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EFFECTS OF STOCK MARKET FLUCTUATIONS ON THE ADEQUACY OF RETIREMENT WEALTH ACCUMULATION

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This paper examines the relation between fluctuations in the aggregate value of equities and the adequacy of households' saving for retirement. Using more recent data than most studies on this topic, we find that many and perhaps most households appear to be saving adequate amounts for retirement, and that there is almost no link between aggregate equity values and the adequacy of retirement saving. A simulated 40 percent decline in stocks has little effect on the adequacy of saving. The substantial growth in equity values and ownership in the 1980s and 1990s did not lead to a surge in the adequacy of retirement saving provisions. The results occur because equity holdings are concentrated among households with significant amounts of other wealth.

Introduction

Several secular trends have led policymakers and researchers to question the adequacy of households' financial preparations for retirement in recent years. The baby boom generation—which has been large enough to shape societal trends at every life-cycle stage it has attained—is rapidly approaching retirement. The need for retirement saving has increased as retirement ages have held constant or fallen, but life-spans have increased. Social security and Medicare face long-term shortfalls that may require benefit cuts. Family networks, a traditional source of support in old age, are suspected to provide less support in the future. Private pension coverage has stagnated. Aggregate private saving rates are low and have fallen over time, and many households approach retirement with little in the way of financial assets.

On the other hand, the last two decades have seen a strong increase in equity values and in the share of households with direct and indirect ownership of equities. Equity values rose from 39 percent of GDP in 1981 to 54 percent in 1990,

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and then climbed dramatically to 186 percent of GDP by 1999. The sharp, sustained rise in stock market values helped assuage some of the concerns about the adequacy of saving. By 2002, however, equity values had fallen to 96 percent of GDP.

This paper examines the adequacy of households' saving for retirement and makes two contributions relative to the previous literature.[1] First, using data from the 2001 Survey of Consumer Finances, we update previous work and provide more recent evidence on how well households are preparing for retirement. In contrast, most previous work uses data that is now 10 years old or older. The use of more recent data is particularly useful in light of the significant changes in the composition and level of wealth accumulation in the 1990s.

To determine whether households are saving adequately, we compare actual wealth accumulation to saving patterns generated by a stochastic life-cycle model that explicitly recognizes precautionary savings due to uncertain earnings and mortality. The incorporation of uncertainty has an important impact on the interpretation of data on wealth accumulation, since optimal wealth accumulation patterns will vary widely across households depending on the household-specific path of earnings realizations.

Our second contribution relative to other work is to examine explicitly the role of stock market fluctuations in determining the adequacy of households' financial preparation for retirement. Despite the common, popular connection between these items, there has been no systematic analysis linking these two issues. Although it may seem obvious that increases in the stock market help people save more for retirement, the interactions may be more complex. First, households may choose to consume a significant amount of increases in equity values before retirement, rather than in retirement. Second, they may choose to retire earlier. Third, variations in equity values may be correlated with changes in the value of real estate and interest-bearing assets that could offset or amplify the effects on retirement wealth. Finally, even if none of the offsets described above occur, to the extent that stock holdings are concentrated among households that are extremely wealthy, variations in equity values will have little effect on how well the vast majority of households are faring with respect to retirement saving.

Our central findings are contrary to what might be considered the common view in two ways. First, despite the concerns noted above, we find that many and perhaps most households appear to be saving adequate amounts for retirement. Second, despite the popular linking of equity values and retirement saving, we find almost no link between stock values and variations in the overall level or distribution of adequate saving for retirement. We derive conclusions regarding the stock market in two ways. First, we show that a simulated 40 percent decline in stock values—roughly the decline of broad market indices from their peak in 1999 to their trough in 2002—has little effect on the observed adequacy of saving. Second, we show that the massive run-up in equity values over the 1980s and 1990s does not correlate well with historical variation in a rough measure of the adequacy of saving.

[1]For reviews of the literature, see Engen *et al*. (1999) and Congressional Budget Office (2003). Scholz *et al*. (2003) provide an important, recent analysis.

The main reason equity price fluctuations have such a small effect on the observed adequacy of saving is that most households who hold stocks have significant amounts of other wealth and thus are deemed to be saving adequately even if stock values fall. Despite the large increase over time in the share of households that hold some equities, the vast majority of American households hold very little equity or none at all, so that even substantial variation in equity prices has little direct effect on the wealth of most American households. These findings, however, do not speak to the issues of whether variation in aggregate equity values is an important factor in overall economic performance or aggregate capital accumulation.

Sections 1 and 2 describe the underlying simulation model and the data we employ. Section 3 updates our earlier analysis of the adequacy of saving to incorporate data from 2001. The following two sections provide information on the growth of equity values and ownership over the past 20 years, and analyze the effects of equity values on the adequacy of saving. Section 6 concludes.

1. A Stochastic Model of Optimal Saving

1.1. *Description*[2]

Households enter the model with two adults aged 21. One child is added at age 25 and a second at age 28. Each child leaves the home at age 21. Families are not linked across generations. Each adult faces an age-varying probability of dying, with a maximum life span of 110 years. Each year, the assets of those who die are bequeathed to members of the generation that is then 45 years old. The bequests are distributed in accordance with the wealth distribution of the 45-year-olds, thus capturing the empirically established tendency of wealthier households to receive larger inheritances. The inheritance is assumed to be unanticipated.

In each period, forward-looking households maximize expected lifetime utility by choosing total consumption (consumption per capita times the number of people in the household) and total saving subject to a lifetime budget constraint, nonnegativity constraints on net assets, income and payroll taxes, and uncertainty regarding future earnings, life span, and inheritances. There are no markets for insurance against these uncertainties. Because there is a positive probability of death at each age, borrowing against future income and inheritances is not permitted.

Utility is separable over time, and separable within a time period between consumption and leisure. The utility function for consumption exhibits constant relative risk aversion, a constant intertemporal elasticity of substitution, and constant prudence, which implies that risky income and uncertain life spans lead to precautionary saving. Thus, households save for retirement and as a precaution against downturns in future income and the possibility of outliving assets once retired. There is no explicit saving for college in the model.[3] Note also that the

[2]Engen *et al*. (1999) provide a complete description of the model and citations to related literature.

[3]As a result, the model may understate optimal saving—that is, a comparison of data and the model may overstate the extent to which households are saving optimally. The effects of this omission would most clearly fall on households with children, and most likely on households with educated adults, who are more likely to send their own children to college. We discuss this issue in the empirical analysis below.

model assumes that households in the model are optimizing relative to current-law social security benefits, even though the current system is not sustainable. In Engen *et al*. (2004) we address social security changes and how they would affect the adequacy of retirement saving.

Before retirement, consumption may be financed by labor earnings, decumulations of previously accumulated assets, or inheritances received. After retirement, consumption is financed by assets accumulated earlier, which are fully taxable, and by annuity income from social security and private DB pensions. The determination of adequate saving therefore accounts explicitly for projected income from public and private defined benefit plans. Balances in private defined contribution plans are counted as part of accumulating wealth.

Labor supply is exogenous and retirement occurs at a predetermined age. Household earnings are modeled as the sum of a stochastic component and a non-stochastic component. The latter follows a hump-shaped pattern with respect to age and varies by education class.

We use a numerical solution method to solve households' consumption-saving problem. Earnings shocks over the life cycle are simulated with a random number generator for each of 10,000 households. Because households receive different earnings shocks, they end up with different realized income, consumption, saving, and wealth.

The model requires specification of numerous parameter values. Conditional survival probabilities for males and females are based on estimates from the life tables for 1994 used by the U.S. Social Security Administration (1997). We assume that retirement occurs at age 62.

To estimate the mean age-earnings profile, we use panel data on earnings of employed heads of households and their spouses from the Panel Survey of Income Dynamics, conducted by the University of Michigan's Institute for Social Research, from 1980 to 1992. We exclude the self-employed and households where the head is over 65 years old. We estimate a fixed-effects model with log earnings as a function of age, age squared, and year dummies to control for macroeconomic effects, with separate equations for household heads with 16 or more years of education and those with less education. Earnings for the group with more education are always higher, rise and fall more steeply, and peak at later ages than for the group with less education. In addition, the wages of all age groups are assumed to rise by 1 percent per year to reflect aggregate growth in the economy.

To measure the variability in current earnings, we use data from the Internal Revenue Service–Michigan tax panel to estimate the stochastic process for the logarithm of earnings variations (Engen, 1993a, 1993b). Measurement error is less of a problem with earnings data collected from Internal Revenue Service W-2 forms filed with income tax returns, because wages are directly reported by employers. Based on that analysis, we model labor earnings shocks as a first-order autoregressive process with a persistence parameter of 0.85 and a variance of 0.05. Under this specification, about half of a given shock to earnings remains after five years.

We impose a progressive income tax, similar to the U.S. system in 1998, with statutory marginal rates of 15 percent, 28 percent, 31 percent, 36 percent, and 39.6 percent. The taxable income brackets, in dollars, are those effective in 1998 for

joint tax filers. Households are allowed a standard deduction of $7,100 and an exemption of $2,650 for each person. To capture in a simple way the effect of preferential capital gains tax rates and tax-preferred saving vehicles, tax rates on capital income are capped at 20 percent. The payroll tax is imposed at a 6.2 percent rate—the employee share—up to the 1998 earnings limit of $68,400.

We assume each household receives income from social security and defined benefit plans based on features of the average age-earnings profile of its education class, not on its individual wage profile.[4] For example, among households without a pension, social security is assumed to replace 35 percent of average final earnings for those with less than sixteen years of education, and 21 percent of average final earnings for those with sixteen years or more of education. For households with both pensions and social security, the replacement rates of the two combined are 64 percent and 57 percent of final earnings for the two education groups, respectively.[5] Real private DB pension benefits are assumed to decline by 1 percent per year.[6]

The real after-tax rate of return is set at 3 percent, an average of the historical real risk-free rate of return and a mix of all returns (the average tax rate on capital income is used here).[7]

Specifying the underlying preference parameters—the intertemporal elasticity of substitution (or risk aversion, given the functional form) and the pure rate of time preference—is difficult but crucial. The goal of the model is to describe optimal (and, implicitly, time-consistent) behavior, rather than actual behavior. As a result, choosing these values so that the model is well calibrated with actual household wealth data, or using estimates of these parameters from previous empirical studies that exploit data on actual consumption choices, would inappropriately impose the assumption that households' actual behavior was optimal. Likewise, basing the choice on values used in other simulation models would also be misleading, since most of these models aim to explain actual behavior. Thus, we turn to other sources of information or evidence on optimal behavior.

In particular, we set the time preference rate at 3 percent and the intertemporal elasticity of substitution (or the inverse of the coefficient of relative risk aversion) at 0.33. If the time preference rate were not set at the real after-tax, risk-free

[4]In Engen *et al*. (1999), we run sensitivity analysis with the replacement rate applying only to the final year's actual salary, rather than on the mean age-earnings profile given education. This generates significantly more uncertainty and hence higher optimal precautionary saving levels.

[5]These replacement rates are consistent with or somewhat lower than those in Carroll (1997), Hubbard *et al*. (1995), Laibson *et al*. (1998), and Scholz *et al*. (2003). The data generating these replacement rates are discussed in Engen *et al*. (1999, Appendix B). In practice, raising or lowering the defined benefit replacement rates by 20 percent (not percentage points) has minor effects on the results.

[6]The SCF contains information on coverage and expected benefits from defined benefit plans. We use the coverage data, but not the expected benefits data, because of concerns regarding discrepancies that have arisen between the self-reported data and the employer-reported data (see Engen *et al*., 1999).

[7]If the model had a safe asset and risky assets, the Euler equation for optimal consumption growth would be determined by the return on the safe asset, and the overall return on saving would be a weighted average of these assets. The real return on short-term Treasury bills has averaged about 1 percent historically. Longer-term government and corporate bonds have yielded about 2 percent in real terms, and the equity market about 9 percent in the postwar period. A market-weighted basket of these returns gives a real pre-tax return of about 5 percent.

TABLE 1

MEDIAN SIMULATED WEALTH-EARNINGS RATIOS BY AGE, EDUCATION, AND PENSION STATUS

	Education <16 years		Education ≥16 years	
Age	No Pension	Pension	No Pension	Pension
30–34	0.25	0.23	0.06	0.06
35–39	0.56	0.46	0.20	0.14
40–44	1.08	0.83	0.62	0.35
45–49	1.84	1.36	1.39	0.78
50–54	2.70	1.97	2.4	1.39
55–59	3.76	2.66	3.67	2.19
60–62	4.74	3.28	4.91	2.92

Source: Authors' calculations.

interest rate (3 percent in our model, as noted above), consumers would find it in their interest to continue to borrow or lend until the two items were equated.[8] The specification of the intertemporal elasticity of substitution is consistent with results in Barsky *et al*. (1997), which asks people to rate the desirability of different hypothetical consumption profiles or payoffs and uses the results to calculate the implied preference parameters. This specification is thus consistent with people's preferences, but is not based on their actual behavior, and hence avoids the bias that would arise from assuming that actual behavior is optimal.

1.2. *Optimal Saving*

The model implicitly defines a household to be saving adequately if it is accumulating enough wealth to be able to smooth its marginal utility of consumption over time in accordance with the optimizing model of consumption described above.

We report simulation and empirical results in terms of the ratio of current wealth to current earnings.[9] Optimal wealth-earnings ratios will evolve differently for different households for two reasons: first, differences in education affect the shape and average level of the age-earnings profile and differences in pension coverage affect retirement income; second, households receive different earnings shocks over time and at a given point in time.

Table 1 reports median optimal wealth-earnings ratios, incorporating the effects of uncertainty over earnings and lifespan, for households classified by age, education, and pension status. Optimal wealth-earnings ratios rise over the life cycle. Controlling for education, households with pensions have lower optimal wealth-earnings ratios than those without, because pensions provide retirement

[8]In Engen *et al*. (1999), we also report results with a time preference rate of zero. Using this time preference rate in the current study would reduce the reported adequacy of saving but have little impact on how that reported level varies with respect to stock market fluctuations.

[9]Despite our reporting the results this way, our model should not be confused with a "buffer stock" or target saving model (see Carroll, 1992). In our model, as already noted, households save both for retirement and as a precaution against uncertain income and life span. The model generates consumption-age profiles that rise, peak in the mid-50s, and then decline, controlling for family size. In the presence of precautionary saving due to uncertain earnings, the shape of the consumption-age profile is much less sensitive to the difference between the time preference rate and the after-tax rate of return than it would be in the absence of precautionary saving.

TABLE 2

DISTRIBUTION OF SIMULATED WEALTH-EARNINGS RATIOS BY AGE AMONG HOUSEHOLDS WITH SIXTEEN OR MORE YEARS OF EDUCATION AND WITH PRIVATE PENSIONS

Age	5th Percentile	25th Percentile	Median	75th Percentile	95th Percentile
30–34	0.00	0.02	0.06	0.17	0.52
35–39	0.01	0.04	0.14	0.39	1.02
40–44	0.01	0.11	0.35	0.81	1.82
45–49	0.04	0.31	0.78	1.48	2.94
50–54	0.12	0.69	1.39	2.35	4.15
55–59	0.29	1.22	2.19	3.41	5.77
60–62	0.37	1.68	2.92	4.35	7.05

Source: Authors' calculations.

income. Controlling for pension status, college graduates have lower optimal wealth-earnings ratios when young and almost equal or higher ratios when old than do other households, owing to steeper age-earnings profiles among college graduates.

Because of the existence of earnings shocks in prior periods, households that are observationally equivalent in the data—that is, that are identical with respect to age, current earnings, family size, life expectancy, education, and pension status—will have different optimal wealth-earnings ratios. Table 2 shows the importance of heterogeneous earnings shocks in generating a *distribution* of optimal wealth-earnings ratios. The table focuses on college graduates with pensions, but similar results occur for other groups (Engen *et al.*, 1999). Optimal wealth-earnings ratios among 35–39 year olds vary by a factor of 100, from 0.01 at the 5th percentile to 1.02 at the 95th percentile. Among 60–62 year olds, optimal wealth-earnings ratios vary by a factor of almost 20.

Notably, these observed ratios represent households' *optimal* responses to the pattern of earnings shocks they receive. The low wealth accumulation exhibited by a significant minority of households in the simulation model is consistent with optimizing behavior and in no way implies a retirement saving shortfall owing to myopia, irrationality, or poor information.

2. DATA ISSUES

We use data from the 1983, 1989, 1992, 1995, 1998, and 2001 Surveys of Consumer Finances (SCFs). The SCF is undertaken by the Federal Reserve Board with the cooperation of the Department of the Treasury. The survey oversamples high-income households and is designed to provide detailed information on family balance sheets, pension status, income, and demographics. We use data for married households where the husband is between the ages of 25 and 62 and works at least twenty hours per week.[10] This generates sample sizes between 1,300 and 1,900 in

[10]Focusing on married households allows for comparisons with our earlier work. Focusing on full-time workers is needed to obtain meaningful wealth-earnings ratios. The sample of married couples with a husband working full-time has higher wealth and income, but not more education, than other SCF respondents in the same age groups.

each year.[11] All of our results are weighted in accordance with a nationally representative population. It is worth keeping in mind throughout the discussion of the empirical results that some of the sample sizes are small. Appendix Table A1 reports sample size by age, education, and pension status for the 2001 sample.

Because the simulation model accounts for precautionary and retirement saving, the empirical wealth measure needs to be broad enough to account for both. We define three measures of wealth. We define broad wealth as all net worth other than equity in vehicles. Specifically, broad wealth is the sum of equity in the primary residence, other real estate equity, equity in businesses, and net financial assets. Net financial assets include the sum of balances in DC plans, 401(k) plans, Individual Retirement Accounts, Keogh plans and non-tax-advantaged financial assets, less consumer debt. Narrow wealth is broad wealth less all equity in the primary residence. Intermediate wealth is broad wealth less half of equity in the primary residence.

As discussed in Engen *et al*. (1999), we believe it is appropriate to include housing equity in retirement saving calculations. It may not be appropriate to include every dollar of equity, however, since liquidating housing wealth through sale or reverse mortgages imposes some transactions costs. These costs are likely to be much less than half of housing wealth, though, so we believe that our intermediate wealth measures generate reasonable and probably conservative empirical results. Nevertheless, we present many results for all three wealth measures, which together bound all the possible options for including housing equity.

Households in which at least one adult has a DB pension from his or her current job are assumed to receive pension benefits, and their wealth, excluding DB pensions and social security, is compared with the simulation benchmarks developed above for households with pension coverage. In effect, this treatment provides each household that has a DB pension from the current job with average DB pension benefits, conditional on education status, as shown in Table 1.[12]

Focusing the sample on married couples where the husband is still a full-time worker may somewhat bias the sample over time, since wealthier households may retire earlier. As reported in Engen *et al*. (1999), this may affect the observations for 61- and 62-year olds, but is less likely to have a significant effect on younger age groups.

3. Recent Evidence on the Adequacy of Saving

Most previous studies are based on data that is now at least a decade old. Our own previous results in Engen *et al*. (1999) extend only through 1995. But as noted above the latter half of the 1990s saw significant changes in the level and composition of wealth and in other factors, so examination of more recent trends

[11]For discussions of the SCF, see Aizcorbe *et al*. (2003), Avery *et al*. (1984a, 1984b), Avery and Elliehausen (1986), Kennickell and Shack-Marquez (1992), Kennickell and Starr-McCluer (1994), Kennickell *et al*. (1997), and Kennickell *et al*. (2000). We use the first replicate of each observation in the SCF. The results are not sensitive to whether a particular replicate or all replicates are used.

[12]We somewhat underestimate DB pension coverage for SCF households because households with DB plans from prior jobs but not on the current job are treated as not having DB plan coverage.

should provide useful information. This section updates our earlier estimates of the adequacy of saving to include analysis of data from the 2001 SCF.

For a household with a given set of observable characteristics, the simulation model generates a distribution of optimal wealth-earnings ratios, rather than a single optimal level. This implies that we cannot determine precisely the optimal wealth-earnings ratio for any particular household. Instead, we compare the distributions of observed and simulated wealth-earnings data for households with a given set of characteristics: marital status, age, lifetime earnings, education, and pension status. Thus, we focus mainly on two issues: determining the proportion of households whose wealth-earnings ratios exceed the median simulated wealth-earnings ratio for households with the same characteristics; and comparing wealth-earnings ratios at different percentiles of the actual and simulated distributions for households with a given set of characteristics. Both approaches provide valuable information, but neither permits us to identify which particular households are saving adequately or inadequately.[13]

3.1. *Median Wealth-Earnings Ratios*

Table 3 reports the results of comparing, for each married couple in the 2001 SCF where the husband works full-time and is between ages 25 and 62, the couple's *actual* wealth-earnings ratio and the *median* of the distribution of wealth-earnings ratios from the simulations *for households with the same observable characteristics*. For the full sample, the table shows that 61 percent of households have actual ratios of intermediate wealth to earnings that exceed the median simulated wealth-earnings ratio for households with the same observable characteristics.

The *interpretation* of this result depends on the fact that the saving benchmark is derived from a stochastic rather than a nonstochastic model. In a nonstochastic model, all households of the same marital status, age, earnings patterns, education, and pension status would be assigned the same optimal wealth-earnings ratio, and the finding above would be interpreted as showing that 61 percent of households exceed the optimal ratio. That would mean that 39 percent of households fall short of their assigned optimal wealth-earnings ratio. This would (perhaps erroneously) suggest that a significant portion of the population is undersaving.

In contrast, once it is recognized that households face uncertainty about their future earnings, it is appropriate to use a stochastic model as the benchmark. This in turn implies that a household that was saving exactly the optimal amount given its earnings history and observable characteristics would have only a 50 percent chance of exceeding the median optimal wealth-earnings ratio *for households with the same observable characteristics*. Put differently, if every household were saving exactly the optimal amount given its current observable characteristics and history of earnings shocks, then only 50 percent of households would have actual wealth-earnings ratios above the median simulated optimal wealth-earnings for households with those characteristics. Thus, the same fact—that 61 percent of actual households exceed the simulated median for households with a given set of char-

[13]As discussed below, Scholz *et al*. (2003) develop a stochastic model that estimates optimal wealth measures on a household-by-household basis.

TABLE 3

PERCENT OF HOUSEHOLDS AT OR ABOVE MEDIAN SIMULATED WEALTH-EARNINGS RATIO, 2001

Sample	Narrow Wealth	Intermediate Wealth	Broad Wealth
Full sample	52.3	61.0	68.8
Households with pension coverage			
All	57.7	66.5	76.3
With 4 or more years of college	78.0	83.6	88.4
With less than 4 years of college	41.4	52.9	66.6
Households without pension coverage			
All	49.7	58.4	65.3
With 4 or more years of college	71.0	76.8	81.9
With less than 4 years of college	39.0	49.1	56.9
All households with 4 or more years of college	73.7	79.4	84.4
All households with less than 4 years of college	39.6	50.1	59.6
Age			
25–29	54.9	66.1	70.3
30–34	59.7	68.9	72.8
35–39	62.4	71.2	73.0
40–44	53.6	63.4	71.4
45–49	49.7	58.8	71.5
50–54	44.0	49.6	61.6
55–59	43.2	49.0	60.3
60–62	33.5	45.3	55.9
Earnings (in $000's)			
0–10	49.6	57.9	65.6
10–20	21.9	36.7	44.9
20–30	34.5	43.9	51.3
30–40	35.2	44.7	50.0
40–50	40.6	49.5	60.4
50–75	47.6	59.5	67.8
75+	68.0	73.9	81.4

Source: Authors' calculations using the 2001 Survey of Consumer Finances.

acteristics—instead suggests adequate, indeed somewhat more than adequate, amounts of wealth accumulation relative to the benchmark at the median of the distribution, controlling for households' observable characteristics.

Table 3 also shows that the treatment of housing wealth can have significant effects on the results, with 52 percent and 69 percent of households having wealth-earnings ratios that exceed the median simulated ratio (given observable characteristics) when housing is entirely excluded or entirely included, respectively. We emphasize that all of these results should be compared against a benchmark expectation that even if everyone were behaving optimally only 50 percent of households would exceed the median wealth-earnings ratios for households that had the same observable characteristics.

The table shows several other interesting results as well. Controlling for education, having a pension is associated with an increase of about 7 percentage points in the proportion of households that exceed the median target wealth-earnings ratio. Controlling for defined benefit pension coverage, having more education is associated with an increase of between 22 and 31 percentage points in the likelihood of exceeding the simulated median wealth-earnings ratio. These qualitative

results are consistent with those of numerous previous studies.[14] As with previous studies of the adequacy of saving, we do not determine whether the results are due to the direct effects of pensions and education or to unobserved characteristics that affect household saving and are correlated with pension coverage and education.

The proportion of households whose wealth exceeds the optimal median target (holding current characteristics constant) falls somewhat as age rises, and rises sharply as income rises (other than the group with income below $10,000, a group which may be unrepresentative since the sample is intended to be full-time workers). This suggests that high-earnings households may have some important difference in tastes or opportunities for saving compared with others.[15] These are similar to patterns found in the 1992 SCF in Engen *et al*. (1999).

Appendix Table A2 reports related results. Households who are more likely to be saving more than the median benchmark include those who: have children;[16] are in better health;[17] are saving for retirement or education; are willing to take more financial risks; have good saving habits; and/or spent less than they consumed in the past year.

3.2. *Distribution of Wealth-Earnings Ratios*

Table 4 provides evidence on the distribution of wealth-earnings ratios. The top panel reports data from the 2001 SCF using the narrow wealth measure. The bottom panel provides simulated wealth-earnings ratios from the model, where the number of households in the model is weighted so that the distribution of households across education levels and pension status (in each age group) is the same in the SCF and the model.

The median wealth-earnings ratio in the data exceeds the median in the simulation for intermediate and broad wealth measures. In addition, the model *underestimates* wealth-earnings ratios at the high end of the distribution. That is, there is a significant amount of real-world wealth accumulation that the model does not include. This may not be particularly surprising because the model does not include bequest motives or the possibility of receiving a very high rate of return on an entrepreneurial investment.

At the 25th percentile and lower, however, the empirical wealth-earnings ratio is below that of the simulated distribution and the difference is especially large at the 5th percentile. This is consistent with a significant amount of undersaving relative to the benchmark at the low end of the wealth distribution. It is also

[14]See Banks *et al*. (1998); Bernheim (1992); Bernheim and Scholz (1993); Gale (1997); Kotlikoff *et al*. (1982); Mitchell *et al*. (1998); Moore and Mitchell (1997); Robb and Burbidge (1989); Warshawsky and Ameriks (1998).

[15]For further evidence on how saving rates vary by income, see Carroll (2000); Dynan *et al*. (2004); Engen *et al*. (1999, 2004); Gentry and Hubbard (1998); Scholz *et al*. (2003).

[16]The results for families with children are consistent with the view that saving for college is an important factor in wealth accumulation (see also Appendix Table A2). For further analysis of the differential saving choices of adults with and without children, see Hurd (1987), Browning and Ejrnaes (2002) and the references therein.

[17]See Rosen and Wu (2004) and Smith (2004) for studies of the relation between health and wealth.

TABLE 4

WEIGHTED DISTRIBUTION OF WEALTH-EARNINGS RATIOS, 2001

Age	5th Percentile	25th Percentile	Median	75th Percentile	95th Percentile
2001 SCF data					
Narrow wealth					
51–54	0.00	0.44	1.73	4.56	15.29
55–59	–0.02	0.70	2.61	5.35	20.00
60–61	0.37	1.10	2.77	7.53	20.71
Intermediate wealth					
51–54	0.08	0.97	2.36	5.45	15.64
55–59	0.00	1.10	3.12	6.44	21.50
60–61	0.92	1.52	4.22	11.85	38.68
Broad wealth					
51–54	0.08	1.37	2.89	6.18	17.02
55–59	0.00	1.49	3.66	7.84	25.94
60–61	1.10	1.90	5.17	14.13	70.11
Simulation					
51–54	0.42	1.37	2.30	3.50	5.75
55–59	0.69	1.97	3.13	4.58	7.24
60–61	1.08	2.50	3.85	5.46	8.33

Source: Authors' calculations.

consistent, however, with other explanations that the model does not take into account. For example, the model does not include a government-provided consumption floor (Hubbard *et al*., 1995; Scholz *et al*., 2003) and does not incorporate individual household-level earnings histories (Scholz *et al*., 2003).

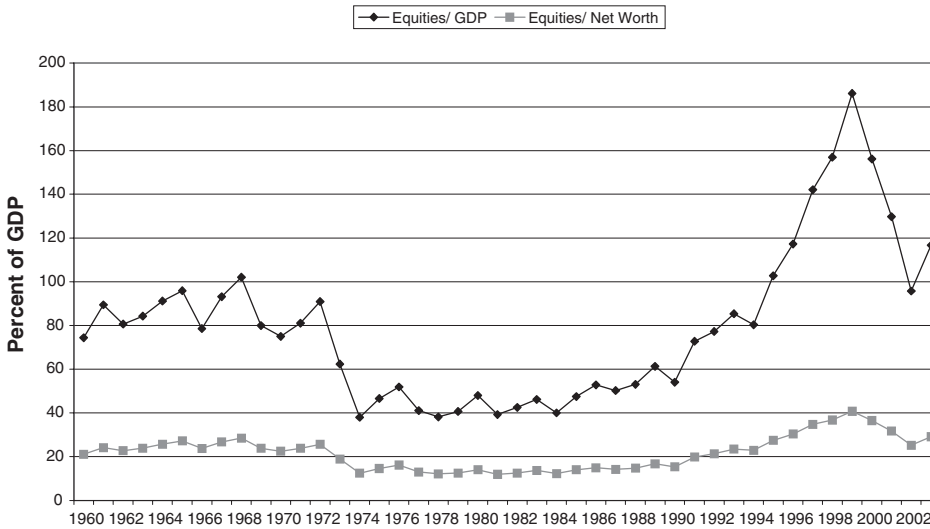
4. THE GROWTH AND DISTRIBUTION OF EQUITIES

We now turn to examination of the role of the stock market in the adequacy of saving. This section provides background on the evolution of equity values and the diffusion of equity ownership. The next section provides tests of the impact of these changes on the adequacy of wealth.

Figure 1 shows the ratio of equity values to GDP and to overall net worth annually since 1960. After peaking at about 100 percent of GDP in the late 1960s, the stock market declined sharply to 38 percent of GDP in 1974 and then remained at about 50 percent or less of GDP for almost a decade. It rose to 60 percent of GDP in the late 1980s, and 85 percent of GDP by 1993 before skyrocketing to more than 185 percent of GDP in 1999. Aggregate equity values then fell sharply to less than 100 percent of GDP in 2002 before rising in 2003.

The general rise in equity values over the past 20 years coincided with a gradual and significant increase in the share of households holding equities.[18] Nevertheless, even by 2001, equity holdings were concentrated among a minority of older, wealthier households. As shown in Table 5, in the sample we employ, 83

[18]Poterba and Samwick (1995) provide detailed information on these trends. See also Aizcorbe *et al*. (2003), Avery *et al*. (1984a, 1984b), Avery and Elliehausen (1986), Kennickell and Shack-Marquez (1992), Kennickell and Starr-McCluer (1994), Kennickell *et al*. (1997), and Kennickell *et al*. (2000).



Aggregate net worth from Flow of Funds Accounts, Historical tables, Table B100, line 43.
Total value of equities from Flow of Funds Accounts, Historical Tables, Table B100e, line 6.
Gross domestic product from the Economic Report of the President, February 2004.

Figure 1. Equities as a Fraction of Net Worth and GDP

TABLE 5

EQUITY HOLDINGS BY AGE GROUP AND QUINTILE OF BROAD WEALTH, 2001

Quintile	Lowest	Second	Middle	Fourth	Highest	All
			Percent of total			
Age group						
25–34	0.13	0.44	1.11	1.82	2.66	6.17
35–44	0.14	0.52	1.73	4.42	14.98	21.75
45–54	0.01	0.31	0.76	3.54	40.89	45.58
55–62	0.00	0.09	0.22	1.91	24.35	26.53
All	0.28	1.36	3.82	11.65	82.93	100.00
			Median equity holdings (among households with equities)			
Age group						
25–34	2,900	6,500	28,000	55,000	228,000	10,000
35–44	3,000	6,000	28,500	65,500	205,000	32,000
45–54	1,200	8,500	13,000	60,000	315,100	61,500
55–62	2,000	14,000	13,000	59,500	259,500	80,700
All	2,700	6,500	20,000	62,000	260,000	34,000
			Mean equity holdings (among households with equities)			
Age group						
25–34	3,916	11,504	35,634	96,502	535,575	48,906
35–44	7,475	12,095	36,680	79,647	367,319	106,141
45–54	3,282	14,128	22,400	73,346	592,320	257,770
55–62	2,693	20,654	17,450	82,987	742,971	357,705
All	5,001	12,636	30,621	80,270	561,820	171,893

Source: Authors' calculations using the 2001 Survey of Consumer Finances.

percent of equities are held by households in the highest wealth quintile and another 12 percent are held by the second highest quintile.

The second panel of Table 5 shows median equity holdings among households that hold equities. In the bottom three quintiles, the median equity holdings are quite small. One way to gauge the magnitude of stock holdings is to examine the effect on retirement income of a 40 percent decline in equity values. In the second quintile, for example, the median equity holding is $6,500. A 40 percent decline would reduce this to $3,900. At an annuity rate of 7 percent, the resulting decline in retirement income would be less than $200 per year. The third panel shows mean equity holdings among households with equities. Again, the figures are small for the bottom three quintiles.

Table 5 thus provides the essential intuition for the more formal results in the subsequent section. Because most stocks are held by households with substantial wealth, and most households hold very little equity, fluctuations in stock market values can affect aggregate wealth, yet have little effect on households' ability to save adequately for retirement. Consistent with this interpretation, 91 (96) percent of all equities in the sample are held by households whose narrow (broad) measure of wealth exceeds the median optimal wealth-earnings ratio for households with the same observable characteristics.

5. Effects of Stock Market Fluctuations on the Adequacy of Saving

We present two sets of tests of the impact of the stock market on the adequacy of wealth accumulation. The first test uses the 2001 data and simulates the effects of a stock market decline of 40 percent. To the extent that stock market fluctuations affect the adequacy of saving, the relation between actual wealth-earnings ratios and simulated optimal ratios should be altered significantly. The second test examines how the adequacy of saving has changed over time. As noted above, equity values soared dramatically, rising by 140 percent of GDP between 1983 and 1999. While many factors affect the adequacy of wealth accumulation, a wealth shock of this magnitude could reasonably be expected to influence the observed adequacy of saving if stock market fluctuations do have a significant effect on the adequacy of saving. In neither case do we find a significant impact of stock market fluctuations on the adequacy of saving.

5.1. *Simulating a Stock Market Decline*

Table 6 examines the effects of simulated stock market declines on the share of households whose actual wealth would exceed the median optimal wealth-earnings ratios, controlling for observable characteristics. We simulate a stock market decline by assuming that all equities, including those in retirement accounts, fall in value by 40 percent. Because equity values account for one-fourth of total wealth in the sample, a 40 percent decline in stocks represents a 10 reduction in overall wealth (holding other wealth constant, an issue we discuss further below).

Table 6 shows that even a decline of this magnitude has a negligible impact on the aggregate share of households whose wealth-earnings ratios exceed the median target. Using narrow, intermediate, and broad wealth, the share of house-

TABLE 6

PERCENT OF HOUSEHOLDS AT OR ABOVE MEDIAN SIMULATED WEALTH-EARNINGS RATIO, 2001

Sample	All Stocks Down by 40%			Change from Baseline		
	Narrow Wealth	Intermediate Wealth	Broad Wealth	Narrow Wealth	Intermediate Wealth	Broad Wealth
Full sample	48.6	58.8	66.6	–3.6	–2.2	–2.2
Households with pension coverage						
All	52.7	64.1	73.4	–5.0	–2.5	–2.9
With 4 or more years of college	71.4	82.1	87.4	–6.5	–1.5	–1.0
With less than 4 years of college	37.6	49.6	62.2	–3.8	–3.3	–4.4
Households without pension coverage						
All	46.7	56.4	63.4	–3.0	–2.0	–1.9
With 4 or more years of college	68.1	74.1	80.1	–2.9	–2.7	–1.9
With less than 4 years of college	35.9	47.4	54.9	–3.0	–1.6	–2.0
All households with 4 or more years of college	69.4	77.1	82.9	–4.3	–2.3	–1.5
All households with less than 4 years of college	36.4	48.0	57.0	–3.2	–2.1	–2.7
Age						
25–29	52.2	66.1	69.6	–2.7	0.0	–0.7
30–34	59.1	68.3	72.0	–0.6	–0.6	–0.7
35–39	59.1	70.8	72.6	–3.4	–0.4	–0.4
40–44	49.9	60.7	68.8	–3.7	–2.6	–2.5
45–49	46.3	55.7	67.7	–3.5	–3.1	–3.8
50–54	38.4	46.7	57.3	–5.6	–2.9	–4.3
55–59	35.9	44.5	59.2	–7.3	–4.5	–1.1
60–62	30.8	39.4	49.9	–2.7	–5.8	–6.0
Earnings (in $000's)						
0–10	49.6	57.9	65.6	0.0	0.0	0.0
10–20	21.9	36.7	44.9	0.0	0.0	0.0
20–30	34.5	43.9	51.3	0.0	0.0	0.0
30–40	35.2	43.9	49.1	0.0	–0.8	–0.9
40–50	37.4	48.0	57.1	–3.1	–1.5	–3.3
50–75	44.7	58.0	65.3	–2.9	–1.5	–2.4
75+	61.8	70.2	78.5	–6.2	–3.7	–2.9

Source: Authors' calculations using the 2001 Survey of Consumer Finances.

holds whose wealth-earnings ratios exceed the median target falls by 3.6, 2.2 and 2.2 percentage points, respectively.

The most likely explanation for the results in Table 6 is simply that despite the growth of the stock market and the growth in the share of households that own stocks, directly or indirectly, stock ownership remains heavily concentrated among households that were already saving more than enough for retirement. This explanation is buttressed by examination of the results in Table 6 for particular demographic groups. Stocks are concentrated among high-income and older households. Thus, for example, a 40 percent decline in the market has no effect on the share of households with income below $30,000 whose wealth exceeds the median target,

given household characteristics. But among households with income above $75,000, the simulated stock market decline reduces the share of households with wealth above the median target by between 3 and 7 percentage points, depending on the wealth measure. Likewise, in almost all cases for households in their 50s and 60s, the simulated decline in stock values reduces the share of households that exceed their median target wealth level by between 3 and 8 percentage points. The same decline in equities has little effect on households below age 40.

Another possible explanation for the small impact of large stock market declines on the share of households whose actual wealth-earnings ratio exceeds the simulated median is that the share is simply not very sensitive to any changes. Table 7, however, shows that in each SCF year between 1992 and 2001, each of the following changes have bigger effects on the measured adequacy of saving than does a 40 percent decline in the stock market: exclusion of business wealth, a 20 percent increase in expected consumption needs (for example, due to medical expenditures) in retirement, or a 10 percent decline in mortality risk.[19] Table 7 also shows that the small aggregate effect of stock market declines on the adequacy of saving is not particularly sensitive to the underlying value of the stock market. In 1992, 1995, and 1998, for example, a 40 percent decline in stock market wealth reduced the share of households with wealth-earnings ratios above the simulated median by between 0.8 and 1.6 percentage points for broad or intermediate wealth. Equity values varied tremendously over this period, however, as discussed above.

5.2. *Effects Over Time*

Table 8 reports the proportion of SCF households whose wealth-earnings ratios exceeded the simulated median ratio over time. The results suggest that stock market fluctuations (as well as other factors that changed over time) raised financial wealth. For example, the proportion of households that exceeded the median simulated wealth-earnings ratio using narrow wealth rose by almost 10 percentage points, from 43 percent in 1983 to more than 52 percent in 2001. This occurred presumably in part because of the large buildup of financial assets in general and stock market values in particular during this period.

But this increase in financial assets did not translate into increases in the adequacy of saving using broader measures of wealth. Using the intermediate wealth measure, the proportion of households who exceeded the median simulated wealth-earnings ratio for households with their characteristics remained within a very narrow range, between 58 percent and 62 percent, in every sample year between 1983 and 2001, and was virtually the same in 1983 and in 2001. Using the broad wealth measure, the comparable share ranged between 66 percent and 71 percent and was actually lower in 2001 than in 1983.

These results indicate that different measures of the adequacy of saving can move in different directions over the same time period. They are also consistent with the view that dramatic changes in equity values have had little effect on broad

[19]In a model that uses lifetime income measures rather than current measures, and thus is not directly comparable to the present study, Engen *et al*. (2004) show that a 30 percent decline in social security benefits has a far greater impact than the stock market decline on the percentage of households exceeding the median optimal wealth target, given observable characteristics.

TABLE 7

SENSITIVITY ANALYSIS: PERCENT OF HOUSEHOLDS AT OR ABOVE SIMULATED WEALTH-EARNINGS RATIO

Case	1992		1995		1998		2001	
	Intermediate Wealth	Broad Wealth	Intermediate Wealth	Broad Wealth	Intermediate Wealth	Broad Wealth	Intermediate Wealth	Broad Wealth
Baseline	59.7	66.4	58.4	66.3	60.8	66.7	61.0	68.8
Sensitivity analysis								
40% decline in the Stock Market	58.2	65.6	56.8	64.8	59.7	65.9	58.8	66.6
Exclude business wealth	56.3	63.9	55.6	64.5	57.6	64.1	57.2	66.0
20% increase in target ratios	55.7	63.4	54.5	61.8	56.3	62.8	56.8	63.3
10% lower mortality risk	53.6	60.6	52.1	59.9	53.2	59.2	55.5	60.8
Difference relative to baseline								
40% decline in the stock market	1.5	0.8	1.6	1.5	1.1	0.8	2.2	2.2
Exclude business wealth	3.4	2.5	2.8	1.8	3.2	2.6	3.8	2.8
20% increase in target ratios	4.0	3.0	3.9	4.5	4.5	3.9	4.2	5.5
10% lower mortality risk	6.1	5.8	6.3	6.4	7.6	7.5	5.5	8.0

Source: Authors' calculations using the 1992, 1995, 1998 and 2001 Surveys of Consumer Finances.

TABLE 8

PERCENT OF SCF HOUSEHOLDS AT OR ABOVE SIMULATED MEDIAN WEALTH-EARNINGS RATIOS, 1983–2001

Sample	Year	Age	Narrow Wealth	Intermediate Wealth	Broad Wealth
All households					
	1983	25–62	42.9	61.7	71.0
	1989	25–62	44.4	62.3	69.3
	1992	25–62	47.0	59.7	66.4
	1995	25–62	46.3	58.4	66.3
	1998	25–62	49.5	60.8	66.7
	2001	25–62	52.3	61.0	68.8
Younger boomer					
(Born 1956–1964)	1983	19–27	–	–	–
	1989	25–33	48.3	63.6	67.0
	1992	28–36	54.5	68.8	71.3
	1995	31–39	53.8	69.1	75.6
	1998	34–42	57.8	66.7	70.7
	2001	37–45	54.9	64.3	70.6
Older boomer					
(Born 1946–1955)	1983	28–37	53.8	72.9	75.9
	1989	34–43	50.3	72.5	78.7
	1992	37–46	44.4	58.6	68.9
	1995	40–49	43.3	55.6	65.1
	1998	43–52	43.9	56.8	64.3
	2001	46–55	47.2	54.4	66.8

Source: Authors' calculations using the 1983, 1989, 1992, 1995, 1998 and 2001 Surveys of Consumer Finances.

measures of the adequacy of saving for retirement. But they should be analyzed with substantial caution. Over time, as underlying wage trajectories, pension and social security replacement rates, family composition, and other factors change, the optimal wealth-earnings ratios should change. Although the direction of such changes is unclear, the existence of changing fundamentals is a reasonable assumption. As a result, comparing data from different years of the SCF to a fixed standard of adequacy is unlikely to give a complete answer. Nevertheless, the stock market grew by 140 percent of GDP over the sample period, and the absence of any significant impact on the adequacy of saving is at least worth noting. At the very least, the results can be seen as providing supporting evidence for the results in Tables 6 and 7.

Table 8 also shows how different cohorts have fared over time relative to their median simulated wealth-earnings ratios. It is worth emphasizing that some of the variation in the age-specific data may be due to relatively small sample sizes. Nevertheless, the data suggest some interesting patterns. Wealth accumulation for younger baby boomers (those born between 1956 and 1964) has improved relative to the simulated medians over the 1989–95 period, as they aged from a range of 25–33 years to between 31 and 39 years. Since 1995, their results have held constant for narrow wealth, but fallen for intermediate and broad wealth. For older boomers (those born between 1946 and 1955), the adequacy of wealth accumulation has declined relatively consistently as the cohort has aged. Even so, the share of such households who exceeded their median simulated wealth-earnings ratio

TABLE 9

WEIGHTED DISTRIBUTION OF WEALTH-EARNINGS RATIOS, 2001; HOUSEHOLDS AGED 51–61

Broad Wealth	5th Percentile	25th Percentile	Median	75th Percentile	95th Percentile
1992	0.07	1.81	3.53	7.57	23.97
1995	–0.03	0.45	1.30	3.07	11.17
1998	0.00	1.81	3.44	7.15	21.97
2001	–0.04	0.61	1.82	4.22	14.23

Source: Authors' calculations using the 1992, 1995, 1998 and 2001 Surveys of Consumer Finances.

was 54 percent for intermediate wealth and 67 percent using broad wealth in 2001. These results show that trends in wealth accumulation can vary significantly across cohorts. To the extent, however, that stock market variations were driving the adequacy of wealth accumulation, one would expect all cohorts to move in the same direction over time.

Table 9 shows the evolution of the distribution of wealth-earnings ratios over time. The key results here are that the wealth-earnings ratio at the 95th percentile of the distribution is smaller in 1995 than in 1992 and is the same in 1998 as in 1992, despite the market being substantially higher in 1995 and especially 1998 than in 1992. Again, the data do not appear to change in conformity with changes in equity values.

6. CONCLUSION

We find that many and perhaps most married couples where the husband is working full-time are saving adequately for retirement and that fluctuations in aggregate stock market values have little impact on the observed adequacy of saving. Our analysis explicitly incorporates uncertainty into the analysis of the adequacy of saving, a departure from most previous work and one that has crucial implications for how empirical patterns are interpreted.

An important caveat to our results is that we compare the *distributions* of observed and simulated wealth outcomes, but can not derive optimal wealth values for individual households. In contrast, Scholz *et al*. (2003) solve for optimal wealth accumulation for each household, using a model that recognizes uncertainty relating to earnings, mortality and health expenditures. In important respects, their results are similar to those reported here and in Engen *et al*. (1999). In particular, they find that most households are saving at least as much as the underlying simulation model indicates is optimal. One difference in results is that in the analysis above, households who undersave appear to be at the low end of the wealth distribution, whereas in Scholz *et al*. (2003), the limited undersaving that occurs (relative to the model's benchmark) is spread throughout the wealth distribution.

A second caveat is that we do not examine the adequacy of saving among singles, widows, or married couples where the husband is unemployed. These groups may have lower rates of wealth accumulation than the sample we examine. As a consequence, our results might not easily be extrapolated to the whole

population. Nevertheless, Scholz *et al*. (2003) do not find significant amounts of undersaving in these groups.

A third caveat has to do with the relation between equity values and other assets. We have analyzed a change in equity values with other asset prices held constant. In many circumstances, though, declining equity prices would be associated with rising interest rates, and hence falling prices for real estate and bonds. In this case, the decline in the stock market would have a larger effect than we have estimated. On the other hand, recent years have seen equity declines accompanied by declines in interest rates and hence increases in housing and bond prices, in which case our results would overstate the impact of declines in equity values. A more complete specification of the general equilibrium determinants of asset prices and the resulting implications for the adequacy of saving are topics left for future research.

Appendix

TABLE A1

Sample Sizes by Age, Education, and Pension Status, 2001

	Education <16 years		Education ≥16 years		
Age	No Pension	Pension	No Pension	Pension	All
25–29	86	10	25	7	128
30–34	85	26	47	18	176
35–39	101	31	74	25	231
40–44	123	49	139	39	350
45–49	103	43	132	56	334
50–54	77	41	112	62	292
55–59	64	22	95	39	220
60–62	33	9	44	7	93
All	672	231	668	253	1,824

Source: Authors' calculations using the 2001 Survey of Consumer Finances.

TABLE A2

PERCENT OF HOUSEHOLDS AT OR ABOVE MEDIAN SIMULATED WEALTH-EARNINGS RATIO: ADDITIONAL RESULTS, 2001

Sample	Sample Size	Narrow Wealth	Intermediate Wealth	Broad Wealth
Full baseline sample	1,824	52.3	61.0	68.8
By children				
With children	1,087	54.3	64.6	71.1
Without children	737	49.3	55.8	65.5
By health status of household head				
Excellent	763	61.5	70.4	74.7
Good	867	51.4	60.4	69.4
Fair	172	32.2	39.1	49.5
Poor	22	21.3	28.9	60.4
By most important reason for saving				
Education	306	54.4	65.6	71.5
Retirement/old age	757	58.8	66.4	74.8
Emergencies	312	45.4	55.7	65.6
By amount of financial risk willing to take				
Substantial	125	78.6	89.5	91.5
Above average	519	65.2	72.9	78.4
Average	782	56.1	64.6	72.1
None	398	30.8	40.3	51.8
By saving habits				
Don't save—spend more than income	54	36.8	43.8	52.5
Don't save—spend as much as income	160	22.0	36.6	45.3
Save whatever is left over—no regular plan	494	44.3	52.7	63.9
Save income of one family member	63	64.2	72.7	78.9
Spend regular income, save other income	148	62.9	66.2	71.2
Save regularly by putting income aside each month	951	63.1	71.0	77.5
Spending relative to income in past year				
Spending exceeded income	231	42.2	53.9	59.9
Spending equaled income	491	40.6	49.7	59.2
Spending was less than income	1,102	62.8	70.4	77.7

Source: Authors' calculations using the 2001 Survey of Consumer Finances.

REFERENCES

Aizcorbe, Ana M., Arthur B. Kennickell, and Kevin B. Moore, "Recent Changes in U.S. Family Finances: Results from the 1998 and 2001 Survey of Consumer Finances," *Federal Reserve Bulletin*, 89(1), 1–32, January 2003.

Avery, Robert B. and Gregory E. Elliehausen, "Financial Characteristics of High-Income Families," *Federal Reserve Bulletin*, 72(3), 163–77, March 1986.

Avery, Robert B., Gregory E. Elliehausen, and Glenn B. Canner, "Survey of Consumer Finances, 1983," *Federal Reserve Bulletin*, 70(9), 679–92, September 1984a.

———, "Survey of Consumer Finances, 1983: A Second Report," *Federal Reserve Bulletin*, 70(12), 857–68, December 1984b.

Banks, James, Richard Blundell, and Sarah Tanner, "Is There a Retirement-Savings Puzzle?" *American Economic Review*, 88(4), 769–88, 1998.

Barsky, Robert B., F. Thomas Juster, Miles S. Kimball, and Matthew D. Shapiro, "Preference Parameters and Behavioral Heterogeneity: An Experimental Approach in the Health and Retirement Study," *Quarterly Journal of Economics*, 112(2), 537–79, May 1997.

Bernheim, B. Douglas, "Is the Baby Boom Generation Preparing Adequately for Retirement? Technical Report," Unpublished paper, Merrill Lynch, New York, September 1992.

Bernheim, B. Douglas and John Karl Scholz, "Private Saving and Public Policy," in James Poterba (ed.), *Tax Policy and the Economy*, Vol. 7, MIT Press, Cambridge and London, 1993.

Browning, Martin and Mette Ejrnaes, "Consumption and Children," Centre for Applied Microeconometrics Working Paper, Institute of Economics, University of Copenhagen, August 2002.

Carroll, Christopher D, "The Buffer-Stock Theory of Saving: Some Macroeconomic Evidence," *Brookings Papers on Economic Activity*, No. 2, 61–135, 1992.
———, "Bugger-Stock Saving and the Life-Cycle/Permanent Income Hypothesis," *Quarterly Journal of Economics*, 112(1), 1–55, February 1997.
———, "Why Do the Rich Save So Much?" in Joel B. Slemrod (ed.), *Does Atlas Shrug? The Economic Consequences of Taxing the Rich*, Harvard University Press, Cambridge, 465–84, 2000.
Congressional Budget Office, "Baby Boomers' Retirement Prospects: An Overview," November 2003.
Dynan, Karen E., Jonathan Skinner, and Stephen P. Zeldes, "Do the Rich Save More?" *Journal of Political Economy*, 112(2), 397–444, April 2004.
Engen, Eric M, "Consumption, Uncertain Lifespan, and Euler Equations: Estimation with Panel Data," Unpublished paper, University of California, Los Angeles, 1993a.
———, "Consumption and Saving in a Life-Cycle Model with Stochastic Earnings and Uncertain Lifespan," Unpublished paper, Federal Reserve Board, Washington, October 1993b.
Engen, Eric M., William G. Gale, and Cori E. Uccello, "The Adequacy of Household Saving," *Brookings Papers on Economic Activity*, No. 2, 65–187, 1999.
———, "Lifetime Earnings, Social Security Benefits, and the Adequacy of Retirement Wealth Accumulation," mimeo, Brookings, 2004.
Gale, William, "Will the Baby Boom Be Ready for Retirement?" *Brookings Review*, 15(3), 4–9, Summer 1997.
Gentry, William M. and R. Glenn Hubbard, "Why do the Wealthy Save so Much? Saving and Investment Decisions of Entrepreneurs," Working Paper, July 1998.
Hubbard, R. Glenn, Jonathan Skinner, and Stephen P. Zeldes, "Precautionary Saving and Social Insurance," *Journal of Political Economy*, 103, 360–99, 1995.
Hurd, Michael D., "Savings of the Elderly and Desired Bequests," *American Economic Review*, 77(3), 298–312, 1987.
Kennickell, Arthur B. and Janice Shack-Marquez, "Changes in Family Finances from 1983 to 1989: Evidence from the Survey of Consumer Finances," *Federal Reserve Bulletin*, 78(1), 1–18, January 1992.
Kennickell, Arthur B. and Martha Starr-McCluer, "Changes in Family Finances from 1989 to 1992: Evidence from the Survey of Consumer Finances," *Federal Reserve Bulletin*, 80(10), 861–82, October 1994.
Kennickell, Arthur B., Martha Starr-McCluer, and Annika E. Sunden, "Family Finances in the U.S.: Recent Evidence from the Survey of Consumer Finances," *Federal Reserve Bulletin*, 83(1), 1–24, January 1997.
Kennickell, Arthur B., Martha Starr-McCluer, and Brian J. Surette, "Recent Changes in U.S. Family Finances: Results from the 1998 Survey of Consumer Finances," *Federal Reserve Bulletin*, 86(1), 1–29, January 2000.
Kotlikoff, Laurence J., Avia Spivak, and Lawrence H. Summers, "The Adequacy of Savings," *American Economic Review*, 72(5), 1056–69, December 1982.
Laibson, David I., Andrea Reppetto, and Jeremy Tobacman, "Self-Control and Saving for Retirement," *Brookings Papers on Economic Activity*, 1, 91–172, 1998.
Mitchell, Olivia, James Moore, and John Phillips, "Explaining Retirement Saving Shortfalls," Pension Research Council, Philadelphia, PA, 1998.
Moore, James F. and Olivia S. Mitchell, "Projected Retirement Wealth and Savings Adequacy in the Health and Retirement Survey," NBER Working Paper 6240, National Bureau of Economic Research, Cambridge, MA, October 1997.
Poterba, James M. and Andrew A. Samwick, "Stock Ownership Patterns, Stock Market Fluctuations, and Consumption," *Brookings Papers on Economic Activity*, No. 2, 295–372, 1995.
Robb, A. L. and J. B. Burbidge, "Consumption, Income, and Retirement," *Canadian Journal of Economics*, 22(3), 522–42, August 1989.
Rosen, Harvey S. and Stephen Wu, "Portfolio Choice and Health Status," *Journal of Financial Economics*, 72(3), 457–84, June 2004.
Scholz, John Karl, Ananth Seshadri, and Surachai Khitatrakun, "Are Americans Saving 'Optimally' for Retirement?" University of Wisconsin, 2003.
Smith, James P., "Unraveling the SES Health Connection," The Institute for Fiscal Studies Working Paper WP04/02, January 2004.
U.S. Social Security Administration, "Social Security Area Population Projections," Actuarial Study 112, Social Security Administration, Office of the Chief Actuary, Baltimore, 1997.
Warshawsky, Mark J. and John Ameriks, "What Does Financial Planning Software Say About Americans' Preparedness for Retirement?" TIAA-CREF Institute, New York, NY, July 1998.