THE RECENT STOCK MARKET FLUCTUATIONS AND RETIREMENT INCOME ADEQUACY

Christian E. Weller
Economic Policy Institute
1660 L Street NW
Washington DC 20036

Abstract

This paper analyzes how the recent stock market boom and bust affected retirement savings adequacy for the average household. The paper also estimates future trends in retirement wealth adequacy using regression based simulations. The findings suggest that for the average household the rapidly growing stock market did not translate into an equally fast increase in retirement wealth. Various factors explain this inelastic response: most household assets are not invested in equities; increases in share prices also translate into more consumption and fewer savings; as assets grew income grew, too; and rising assets and incomes provided more collateral to borrow against. The results of this paper also indicate that there is a chance of greater than 50% that households, on average, will not reach the peak wealth to income ratios observed during early 2000 in the next 30 years. Similarly, there is a greater than 50% chance that the average household will not achieve an adequate ratio of wealth to income in the next 50 years.

Key words: Stock market, retirement savings, retirement income adequacy

I. Introduction

Beginning in March 2000, the stock market fell precipitously. Compared to one year earlier, the S&P500 was down by 23%, the Dow Jones by 10% and the Nasdaq by 60% by March 2001. Household wealth declined substantially alongside stock prices. Households lost 16% of their financial wealth by the end of March 2001 – compared to one year earlier - and 13% of their combined financial and housing wealth – the largest nominal decline since 1952. This was also the period of the sharpest decline in household wealth relative to income since 1952. In fact, the decline in the household wealth to income ratio erased all gains made since March 1997.

As public policy debates focus on the provision of retirement income through individual accounts, either as add-ons to or carve outs of Social Security, the question arises as to what the gyrations of the stock market over the past few years did for the adequacy of retirement savings. The paper looks both at the past few years and estimates likely outcomes for the next 25 years to allow for an assessment of the retirement adequacy for the average household during the boom and bust of the stock market, and likely paths of recovery in retirement savings adequacy in the near to medium term.

The paper's main findings suggest that households, on average, did not reach adequate retirement savings over the past few years, and that their likelihood of reaching adequate retirement savings are relatively low. In particular, average retirement wealth has consistently fallen below reasonable standards for adequate savings. Moreover, it will likely take decades for retirement wealth levels to recover from the effects of the stock market crash of 2000-01. Further, there is a 80-100% chance that

II. The stock market and household wealth

Over the course of one year, household wealth declined dramatically. Direct equity holdings by households, the single largest item in households' portfolio, declined by $3.5 trillion in nominal terms from March 2000 to March 2001, a drop of 37% (BoG, 2001: Table L.100). The vast majority of this decline, $3.2 trillion or 92%, resulted from the decline in prices, whereas the remaining 8% resulted from households selling their shares[1]. Consequently, by March 2001, total household financial assets fell by $4.3 trillion, or 12%, compared to a year earlier, and by 15% in real terms, their largest annual drop since September 1974. However, at the same time that financial assets declined, households increased their debt, such that total household liabilities rose by 7% or $513 billion from March 2000 to March 2001. As a result, household financial wealth – the difference between assets and liabilities – dropped by 17% or $4.9 trillion nominally and by 19% in real terms, its largest decline since 1952. By March 2001, real household financial wealth was once again close to its level of September 1998, thereby erasing all gains made during the stock market run-up in 1999 and 2000.

To gauge the impact of declining wealth on retirement income adequacy, the changes in wealth need to be related somehow to income. While some forms of wealth,

[1] These are calculated from the change in the amount outstanding minus the net purchases of equities.

such as pension wealth, are more obvious forms of retirement wealth, it is important to note that a substantial share of households is not covered by any pension plan. For the average household, all types of financial wealth can and will serve as store of retirement wealth, and are therefore included in this study.

Subsequently, total wealth is related to total income. For the purposes of measuring retirement income adequacy, a household's wealth is set in relation to its average earnings over the working life. As incomes grow, wealth should increase, too, to provide the same level of retirement income adequacy, reflected in a constant wealth to income ratio. This study assumes that age earnings profiles remain constant over time, that the relative share of workers in each age range stays the same and that the share of workers among the total adult population remains in place[2]. Thus, the ratio of average household wealth to average income is just the ratio of the average household's wealth to its average income over its working life adjusted by a constant. By March 2001, financial wealth relative to personal income fell to 281%, the same level as March 1997[3].

The remainder of this study will focus on the average household, rather than the median household. However, most research has shown that retirement wealth is unequally distributed and that the inequality of the distribution of retirement wealth has in fact grown from 1983 to 1998 (Wolff, 2002). Thus, the median households retirement income adequacy is below the average household's retirement adequacy.

III. Retirement saving adequacy in the 1990s

Since the stock market decline came on the heels of extraordinary stock market and wealth growth, it is conceivable that household wealth for the average household rose well above its target value for adequate retirement wealth. In other words, households may have had a substantial wealth buffer built up prior to the stock market and wealth decline, which may have left them still adequately prepared for retirement. To assess this probability, a target wealth to income ratio for the 1990s is estimated and compared to the actual wealth to income ratio.

Several studies have focused on adequate retirement wealth. All studies rely on household data, which provides a glimpse of how well households did at a certain point in time, or over a period in the past. Several studies have used the 1992 wave of the Health and Retirement Survey (HRS) for this purpose. Two general conclusions can be draw. First, on average households seem to fall below a target for adequate savings in 1992. Second, there is a large variance among households, suggesting that a large minority of households accumulated only a small fraction of what is needed for adequate retirement income.

Moore and Mitchell (2000) found that the median household would have to save an additional 16% annually of earnings if it were to retire at age 62 and an additional 7%

[2] Some adjustments to account for changes in these assumptions are made later in the calculations.
[3] Even though households spend out of disposable income, retirement wealth needs to be seen in relation to personal income since retiree households still have to pay some taxes.

annually for retirement at age 65. Further, Engen, Gale and Uccello (1999) found that 52 to 61% of households exceeded the target wealth to earnings ratio. In other words, their findings suggest that 40 to 50% of households fall short of the target wealth to earnings ratio. Furthermore, the median household in their sample has only 79% of the wealth earnings ratio that their model calculations prescribe. Finally, Gustman and Steinmeier (1999) show that nominal replacement rates are 86% of earnings, while inflation adjusted replacement rates are 60%. Moreover, replacement rates are very heterogeneous as one fourth of the sample had real replacement rates of 33% or less of lifetime earnings.

While, the remainder of the paper will focus on the average wealth to income ratio, it is important to keep in mind that there is a large degree of heterogeneity in the distribution of retirement wealth across households. Mitchell and Moore (1998) reported that single households were less adequately prepared than married couples, and that people with more wealth had more adequate savings. Moreover, Mitchell, Moore and Phillips (2000) found that black and Hispanic married households experienced a larger shortfall relative to target wealth ratios than whites, and that more education resulted in improved adequacy of retirement savings. Further, (Engen, Gale and Uccello, 1999) showed that less education increased the chance to fall below the target, that whites are more likely to reach the target than nonwhites or Hispanics, and that higher inherited wealth increases the chance of reaching the target. Finally, Gustman and Steinmeier (1999) showed that retirement adequacy declined with lifetime earnings, largely as a function of the progressive benefit structure of Social Security.

Moreover, by focusing on the average household, rather than the median household, the calculations in this paper are likely overstating the actual preparedness of a typical (median) household. Since most studies have found a rather unequal distribution of retirement wealth, that appears to have become even more unequal over the course of the 1990s (Wolff, 2002), the median household's wealth typically is significantly lower than the average household's wealth, and falling further and further behind.

Even though replacement rates of less than 100% are a common finding, they may still offer adequate retirement income. In fact, a replacement rate of around 80% is generally considered adequate since the income needs of retirees are likely to be lower than those of workers. The need to save for retirement is substantially reduced; taxes are lower because payroll taxes are no longer due and because of extra tax exemptions; work related expenses for clothing and commuting disappear; the family size of retirees is generally smaller than the family size of workers as children leave the household and as spouses die; and households eventually pay off their mortgages reducing housing costs (Engen, Gale, and Uccello, 1999; McGill et al., 1996). Reducing income needs by these adjustments should generate a 100%, and thus adequate, replacement ratio. Moreover, a reasonable adjustment results in the adjusted replacement ratio to be about one fifth higher than the non-adjusted replacement ratio (Gustman and Steinmeier, 1999).

Both nominal and real replacement ratios are considered prior to making adjustments. A real replacement ratio suggests that income levels should afford retirees a constant standard of living in retirement. In comparison, a nominal replacement ratio

assumes declining real income of retirees over time. But rising health care costs, especially for the elderly, may counter reduced consumption on other items. Therefore, both a nominal replacement ratio of 86% and a real replacement ratio of 60% are considered as starting points (Gustman and Steinmeier, 1999)[4]. After making the above mentioned adjustments, the nominal replacement ratio increases to 103%, and the real replacement ratio increases to 72%. Put differently, workers can on average expect a drop in their living standards by 28% compared to their pre-retirement living standards if inflation is accounted for, based on their wealth in 1992.

The replacement ratios are further adjusted because they are based on measures that include housing and social security wealth, but fluctuations on the stock market impact financial wealth, and not Social Security wealth or housing wealth. Gustman and Steinmeier (1999) calculate that housing wealth is on average 16% of total wealth and that Social Security wealth is another 23.7%. The nominal replacement ratio was 100% in 1992, which included Social Security wealth. Excluding housing and Social Security wealth obviously does not change the result since the household is still expected to receive Social Security benefits. To make this point clearer, consider the real replacement ratio of 72% in comparison, which also includes Social Security wealth, but not housing wealth. If we assume that the remaining 28% between actual wealth and target wealth levels had to be covered by financial savings alone, private wealth would have to increase by 47%. Put differently, financial wealth was only at a level of 53% of what it ideally should have been. Including housing wealth, private wealth was at 67% of where it should have been in 1992. Consequently, the fully adjusted private wealth to income ratio for 1992 was either 100%, 67% (for the real ratio including housing wealth), or 53% (for the real ratio excluding housing wealth) of the target private wealth to income ratio.

To calculate the target values for the years after 1992, I adjust the ratio for 1992 for demographic changes, such as the increasing age of workers, the rising life expectancies, and the share of the population over the age of 65[5][6].

$$\frac{\hat{W}_t}{Y_t} = \frac{W_{t-1}}{Y_{t-1}} * (1 + (age_{t-1}) * \alpha + \frac{(p_{t-1})}{\beta} - 65plus_{t-1}) \quad (1)$$

$$\alpha = (1 + r_{LT})^{(AGEt - AGEt-1)} \quad (1)'$$

$$\beta = (1 + r_{LT})^{(LE65t - LE65t-1)} \quad (1)''$$

The target wealth to income ratio, *W/T*, in period t is determined by the adjusted wealth-income ratio in the previous period. It is adjusted for the percent increase in the

[4]These rates are close to those of Engen, Gale and Uccello (1999), but below those calculated by Moore and Mitchell (2000).
[5] Alternatively, these adjustments could be made to the actual wealth to income ratio as discussed earlier. The adjustments to the target wealth to income ratio are chosen for presentation purposes only.
[6] Because wealth to income ratios are used, no adjustments for income changes have to be made. Similarly, personal savings rates and real rates of return are assumed to equal historic averages.

age of the average worker, *age*, which itself is adjusted by an interest factor, α. A higher age means that fewer years are left to retirement, therefore requiring more wealth relative to income. Moreover, not only does the worker have to compensate for fewer working years, but also for the loss of compounded interest over those years. Hence, equation (1)' shows that the percent change in the average age of workers is adjusted for the loss of long-term interest, r_{LT}, compounded for the actual number of years that the average age of workers, *AGE*, has changed from period t-1 to t. Also, the target wealth to income ratio grows with higher life expectancies at age 65, $65plus_t$. Longer life expectancies require more wealth to maintain the same income level in retirement. Further, the increase in the life expectancy at age 65 is adjusted for the fact that the average worker can increase her wealth to income ratio partially due to compounded interest. Thus, the overall increase in the wealth to income ratio due to a higher life expectancy is reduced by a discount factor, β. Equation (1)'' shows that the adjustment is the long-term interest rate compounded over the additional years of life expectancy at age 65, *LE65*. Another adjustment is the change in the share of population over 65, $65plus_t$. If the share of over 65-year-olds rises, the wealth to income ratio should decline since most elderly households are dissavers[7].

For the calculations, actual changes of the average age of workers, of life expectancy at age 65 (SSA, 2000, 2001), and of the share of the population over 65 (IDB, 2001) are chosen[8]. This allows for the calculation of target levels from 1992 to 2000, starting with adequacy levels of 100%, 67% or 53%.

Table 2 summarizes the calculations. Starting from adequacy levels of 100% in 1992, comparing actual to target wealth to income ratios shows that the financial wealth to income ratio increased to 44% above its target in 1999 before falling to 24% above its target in 2000, and that the financial and housing wealth to income ratio rose to 28% above the target in 1999 before falling to 16% above the target. Starting from adequacy ratios of less than 100%, the average household never reached its target wealth to income ratios throughout the period of strong stock market growth in the late 1990s as the average household was 22 percentage points (including housing wealth) or 34 percentage points (excluding housing wealth) below its target wealth to income ratio in 2000.

IV. The future outlook

This section develops a simple regression model and uses it to simulate wealth to income ratios for the next 50 years.

Wealth relative to income rose slower than one may have expected from the record rise of the stock market. From 1992 to 2000, the stock market grew by an annual average of 13.9% and income by 5.2%. The difference of the two rates suggests that one may naïvely expect the wealth to income ratio to grow at about 8.5% a year. Instead, the financial wealth to income ratio grew annually by 3.3%, and the combined financial and housing wealth to income ratio by 2.4%. The wealth to income ratio grew hence only at

[7] This also assumes that the labor force participation of the over 65 year olds remains constant.
[8] All input variables for the period 1992 through 2000 are detailed in table 1.

25-40% of its naïve potential from 1992 to 2000, suggesting that households had also built up less of a buffer for the event of a market decline than they could have had.

Most household assets were not allocated in corporate equities. Assuming that households held equities in mutual funds, life insurances, pension funds and bank personal trust at a rate proportional to all other investors, households' direct and indirect equity holdings never amounted to more than 50% of financial assets (BoG, 2001)[9]. Thus, the impact of stock price changes was muted by the less volatile rates of return of other assets. The average effective nominal rate of return – defined as holding gains[10] relative to beginning-of-period assets – was 6.3% for the 1990s, and 7.4% for the late 1990s, and the real effective rate of return was 3.7% for the 1990s, and 4.9% for the years 1996 to early 2001. In comparison, nominal stock market growth was on average 14.1% for the 1990s and 11.4% in real terms for the entire 1990s.

Also, as wealth grew, so did income as wage and employment growth accelerated in the latter part of the 1990s (SSA, 2001). Faster income growth required faster wealth growth to maintain the same level of retirement savings adequacy, but more wealth also provided households with more collateral to borrow. Households increased their debt more than they raised their assets in 15 out 33 quarters between December 1992 and March 2001, and in 13 out of 21 quarters from December 1995 to March 2001 (BoG, 2001: Table F.100). Also, net housing wealth relative to personal income fell from 125% in December 1992 to 119.8% in September 1996. It only reached 125% again by December 1999 (BoG, 2001: Tables B.100 and L.100).

Also, more accumulated wealth provided households with more resources to increase their consumption (Poterba, 2000), thereby reducing savings. On average, households contributed about 8% of personal disposable income to their financial assets in the 1990s, below the averages of all previous post-war business cycles. For the latter part of the 1990s, when stock prices rose at record rates, the average addition was only 6.5%. Also, the wealth effect appears to be slightly asymmetric. When holding gains were positive, households added on average 8.5% of their PDI to their financial assets, and when holding gains were negative they added only 6.5% (BoG, 2001: Table F.100).

So far, each factor that could have affected wealth to income ratios has been considered in isolation. But to simulate future wealth to income ratios, it seems important to gain a sense of the joint effects of all factors, in particular: changes in stock prices; portfolio allocation; income; changes in liabilities; varying savings rates, as well as demographic changes discussed above (equation 1). To study the relative importance of each factor determining the wealth to income ratio, the following equation is estimated:

[9]Annual estimates by the Federal Reserve Bank (BoG, 2001: Table B.100e) show that the total equity share out of total financial assets reached its highest point in 1999 with 49.5%.

[10] Holding gains are defined as the difference in the outstanding value of financial assets minus net financial acquisitions (BoG, 2001: Tables R.100, F.100; L.100).

$$\ln \frac{W}{Y}_t = \beta_0 + \beta_1 \ln(\frac{S\&P500}{CPI})_t + \beta_2 \ln(\frac{Y}{CPI})_t + \beta_3 \ln(\frac{E}{A})_t + \beta_4 \ln(\frac{L}{Y})_t$$
$$+ \beta_5 \ln(\frac{S}{PDI})_t + \beta_6 \ln(LE65)_t + \beta_7 \ln age_t + \beta_8 \ln 65plus_t + \varepsilon_t \quad (2)$$

where the wealth to income ratio, *W/Y*, depends on the real value of the S&P 500, on real income (both deflated by the consumer price index, CPI), on the share of equities out of financial assets, *E/A*, on the ratio of debt relative to income, *L/Y*, on the savings rate out of personal disposable income, *S/PDI*[11]. To control for demographic changes, the life expectancy at age 65, *LE65*, the average age of workers, *age*, and the share of the population aged 65 and older are included. Also, ε is a normally distributed random error term. A logarithmic specification is used for each variable.

The expected signs of the explanatory variables are straightforward. The S&P 500, the savings rate, the equity share in households' portfolio, average age of workers, and longevity at 65 should all be positively related to the wealth to income ratio. By contrast, real income, liabilities, and the population over the age of 65 should be negatively related to the wealth to income ratio.

The explanatory variables do not include an autoregressive term for a couple of reasons. First, the average household in one period is independent from the average household in the next period. Second, estimates that include the lagged value of the dependent variable show this variable to be consistently statistically insignificant[12]

All economic variables are compiled from the *Flow of Funds Statistics for the United States* (BoG, 2001), with the exception of the (seasonally adjusted) CPI, which is taken from the Bureau of Labor Statistics (2001). The data for life expectancy are taken from the National Center for Health *Statistics' Life Expectancy by Race, Sex, 1970 to 1998 (at Birth, Age 65 and Age 85)*, and the *2001 Social Securities Trustees' Report* (SSA, 2001). Average age is calculated as a weighted average of workers covered by Social Security in a given year (SSA, 2000). Missing demographic data are interpolated.

For the regression estimation, several adjustments are necessary. With the exceptions of the ratio of liabilities to income, all variables are stationary. To correct for non-stationarity, the series is differenced once. Further, the savings rate may be endogenously related to the dependent variable as a positive shock to asset prices raises consumption and lowers savings. To address this issue, the savings rate is instrumented by regressing it on its own value lagged once and on all other explanatory variables. Also, to correct for autocorrelation, a Corchran-Orcutt regression estimator is used.

The regression results for financial wealth as the dependent variable are presented in table 3. The estimated coefficients have the expected signs or are insignificant for the entire period from 1952 to March 2001. In particular, stock prices, real income and life

[11] Since the savings rate is negative in some quarters the logarithmic series is calculated as ln(S/Y+1).
[12] Detailed results are available from the author.

expectancy at 65 are insignificant. Age has the largest estimated effect as a 1% increase in the average age of workers leads to a 0.96% increase in the wealth to income ratio. In comparison, changes in the personal savings rate have the smallest effect as a 1% increase results only in a 0.03% increase in the wealth to income ratio.

It is likely that the determinants of the financial wealth holdings of households vary over time. Thus, the sample is first separated in 1974, which marks the introduction of the Employee Retirement Income Security Act (ERISA), and then in 1982, which marks the beginning of the widespread introduction of 401(k) plans.

The results for the respective subperiods are relatively similar. In the earlier periods, the stock market and personal savings played no statistically significant role, whereas the change in liabilities relative to income did. The opposite is true for the later period. Also, age has a significant negative effect in both earlier periods, whereas its effect is positive after 1974, but negative after 1982.

Further, it is likely that households consider not only their financial wealth as retirement wealth, but also part or all of their housing wealth. Thus, equation (2) is re-estimated with financial wealth plus housing wealth relative to income as dependent variable. The results are very similar to those for financial wealth alone (table 4), except that there is some evidence that the share of the population over 65 had a positive impact during the early part of the period, but a negative impact in the latter part. This may reflect a generational change, whereby younger cohorts are more likely to be dissavers.

Finally, it is not clear whether income or assets are the more appropriate collateral to use for personal credit. Consequently, the previous two regressions are re-estimated with the ratio of personal credit relative to assets instead of income (table 5). The results change insofar as the coefficient for the change in debt relative to assets is significantly negative in the latter period, whereas the ratio of credit to income was insignificant.

The regression results are largely robust, and all explanatory variables are significant determinants during one period or another. The estimated coefficients for the various subperiods are consequently used to simulate future wealth to income ratios.

By early 2001, under realistic assumptions, households had fallen 22-34% below their target levels. The following calculations focus on the time it may take the average household to recover the losses incurred since March 2001, and the time it may likely take to reach its target level.

Historically, it has taken quite some time for households to recover their wealth positions after a sharp decline. The wealth to income ratio declined from 286% in December 1961 to 200% in December 1974. The wealth to earnings ratio climbed above 286% again in June 1997, or almost 46 years later. Also, despite an unprecedented run-up in stock prices in the late 1990s, the retirement wealth of households did not seem to reach adequate levels. Thus, it may take decades for the average household to reach either their previous peak levels of wealth to income or to have adequate retirement income.

The target levels for the wealth to income ratios are simulated using equation (1) as basis for Monte Carlo simulations. The hypothetical target levels are calculated for the period from 2000 to 2050 using Monte Carlo simulations, using 1,000 random observations for each input variable, changes in the age of workers, in the life expectancy at age 65, and the share of the population over 65[13]. Also, there are two separate starting points for each of two wealth to income ratios for the relative adequacy levels in 1992: 100% and 53% for the financial wealth to income rate, and 67% and 100% for the financial wealth plus net housing wealth to income rate.

To simulate the actual levels, the estimated coefficients for the full sample from table 3 are used first:

$$\begin{aligned}\ln\frac{W}{Y}_t &= 0.05*\ln\frac{S\,\&\,P500}{CPI}_t - 0.38*\ln\frac{Y}{CPI}_t + 0.42*\ln\frac{E}{A}_t - 0.09*\Delta\ln\frac{L}{Y}_t \\ &+ 0.03*\ln\frac{S}{PDI}_{t-1} + 0.97*\ln LE65_t + 0.96*\ln age_t + 0.60*\ln 65plus_t\end{aligned} \quad (3)$$

Again, Monte Carlo simulations are used to simulate actual wealth to income ratios based on 1,000 random values for each variable for each of the next 50 years. The distribution of hypothetical actual values is used to calculate the chance of reaching the last peak or of falling below the target level in any given year.

The results in table 7 illustrate the risks associated with using private wealth as a vehicle of retirement income provision. The chance of remaining below the peak levels of March 2000 stays above 50% for the next 30 years, regardless of the wealth measure used. Also, starting from a 100% adequacy level in 1992, the probability remains over 50% for financial wealth relative to income and above 80% for financial and housing wealth relative to income for the next 50 years. If the starting adequacy levels are lower, the chance of staying below the target level is above 90%. The fact that the average household has no discernible possibility to reach its target level, at least when the starting point for 1992 is below 100%, should not be surprising given the recent experience. Despite an unprecedented increase in the stock market, the average household did not reach adequate wealth to income ratios in the late 1990s.

Alternatively, it may be that the parameter estimates for the wealth to income ratios for the full sample may not adequately reflect the determinants of household wealth. Instead, the coefficient estimates for the period after 1982 may more accurately reflect the importance of each variable. Consequently, I recalculate the hypothetical target and actual values for the period from 2000 to 2050 using the parameter estimates for the period after 1982 (tables 3 and 4).

The results in table 8 suggest a similar future as the results using the parameter estimates for the full sample. The chance of not reaching peak levels remains above 60%

[13]See table 6 for details on each input variable.

for the financial wealth to income ratio, and close to 100% for the financial and housing wealth to income ratio. Similarly, the chance of falling below its target remains above 50%, with an increasing tendency, for the financial wealth to income ratio, and of more than 80% for the financial and housing wealth to income ratio, when a starting position of 100% adequacy in 1992 is assumed. When starting points of 53% and 67% of adequate wealth to income are assumed the chances of staying below adequate levels stay above 90% and 100%, respectively.

V. Conclusion

The stock market fluctuations of the 1990s were also reflected in changes in household wealth. Since saving for retirement is one of the most important reasons for household wealth accumulation, this paper studies the consequences of the stock market ups and downs for retirement income adequacy. In particular, this paper analyzes the retirement income adequacy of the average household for the period from 1992 to 2000, and provides simulations for possible future developments over the next 50 years.

The findings suggest that for the average household the rapidly growing stock market did not translate into an equally fast increase in retirement wealth relative to income. Various factors contribute to this inelastic response. Most household assets were not invested in equities; increases in share prices also translated into more consumption and lower savings; income grew along with assets; and rising assets and incomes provided more collateral for household debt. The results suggest that the average household's wealth to income ratio was 22-34 percentage points below its target by the end of 2000.

The chances for the average household to recover the lost wealth and to reach adequate retirement savings are very low. It will take the average household more than 30 years, in the best case scenario, to have a greater than 50% chance of reaching its previous peak wealth to income level again. Moreover, for the average household the chances of reaching its target wealth to income ratio remain below 50%, and often close to 100%, for the next 50 years. This should not come as a surprise. The past few years saw an unprecedented boom on the stock market combined with a proliferation of indirect stock ownership of households. Neither development is likely to be repeated in the near future. Yet, households on average fell short of adequate retirement savings. In other words, without drastic policy changes that will increase household wealth on average, households will most likely not reach adequate levels of retirement savings in the foreseeable future.

TABLE 1
INPUT VARIABLES FOR CALCULATION OF RETIREMENT INCOME ADEQUACY STANDARD, 1992 TO 2000

Year	age	p	65plus
1992	0.17	-0.003	0.13
1993	0.13	0.001	0.13
1994	0.09	0.000	0.06
1995	0.06	0.001	0.07
1996	0.11	0.003	0.02
1997	0.11	0.001	-0.06
1998	0.20	0.001	-0.09
1999	0.20	0.000	-0.11
2000	0.20	0.000	-0.04

Notes: All observations are in %. *age* is the quarterly % change of the average age of workers, *p* is the average quarterly % change of the life expectancy at age 65, and *65plus* is the average % change of the share of the population over the age of 65. Data for average growth of the age of workers after 1997 are extrapolated on the basis of historic averages. In particular, the average quarterly growth rate for the period from 1980 to 1997 was 0.38%, and the average quarterly growth rate from 1950 to 1997 was 0.11%. The unweighted average between these two trends is 0.195% and is used for the years 1998 to 2000. The sources are SSA, Annual Statistical Supplement 2000, Table OASDI 4.B5 Covered Workers; SSA, 2001 Annual Report of the Trustees of the Federal Old Age, Survivorship and Disability Insurance Trust Funds, Table V.A4 Cohort Life Expectancies, and U.S. Bureau of the Census, International Data Base, http://www.census.gov/ipc/www/idbnew.html

TABLE 2
COMPARISON OF ACTUAL WEALTH TO INCOME RATIOS WITH PROJECTED ADEQUATE RATIOS

Year	Fin. wealth to income	Fin. and housing wealth to income	Financial wealth to income		Financial and housing wealth to income		Financial wealth to income		Financial and housing wealth to income	
			100% adequacy in 1992		100% adequacy in 1992		53% adequacy in 1992		67% adequacy in 1992	
	Actual at year end		target at year end	Actual to target levels	target at year end	Actual to target levels	target at year end	Actual to target levels	target at year end	Actual to target levels
1992	236.17	361.54	236.17	100	361.54	100	445.61	53	539.62	67
1993	243.89	367.47	238.72	102	365.44	101	450.42	53	545.43	67
1994	238.03	358.52	240.17	99	367.66	98	453.17	53	548.75	65
1995	264.03	385.06	241.42	107	369.57	104	455.51	58	551.59	70
1996	279.47	399.42	242.70	115	371.53	108	457.94	61	554.52	72
1997	305.17	425.82	243.23	125	372.34	114	458.95	66	555.73	77
1998	320.72	442.80	244.31	131	374.00	118	461.00	70	558.21	79
1999	354.11	479.28	245.21	144	375.37	128	462.71	77	560.26	86
2000	306.18	438.18	246.82	124	377.84	116	465.77	66	563.94	78

TABLE 3
REGRESSION ESTIMATES FOR FINANCIAL WEALTH TO INCOME RATIO

Explanatory Variables	Full Sample	1952 to 1974	1975 to 2000	1952 to 1982	1983 to 2000
$\ln(S\&P500/CPI)_t$	0.05	0.003	0.10*	-0.01	0.21***
	(0.03)	(0.03)	(0.05)	(0.03)	(0.06)
$\ln(E/A)_t$	0.42***	0.49***	0.37***	0.46***	0.33***
	(0.04)	(0.04)	(0.06)	(0.04)	(0.08)
$\Delta\ln(L/Y)_t$	-0.09	-0.17***	-0.05	-0.15***	0.15
	(0.06)	(0.05)	(0.12)	(0.05)	(0.17)
$\ln(S/PDI)_{t-1}$	0.03***	0.01	0.04***	0.01	0.02**
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
$\ln(Y/CPI)_t$	-0.38***	-0.63***	-0.42*	-0.54***	0.30
	(0.09)	(0.08)	(0.22)	(0.07)	(0.24)
$\ln(LE65)_t$	0.97*	0.81	0.38	0.32	0.30
	(0.52)	(1.18)	(0.78)	(0.50)	(0.72)
$\ln age_t$	0.96**	-2.60***	2.62*	-1.25*	-1.89*
	(0.48)	(0.93)	(1.58)	(0.74)	(1.11)
$\ln 65plus_t$	0.60	0.18	-0.57	0.60	-1.47***
	(0.40)	(0.52)	(1.00)	(0.38)	(0.38)
Constant	1.69	19.72***	0.90	14.14***	8.27***
	(2.19)	(5.69)	(3.35)	(3.83)	(1.88)
N	193	88	104	119	72
Adj. R-squared	0.84	0.94	0.78	0.93	0.96
rho	0.94	0.87	0.95	0.86	0.51
Durbin-Watson	1.94	1.78	2.13	1.78	1.88

Notes: Standard deviations in brackets. * indicates significance at the 10%-level; ** indicates significance at the 5%-level, and *** indicates significance at the 1%-level.

TABLE 4
REGRESSION ESTIMATES FOR THE FINANCIAL AND HOUSING WEALTH TO INCOME RATIO

Explanatory Variables	Full Sample	1952 to 1974	1975 to 2000	1952 to 1982	1983 to 2000
$\ln(S\&P500/CPI)_t$	0.03	0.01	0.07	-0.005	0.16***
	(0.03)	(0.03)	(0.05)	(0.03)	(0.05)
$\ln(E/A)_t$	0.32***	0.35***	0.29***	0.33***	0.27***
	(0.04)	(0.03)	(0.06)	(0.04)	(0.07)
$\Delta\ln(L/Y)_t$	-0.07	-0.14***	-0.06	-0.12***	0.14
	(0.05)	(0.04)	(0.10)	(0.04)	(0.14)
$\ln(S/PDI)_{t-1}$	0.02***	0.01	0.03***	0.01	0.02***
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
$\ln(Y/CPI)_t$	-0.42***	-0.70***	-0.52**	-0.63***	0.23
	(0.09)	(0.06)	(0.20)	(0.05)	(0.21)
$\ln(LE65)_t$	1.02**	2.09**	0.29	0.56	-0.47
	(0.47)	(0.98)	(0.68)	(0.43)	(0.68)
$\ln age_t$	0.04	-2.61***	2.56*	-2.21***	-0.88
	(0.51)	(0.72)	(1.37)	(0.56)	(1.00)
$\ln 65plus_t$	0.54	-0.06	-2.10*	0.60**	-2.16***
	(0.40)	(0.41)	(1.16)	(0.31)	(0.35)
Constant	6.46***	18.65***	7.38**	18.98***	10.35***
	(2.25)	(4.52)	(3.37)	(3.00)	(1.72)
N	193	88	104	120	72
Adj. R-squared	0.78	0.93	0.72	0.90	0.93
rho	0.96	0.83	0.96	0.83	0.55
Durbin-Watson	1.90	1.64	2.12	1.59	1.93

Notes: Standard deviations in brackets. * indicates significance at the 10%-level; ** indicates significance at the 5%-level, and *** indicates significance at the 1%-level.

TABLE 5
REGRESSION ESTIMATES FOR THE WEALTH TO INCOME RATIOS, WITH ALTERNATIVE PERSONAL CREDIT MEASURE

Dependent variable	Financial wealth to income			Financial and housing wealth to income		
Explanatory Variables	Full Sample	1952 to 1982	1983 to 2000	Full Sample	1952 to 1982	1983 to 2000
$\ln(S\&P500/CPI)_t$	0.07**	0.01	0.24***	0.05*	0.01	0.18***
	(0.03)	(0.03)	(0.05)	(0.03)	(0.03)	(0.05)
$\ln(E/A)_t$	0.33***	0.39***	0.22***	0.24***	0.27***	0.18***
	(0.04)	(0.04)	(0.07)	(0.03)	(0.03)	(0.07)
$\Delta\ln(L/A)_t$	-0.20***	-0.14***	-0.22***	-0.17***	-0.12***	-0.19***
	(0.03)	(0.03)	(0.06)	(0.02)	(0.02)	(0.06)
$\ln(S/PDI)_t$	0.03***	0.01	0.03***	0.02***	0.01	0.03***
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
$\ln(Y/CPI)_t$	-0.29***	-0.44***	0.14	-0.35***	-0.54***	0.06
	(0.08)	(0.07)	(0.21)	(0.08)	(0.06)	(0.20)
$\ln(LE65)_t$	0.84*	0.29	-0.02	0.92**	0.50	-0.66
	(0.46)	(0.47)	(0.72)	(0.42)	(0.41)	(0.72)
$\mathrm{Ln}age_t$	1.34***	-0.57	-0.14	0.33	-1.50**	0.78
	(0.43)	(0.73)	(1.08)	(0.46)	(0.62)	(1.01)
$\ln 65plus_t$	0.41	0.44	-1.57***	0.38	0.53*	-2.24***
	(0.35)	(0.36)	(0.39)	(0.36)	(0.31)	(0.38)
Constant	0.08	10.77***	5.75***	5.20***	15.55***	7.83***
	(1.96)	(3.75)	(1.93)	(2.04)	(3.19)	(1.82)
N	193	120	72	193	120	72
Adj. R-squared	0.87	0.93	0.96	0.83	0.91	0.91
rho	0.94	0.86	0.57	0.96	0.86	0.65
Durbin-Watson	1.68	1.66	1.87	1.65	1.52	1.92

Notes: Standard deviations in brackets. * indicates significance at the 10%-level; ** indicates significance at the 5%-level, and *** indicates significance at the 1%-level.

TABLE 6
ASSUMPTIONS FOR INPUT VARIABLES FOR HYPOTHETICAL TARGET AND ACTUAL WEALTH TO INCOME RATIOS, 2005 TO 2025

Variable	Full sample
Δage	0.04 (0.15)
Δ65plus	0.77 (0.56)
ΔLE65	0.56 (0.87)
Δ(S&P500/CPI)	4.38 (7.09)
E/A	28.82 (7.09)
L/Y	61.16 (12.75)
S/PDI	7.71 (1.02)
Δy	3.19 (0.89)

Notes: All figures are in %. Δ denotes percentage changes. Figures in parentheses are standard deviations.

TABLE 7
SUMMARY OF SIMULATION RESULTS, 2005 TO 2050, BASED ON FULL SAMPLE

	Financial wealth to income ratio			Financial and housing wealth to income ratio		
Year	Probability of falling below past peak	Probability of falling below target levels		Probability of falling below past peak	Probability of falling below target levels	
	Peak: 356.3% in March 2000	100% adequacy in 1992	53% adequacy in 1992	Peak: 482.6% in March 2000	100% adequacy in 1992	67% adequacy in 1992
2010	99	54	100	100	99	100
2020	86	57	100	100	99	100
2030	55	65	100	99	100	100
2040	22	67	100	86	100	100
2050	8	71	100	52	100	100

Note: All figures are in percent.

TABLE 8
SUMMARY OF SIMULATION RESULTS, 2005 TO 2025,
BASED ON SAMPLE AFTER 1980

	Financial wealth to income ratio			Financial and housing wealth to income ratio		
Year	Probability of falling below past peak	Probability of falling below target levels		Probability of falling below past peak	Probability of falling below target levels	
	Peak: 356.3% in March 2000	100% adequacy in 1992	53% adequacy in 1992	Peak: 482.6% in March 2000	100% adequacy in 1992	67% adequacy in 1992
2010	68	54	90	94	87	100
2020	64	59	90	94	95	100
2030	65	66	95	99	100	100
2040	63	71	96	99	100	100
2050	62	74	97	100	100	100

Note: All figures are in percent.

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