needed to construct income, education, and consumption measures are not available. The 1994 supplement did not provide revised estimates of active saving. To make our change in wealth estimates consistent with our active saving estimates, therefore, we continue to use the 1984 and 1989 numbers reported in 1989.

B. Constructed Variables

1. *Saving*. We use three measures of saving.

a) *Change in wealth*. This variable equals the difference between real net worth in 1984 and real net worth in 1989, where net worth includes the value of checking and savings accounts, money market funds, CDs, government saving bonds, T-bills, and IRAs; the net value of: stocks, bonds, rights in a trust or estate, cash value of life insurance, valuable collections, and other assets; the value of main house, net value of other real estate, net value of farm or business, and net value of vehicles; *minus* the remaining mortgage principal on main home and other debts. Net worth does not include either defined benefit or defined contribution pension wealth.

b) *Active saving*. The "active saving" variable was constructed by the PSID staff. It is equal to the change in wealth (1984 to 1989), adjusted for passive increases or decreases in wealth (such as capital gains). Capital gains were not asked directly however, so the measure is built up in part from questions about saving flows. Rewriting the definition of active saving in the PSID codebook (to ignore entries that are both added and subtracted) we get:

active saving =

\+ the value of private annuities purchased since 1984 (v17340)
\- the value of private annuities or pensions cashed in since 1984(v17343)

\+ the value of real estate purchased since 1984 (v17346)
\- the value of real estate sold since 1984 (v17349)
\+ the cost of additions or repairs to real estate since 1984 (v17352)

\+ the amount invested in business or farm since 1984 (v17355)
\- the value of farm or business sold since 1984 (v17358)

\+ the amount of stock purchased since 1984 (v17365)
\- the amount of stock sold since 1984 (v17368)

\+ the value of assets less debts removed by movers out of the family unit since 1984 (v17371-v17373)
\+ the value of debts less assets added by movers into the family unit since 1984 (v17379-v17377)

\+ the value of vehicles in 1989 (v17320)
\- the value of vehicles in 1984 (v17592)

\+ the value of cash assets in 1989 (v17329)
\- the value of cash assets in 1984 (v17601)

\+ the net value of other assets in 1989 (v17332)
\- the net value of other assets in 1984 (v17604)

\+ the remaining mortgage principle in 1984 (v10020)
\- the remaining mortgage principle in 1989 (v16326)

\+ the value of other debt in 1984 (v17607)
\- the value of other debt in 1989 (v17335).

Imputation procedures were used by the PSID staff when respondents failed to provide an estimate of a wealth component or when they could only provide a range of values. We do not deflate the active saving variable.

c) *Active saving augmented by Social Security and pension saving*.

Social security saving:

We began with Feldstein and Samwick's (1992) imputation methods for determining what fraction of Social Security payroll contributions can be considered saving. Along the three relevant segments of the AIME schedule, they calculated Social Security net marginal tax rates, equal to the payroll tax minus the present discounted value (using a 4% real discount rate) of marginal benefits. Net marginal tax rates were calculated at each age for single women, single men, and couples, and were corrected for average life expectancy and spousal benefits. (We are especially grateful to Andrew Samwick, who provided us with detailed tables of these net tax rates.) In some cases the Social Security net marginal tax rate is positive (the 11.2 cent payroll tax yielded an increase in the present value of benefits less than 11.2 cents) and in some cases it is negative (i.e. the 11.2 cent payroll tax yielded an increase in the present value of benefits greater than 11.2 cents).

Assigning single households to the appropriate group was straightforward (single males, single females). For couples the problem is more complex, since couples may benefit more by receiving spousal benefits rather than gaining credit for a lower-paid spouse's individual contributions. Thus we used earnings of the highest paid spouse (male or female) when the lower-paid spouse earned less than 40 percent of the higher-paid spouse.

We constructed social-security-eligible earnings by excluding earnings above the taxable limit in any of the 5 years 1984-89. We then averaged these eligible earnings across the five years. Next, we integrated the Feldstein and Samwick net marginal tax rates along the

AIME schedule to measure the Social Security net **average** tax rate for the specific household. Dollars of Social Security saving equals 11.2 percent minus the net average tax rate, multiplied by eligible earnings. Households that pay a net average tax have Social Security saving less than 11.2 percent of earnings, while households that receive a subsidy, (e.g. some lower income households, that are accumulating largely along the first, 90 percent AIME schedule) have Social Security saving greater than 11.2 percent of earnings. We add this Social Security saving to the reported PSID saving.

Pension saving:

Finally, we consider the imputation of pension benefits. The PSID asks about employee contributions toward defined contribution plans. We start with the answer to: "On the average, what amount or percent of pay have you contributed over the last five years since 1984?" and multiply this by average labor income from 1984-1988 to get a dollar amount of saving. We do this for the contributions to all defined contribution pension plans with the current employer (exclusive of IRAs, which are included elsewhere) for both the head and spouse. If a household answered that they contributed to a DC plan, but did not report the percent, we set the percent equal to 5.5. We do not include contributions from previous jobs held during this period because of concerns about double counting of contributions and because we don't know the length of the period of contributions (test results that included these contributions did not materially differ from those reported). We have no data on employer contributions to defined contribution plans.

Defined benefit plans are more complicated, since there are often quite complex accumulation rules. However, Gustman and Steinmeier (1989) used the detailed pension information from the 1983 SCF Pension Provider Supplement to calculate the implicit returns to average DB plans at that time. While they did not report implicit contribution rates by income group, they did provide such rates by age group. For PSID households that indicated that they have a DB plan, we use their calculations to add to our measure of saving accumulation in defined benefit plans (see their Table 13 on page 85). Implicit accumulation rates range from less than 6 percent of labor income before age 35 to 18 percent (briefly) around age 50 back to 5 percent prior to retirement.

2. *Disposable Income*. Disposable income is constructed by subtracting Federal taxes paid by the head and wife and Federal taxes paid by other members of the family unit from total family money income. Total family money income is the sum of taxable income of the head and wife, taxable income of other members of the family unit, transfers of the head and wife, and transfers of other members of the family unit. Taxes paid are estimated by the PSID staff based on taxable income, number of dependents and exemptions, filing status, estimated standard and itemized deductions, estimated earned income tax credits, and estimated

elderly tax credits. All nominal components of disposable income are deflated using the implicit price deflator described above. Average disposable income is calculated for 1984-88 (1985-89 survey years). We calculate an additional measures of average disposable income to use with the broader saving measure described above. This measure starts with the above measure of disposable income and adds 1) one half of Social Security saving to average disposable income (1984-88), to correct for the fact that the employer contribution to Social Security is not measured in the conventional definition of income, but is measured as part of our augmented Social Security saving, and 2) the imputed employer-contribution to defined benefit and/or defined contribution plans, for the same reason.

3. *Saving Rates*. We calculate the saving rates by dividing active saving and the change in wealth by five times average disposable income from 1984-88. Our broader saving measure is divided by five times the corresponding average disposable income measure.

4. *Food Consumption*. We use food consumption as a proxy for total consumption since the PSID does not ask more general consumption questions. We follow Zeldes (1989) in the construction of food consumption. In survey years 1977-87 and 1990-92, the question on food consumed at home was designed to exclude the amount saved from food stamps. To measure total annual food consumed at home we add the annual food consumed at home constructed by the PSID staff and (when appropriate) the annual amount saved from food stamps. This variable is deflated by the home food consumption deflator described above. Annual food consumed out of the home is deflated by the appropriate measure for food consumed out of the home. Total real annual food consumption is the sum of total real annual food consumed at home and annual real food consumed out of the home.

Since questions on food consumption were omitted from the survey in 1988 and 1989, we use food consumption in 1984, 1985, 1986, and 1987 as our instruments.

5. *Education*. We consider education of the head in 1989 only. The sample is divided into 3 education categories: no high school degree, high school degree only, and college degree. Observations are coded “no high school degree” if they have 0-11 years of schooling and they have not received a high school degree. Observations holding a high school degree, a high school degree and non-academic training, or a high school degree and some college attendance (but no college degree) are coded “high school degree only”. Finally observations holding a college degree or a college degree plus advanced training are coded “college degree”.

6. *Lagged Earnings* Here we describe two complications in calculating lagged after-tax earnings. The first relates to correcting for taxes on labor income. We calculate the average tax rate equal to taxes paid by head and spouse divided by

taxable income of head and spouse. After-tax labor income of the head and spouse is equal to pre-tax labor income multiplied by (1 minus the average tax rate) plus transfers of the head and spouse.

The second complication relates to maintaining the same head-spouse combination throughout the period in which we calculate lagged earnings. In order to ensure that the head-spouse combination is the same in each year in which lagged earnings are calculated as in the 1984-88 period, we set after-tax earnings to missing in a given (lagged) year if the head-spouse combination is not the same as in the following year. This is done recursively starting in 1983 and ending in 1968. For example, if the head-spouse combination changed between 1980 and 1981, all after-tax earnings from 1980 back to 1968 would be set to missing. This ensures that we only include lagged earnings as instruments for households whose head-spouse combination is the same across all years.

7. *Future Earnings*. We calculate after tax future earnings by the same method described above for lagged earnings. Specifically, after-tax labor income of the head and spouse is equal to pre-tax labor income multiplied by (1 minus the average tax rate) plus transfers of the head and spouse. To ensure that the head-spouse combination is the same throughout the period in which we calculate future earnings (1989-91), we set after tax earnings to missing if in a given (future) year the head-spouse combination is not the same as in the previous year. In this case, we care about whether the head-spouse combination is the same going forward from 1988, rather than backward (as with lagged earnings).

C. Weights

All quintiles were calculated using the 1989 family weights from the PSID (V17612).

D. Sample Selection

We use the family-individual file from the PSID, and each individual constitutes an observation. We start with a sample of individuals who were heads for at least one year between 1968 and 1994 (19914 observations). We then restrict the sample to individuals who were heads for at least one year between 1968 and 1992 (1987 observations dropped) and who were heads in all years from 1984 to 1989 (12740 observations dropped). We further restrict the sample to observations who had no change in family composition affecting the head between 1984 and 1989 (7 observations dropped). We drop households whose head was less than 30 years old in 1987 (767 dropped). For all but Table 7, we also drop households whose total real after-tax money income in any year from 1984-88 was less than $1000 (for a total of 66 dropped), and households with the absolute value of active saving above $750,000 (3 observations dropped). Finally, for all but Table 7 we drop households whose head was older than 59 in 1987 (1126 dropped) and households whose head-spouse combination changed over the 1984-89 period (351 dropped). The sample is restricted further in that we drop observations whose income or education measure used in the one and two stage regressions is missing. In the one stage regression using current income quintiles, no observations are dropped. In the one and two stage education regressions, 15 observations are dropped. In the two stage regression using food consumption as an instrument, 63 observations are dropped. In the two stage regressions using lagged and future income (separately) as instruments, 892 and 381 observations are dropped, respectively.

For Table 7, we begin by dropping observations who were working during the 1984-89 period (3510 dropped). Then we drop observations whose head was less than 70 years old in 1987 (472 dropped) and observations whose head-spouse combination was not the same from 1984-89 (25 dropped). We also drop households whose total real money income in any year between 1984-88 was less than $1000 (see above for variable numbers, 2 dropped) and households who had an absolute value of active saving greater than $750,000 (1 dropped). Finally, in the education regressions we drop observations whose education level is missing (1 dropped). No observations had missing data for the quintile regressions and thus no observations were dropped.

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