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# The Effect of Large Capital Gains or Losses on Retirement

Michael D. Hurd, Monika Reti, and Susann Rohwedder

## 4.1 Introduction

Although it is natural to suppose that years of retirement are a normal good, so that increases in wealth would lead to earlier retirement, it has been difficult for research to estimate plausible wealth effects on retirement.[1] Part of the reason for the difficulty is that some of the cross-section variation in wealth is the result of taste variation: for example, people who are especially risk averse will tend to accumulate more wealth and to retire later than those who are less risk averse. Also, it is difficult to control for the quality of the job: higher paying jobs tend to have amenities that make work more pleasant, thus delaying retirement, and at the same time, higher incomes are associated with greater rates of wealth accumulation. Such positive cross-section correlations between wealth and retirement age are apparently large enough to offset negative correlations induced by a wealth effect on retirement.

In panel data, observed wealth change may not be related to a wealth effect on retirement. Economic models of wealth accumulation and retirement imply that individuals accumulate wealth so that they can retire at an optimal age. As long as there are no unforeseen changes in the environment

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1. Two examples are Gustman and Steinmeier (1986) and Samwick (1998). Both report small wealth effects on retirement.

or in other determinants of retirement, the optimal retirement age will not change over time. The constancy of the optimal anticipated retirement age holds, whether individuals save at a high rate (large wealth accumulation) or at a low rate. The result is that we should observe no relationship between wealth change and changes in anticipated retirement simply because the anticipated retirement age would not change. Only when there are unanticipated changes in the determinants of retirement would the optimal anticipated retirement age change.

The stock market boom of the mid-1990s to 2000, and the subsequent bust between 2000 and 2002, provide an opportunity to study what was likely an unexpected wealth change for at least part of the population. The boom produced wealth increases for some that were substantially similar to the thought experiment of giving large windfall wealth increases to the population that was approaching retirement, making it possible to avoid many of the difficulties associated with nonexperimental data. The purpose of this chapter is to study the associated change in actual retirement and in expected retirement of that population.

In 1992 the age-eligible respondents in the Health and Retirement Study (HRS) were approximately fifty-one to sixty-one years old (Juster and Suzman 1995). Their financial resources included private savings, part of which was invested in the stock market, part in the bond market, and part in checking and savings accounts and other miscellaneous assets. They also had claims to pensions, some of which were direct benefit (DB) plans and some direct contribution (DC) plans.

Between wave 1 in 1992 and wave 2 in 1994, the stock market increased in value by 14 percent as measured by the New York Stock Exchange Composite Index (NYSEI). However, beginning in 1994, stock prices increased at much greater rates than they had historically: between waves 2 and 4 in 1998 the NYSEI increased by 90 percent. Thus, between 1994 and 1998 many households had large gains in wealth. By historical projection, much of these gains would have been unanticipated and could reasonably be taken to be exogenous to previous decisions about saving and anticipated retirement. The stock market continued to rise until about August, 2000, and then dropped sharply until about August, 2002, when it was about 27 percent below its peak. Although the decline was not sustained for as long as the increase, in terms of deviations from expectations it likely was sharper.

Under the assumption that some of the gains and losses in the stock market were unanticipated, the increase and subsequent decline in wealth have aspects of a natural experiment in which some households had large changes in wealth in the years shortly before retirement and others did not. A number of households would have had similar economic positions in 1994 except that their portfolio mix differed: some held stocks and some did not. Some households had firm-directed DC plans that invested in stocks and some had plans that invested in bonds. These households would have had very different changes in the value of their private assets and in their DC plans, and the differential change would not have been expected and would have been only partially under their control. Thus, variation in tastes that makes the interpretation of nonexperimental data so difficult is likely to be much less important.

In summary, there were large changes in wealth for some of the respondents, and some of the wealth change can be assumed to be unanticipated. Their behavior in the waves following the large changes can be compared with the behavior of respondents who had no such wealth changes, and the difference can be attributed to a windfall wealth effect.

Our main research question is: how did the large increase and subsequent decline in wealth affect behavior? An obvious response for workers in the age range of the HRS is to buy more leisure by retiring earlier than anticipated or by delaying retirement following a loss in wealth. We will study actual retirement and anticipated retirement as measured by the subjective probability of working past age sixty-two, which is asked in every wave of HRS. We ask whether those with wealth gains retired earlier than those who did not have them, and whether anticipated retirement as measured by the subjective probability of working past age sixty-two changed in the panel in response to the wealth changes. The difference between actual and anticipated retirement should be particularly informative, as it will show whether those workers that had large gains in wealth actually retired earlier than their intentions as stated before any windfall gain in wealth. This will be a direct measure of the elasticity of retirement with respect to wealth that takes into account any individual propensity to retire.

By comparing changes in retirement or retirement intentions during the stock market boom period with changes in retirement or retirement intentions during the bust period, we will find whether there are asymmetries in responses to wealth gain compared with wealth loss.

### 4.1.1 Prior Research

Besides econometric estimations based on conventional household surveys, as in Gustman and Steinmeier (1986), there have been three approaches to estimating the effect on labor supply of unexpected wealth gains. Imbens, Rubin, and Sacerdote (1999, 2001) estimated the effect of windfall gains in wealth from the behavior of lottery winners. Their basic finding was that large gains induced a reduction in labor force participation, but the magnitude was small in the population, although larger among those of retirement age. The age difference is very plausible, in that many workers approaching retirement age may be on the margin of working or retiring, so that a positive wealth shock could induce retirement.

Younger workers are likely to be far from the margin. Furthermore, a given wealth shock would represent a greater increase in the fraction of the rest-of-lifetime resources of older workers, so the effect should be greater.

A second approach is based on inheritances. Holtz-Eakin, Joulfaian, and Rosen (1993) used 1982 and 1986 IRS tax records on inheritances and income to estimate the effect of large wealth gains on labor force participation. Based on their estimates, we calculate that a wealth gain of about $300,000 would reduce participation by about seven percentage points. Joulfaian and Wilhelm (1994) used the PSID to estimate the effects of inheritances on labor supply, but they found substantially smaller effects than Holtz-Eakin, Joulfaian, and Rosen.

Cheng and French (2000) used the estimates based on the lottery findings and on the Holtz-Eakin, Joulfaian, and Rosen findings on inheritances to calculate the effects of the stock market gains between December 31, 1994, and December 31, 1999. They estimated that about two-thirds of the gain in the stock market over that time period was unanticipated. From that estimate, along with the behavioral responses due to lotteries and inheritances, they calculated that labor force participation among those fifty-five to sixty-four years old was about 1.1 percentage points lower than it would have been in the absence of the stock market run-up. While this is a carefully done and useful study, it is based on many constructed variables and the samples in the underlying studies are small, especially for the lottery study.

The third approach for finding the effects of the stock market boom on retirement is based on HRS data on actual retirement or expected retirement.

Sevak (2002) compared the retirement rates of those with DC pension plans with those with DB pension plans in 1992 and again in 1998.[2] The thinking is that those with DC plans had windfall gains from the stock market run-up whereas those with DB plans did not have such gains, or at least did not within the plans. Indeed, Sevak reports substantial increases in the value of DC plans during the 1990s, as do Cheng and French. She found that in 1998, DC plan holders had retirement rates about seven percentage points higher than DB plan holders compared with the differential in 1992, and interpreted the difference to be due to the increase in value of DC holdings. While the results have plausibility and are in accord with the general aim of this chapter, we have some reservations based on the very substantial increase in the fraction of the population with DC plans: in 1992 about 38 percent of men in the HRS population in the relevant age range (fifty-five to sixty) had a DC plan, but in 1998 about 56 percent had a DC plan. Similarly, the percentage of men with a DB plan only fell from

2. The measure of retirement is a self-report about retirement, not actual labor force participation.

38 percent to 25 percent. Such a large compositional change means that there could be other factors in the higher retirement rates: for example, if those with a marginal attachment to the labor force were the same type of people who acquired DC pensions between 1992 and 1998, the compositional changes would be the correct explanation for the retirement difference, not the run-up in the values of DC plans.

Hurd and Reti (2001) conducted an analysis based on four waves of the HRS (1992, 1994, 1996, and 1998). Their measure of anticipated retirement is the subjective probability of working full time past age sixty-two, which we discuss at length later. They compared the change in anticipated retirement of stockholders versus nonstockholders. They found no difference in the change. Their study has a number of limitations, however. First, there may be a time lag between stock price changes and changes in retirement plans, because people often take time to adjust to new situations.[3] Perhaps such changes in retirement plans had not taken place by 1998. Second, the gains in the stock market accelerated after 1998, so possibly the gains observed by Hurd and Reti were not yet large enough to induce substantial changes in behavior. Third, Hurd and Reti imposed no structure on their estimation, yet theory suggests that people in differing economic circumstances or with differing characteristics would have been affected differently. For example, if most of the wealth gain is concentrated among the very well-to-do, there may be little change in average retirement behavior even though average wealth increased substantially. Fourth, Hurd and Reti only studied wealth change in posttax accounts and had no control for pension wealth. But wealth in pretax accounts such as DC plans is substantial, and for many may be a more important determinant of retirement than wealth in posttax accounts. Furthermore, some who do not have stocks in posttax accounts may have had gains in pretax accounts, which would blur the differences between the two groups.

Coronado and Perozek (2003) found an effect of stock market holdings, but they used a different measure of anticipated retirement than Hurd and Reti—the expected retirement age. They compared the expected retirement age as stated in 1992 with the actual retirement age as observed in 1998. This measure is more difficult to use than the subjective probability of working because of fairly high rates of nonresponse, because of right censoring when comparing it with actual retirement, and because some workers say they will never retire. Right censoring is particularly difficult: for example, by 1998 among those retired, 50 percent had retired earlier than their expected retirement age as stated in 1992 but just 18 percent had retired later. This difference indicates substantial censoring: many of them who eventually will retire later than expected had not yet retired by 1998.

3. For example, Imbens, Rubin, and Sacerdote report a lag of several years between winning the lottery and changes in labor supply.

A positive aspect of their paper is that Coronado and Perozek included measures of pension wealth, which perhaps was responsible for their finding an effect.

Khitatrakun (2004) based an analysis on the expected retirement age. He made an advance over previous studies based on expected retirement by controlling for right censoring and for stock market wealth and other important determinants of retirement that could mitigate a wealth effect. He found a significant reduction in expected retirement or actual retirement among those who had substantial stock market wealth and who did not have a defined benefits pension plan.[4] For example, those with stock holdings in the top 25 percent revised downward their expected retirement age or actually retired about eleven months earlier than anticipated.[5] These results are suggestive of a measurable effect in the part of the population that experienced an important gain in wealth.

Based on data from the HRS, the CPS, and the SCF, Coile and Levine (2004) conclude that few households have enough stock wealth that the variation in stock prices is likely to have a noticeable effect on average labor force participation rates. Indeed, they find no evidence that changes in the stock market had a measurable effect on participation.

In summary, there were large changes in wealth for part of the preretirement population, and at least some of the wealth change was likely unanticipated. Their behavior in the waves of the HRS following the large changes can be compared with the behavior of respondents who had no such wealth changes. Whether there will be differences and whether they can be attributed to a windfall wealth effect will depend on whether the wealth changes were anticipated. But there is a considerable literature that takes the gains to be at least partially unexpected. For example, Poterba (2000) states that "The evidence suggests that the rising stock market has surely contributed to rising consumer spending in the 1990s."[6] Were the increases fully anticipated, economic theory would not call for any change in consumption. If consumption responds to stock gains, the theory suggests that retirement would also respond.

## 4.2 Wealth in the HRS population

Our study population will be the original HRS cohorts born in 1931 to 1941 and observed in 1992 and every two years until 2002, and the

4. Restricting the sample to those lacking a DB plan for these estimations was done under the argument that DB plans restrict freedom about when to retire, so that a stock gain would have little effect on expected or actual retirement.

5. However, the result is mainly due to the 1992 to 1994 and 1994 to 1996 waves. These were not the waves of large stock market gains, which suggests that factors other than the stock market may have been responsible.

6. See also Juster, Lupton, Smith, and Stafford (1999) and Parker (1999).

**Table 4.1** **Average income and wealth (thousands) of age-eligible respondents, cross-section.**

| Wave | *N* | Total household income | Total wealth | Financial | Housing | Stock | Number stock owners | Percent stock owners |
|---|---|---|---|---|---|---|---|---|
| 1 | 9,769 | 46.1 | 206.6 | 47.3 | 60.6 | 18.7 | 3281 | 33.6 |
| 2 | 8,844 | 50.5 | 238.9 | 60.4 | 67.4 | 25.6 | 3181 | 36.0 |
| 3 | 8,467 | 53.9 | 264.7 | 70.4 | 72.5 | 36.0 | 3071 | 36.3 |
| 4 | 11,191 | 60.5 | 301.3 | 85.2 | 83.8 | 49.0 | 4332 | 38.7 |
| 5 | 10,584 | 63.1 | 361.8 | 103.5 | 97.0 | 62.2 | 4244 | 40.1 |
| 6 | 10,284 | 61.3 | 374.0 | 97.3 | 110.0 | 49.2 | 3868 | 37.6 |

*Source:* Authors' calculations, based on HRS.

*Note:* Financial wealth, measured in nominal dollars, is the sum of the holdings of stocks, checking and savings accounts, bonds, certificates of deposit, and other, minus debt. See table 4.3 for detailed listings.

War Baby cohorts born in 1942 to 1947 and observed in 1998, 2000, and 2002.

Table 4.1 shows cross-section income, wealth, and some components of wealth, all measured at the household level. The unusual increase in income at wave 4 is due to the induction of the War Baby cohort into the HRS in 1998. They were fifty-one to fifty-six at the time and had higher average income than the original HRS cohort. Income reached a maximum in wave 5, when the average age of the HRS cohort was about sixty-two, and then began to decline as retirement accelerated. Wealth increased by 10 to 15 percent per wave until wave 5, when it increased by about 20 percent. There was a large increase in financial wealth and stock wealth between waves 4 and 5. The increase is partly the result of the boom in the stock market.

We define stock ownership either to be direct ownership outside the pension system or ownership in a defined contribution (DC) pension. In the HRS, respondents are asked whether they (or their spouse) own any stocks or mutual funds. Respondents with DC pensions are asked whether any of the DC balance is invested in stocks. Although there was an increase in the percentage of the cohort holding stocks, from about 34 percent in wave 1 to 40 percent in wave 4, the primary cause of the increase in stock wealth was gains in the value of stocks per household, not in the number of owners. Housing wealth increased at a rate somewhat higher than the rate of increase of consumer prices, which was about 2 percent per year over each two-year period.

The change from wave to wave in cross-section income and wealth is not necessarily the average change experienced by individuals in the cohort because of cohort effects, differential mortality, and differential sample attrition by socioeconomic stratum. Table 4.2 controls for cohort effects and changes in composition by following the same individuals over each two-year panel comparison. For example, we observe data on 8,805 age-eligible

**Table 4.2** **Average income and wealth (thousands) of age-eligible respondents, panel.**

| Wave | *N* | Total household income | Total wealth | Financial | Housing | Stock | Number stock owners | Percent stock owners |
|---|---|---|---|---|---|---|---|---|
| | | | | *All* | | | | |
| 1 | 8,805 | 46.8 | 209.0 | 48.3 | 60.8 | 19.4 | 3061 | 34.8 |
| 2 | 8,805 | 50.5 | 238.9 | 60.6 | 67.5 | 25.7 | 3167 | 36.0 |
| 2 | 8,066 | 51.3 | 240.2 | 61.4 | 67.6 | 25.7 | 2986 | 37.0 |
| 3 | 8,066 | 54.1 | 266.0 | 70.9 | 72.2 | 36.1 | 2969 | 36.8 |
| 3 | 7,732 | 54.6 | 272.0 | 72.5 | 73.6 | 37.3 | 2874 | 37.2 |
| 4 | 7,732 | 54.9 | 314.3 | 90.8 | 87.1 | 51.1 | 2814 | 36.4 |
| 4 | 10,202 | 60.8 | 308.5 | 87.4 | 85.3 | 50.0 | 4044 | 39.6 |
| 5 | 10,202 | 63.2 | 365.5 | 104.5 | 97.5 | 62.9 | 4127 | 40.5 |
| 5 | 9,703 | 64.3 | 370.4 | 105.9 | 99.2 | 64.5 | 3985 | 41.1 |
| 6 | 9,703 | 61.6 | 373.2 | 98.4 | 111.1 | 49.8 | 3716 | 38.3 |
| | | | | *Stock owners in both waves* | | | | |
| 1 | 2,417 | 70.0 | 395.5 | 126.1 | 91.8 | 64.3 | 2417 | 100.0 |
| 2 | 2,417 | 81.0 | 473.9 | 156.0 | 111.7 | 81.7 | 2417 | 100.0 |
| 2 | 2,401 | 81.5 | 457.3 | 151.6 | 107.7 | 78.3 | 2401 | 100.0 |
| 3 | 2,401 | 85.6 | 520.0 | 185.4 | 111.7 | 112.2 | 2401 | 100.0 |
| 3 | 2,258 | 87.0 | 536.2 | 187.6 | 118.0 | 111.8 | 2258 | 100.0 |
| 4 | 2,258 | 89.6 | 651.4 | 242.4 | 149.0 | 156.7 | 2258 | 100.0 |
| 4 | 3,219 | 96.3 | 588.8 | 224.2 | 123.9 | 144.9 | 3219 | 100.0 |
| 5 | 3,219 | 103.4 | 704.1 | 260.0 | 148.6 | 178.7 | 3219 | 100.0 |
| 5 | 2,943 | 106.0 | 741.2 | 276.0 | 157.7 | 189.1 | 2943 | 100.0 |
| 6 | 2,943 | 101.3 | 734.9 | 246.4 | 177.5 | 148.6 | 2943 | 100.0 |
| | | | | *Stock owners in neither wave* | | | | |
| 1 | 4,994 | 32.2 | 106.3 | 11.8 | 42.1 | 0.0 | 0 | 0.0 |
| 2 | 4,994 | 32.7 | 110.5 | 14.9 | 45.5 | 0.0 | 0 | 0.0 |
| 2 | 4,512 | 33.4 | 111.5 | 14.2 | 42.7 | 0.0 | 0 | 0.0 |
| 3 | 4,512 | 34.8 | 118.9 | 13.0 | 47.9 | 0.0 | 0 | 0.0 |
| 3 | 4,302 | 34.1 | 118.9 | 12.7 | 48.0 | 0.0 | 0 | 0.0 |
| 4 | 4,302 | 34.0 | 122.6 | 13.5 | 52.8 | 0.0 | 0 | 0.0 |
| 4 | 5,250 | 37.9 | 123.7 | 11.7 | 51.7 | 0.0 | 0 | 0.0 |
| 5 | 5,250 | 37.0 | 142.3 | 16.4 | 57.9 | 0.0 | 0 | 0.0 |
| 5 | 4,945 | 37.0 | 143.0 | 15.9 | 58.5 | 0.0 | 0 | 0.0 |
| 6 | 4,945 | 36.6 | 154.3 | 19.5 | 67.4 | 0.0 | 0 | 0.0 |
| | | | | *Entrants into stock owning* | | | | |
| 1 | 750 | 53.9 | 215.9 | 27.1 | 74.7 | 0.0 | 0 | 0.0 |
| 2 | 750 | 59.3 | 312.2 | 73.2 | 80.8 | 38.0 | 750 | 100.0 |
| 2 | 568 | 61.0 | 264.3 | 49.6 | 82.7 | 0.0 | 0 | 0.0 |
| 3 | 568 | 66.7 | 345.6 | 82.0 | 94.3 | 37.9 | 568 | 100.0 |
| 3 | 556 | 65.0 | 291.7 | 35.9 | 83.6 | 0.0 | 0 | 0.0 |
| 4 | 556 | 73.3 | 447.2 | 128.1 | 97.2 | 73.7 | 556 | 100.0 |
| 4 | 908 | 59.3 | 274.2 | 33.6 | 87.4 | 0.0 | 0 | 0.0 |
| 5 | 908 | 74.6 | 444.2 | 123.5 | 114.4 | 72.7 | 908 | 100.0 |
| 5 | 773 | 64.6 | 374.0 | 37.5 | 135.7 | 0.0 | 0 | 0.0 |
| 6 | 773 | 68.6 | 444.9 | 114.7 | 127.0 | 60.0 | 773 | 100.0 |

**Table 4.2** (continued)

| Wave | *N* | Total household income | Total wealth | Financial | Housing | Stock | Number stock owners | Percent stock owners |
|---|---|---|---|---|---|---|---|---|
| | | | | *Exiters from stock owning* | | | | |
| 1 | 644 | 64.4 | 297.1 | 63.6 | 73.9 | 23.6 | 644 | 100.0 |
| 2 | 644 | 64.2 | 266.9 | 42.6 | 56.7 | 0.0 | 0 | 0.0 |
| 2 | 585 | 55.8 | 318.1 | 66.4 | 80.5 | 33.6 | 585 | 100.0 |
| 3 | 585 | 61.3 | 281.0 | 36.7 | 76.4 | 0.0 | 0 | 0.0 |
| 3 | 616 | 70.1 | 354.9 | 100.8 | 79.9 | 58.7 | 616 | 100.0 |
| 4 | 616 | 56.2 | 296.8 | 41.6 | 90.1 | 0.0 | 0 | 0.0 |
| 4 | 825 | 69.8 | 428.9 | 94.8 | 146.3 | 52.9 | 825 | 100.0 |
| 5 | 825 | 60.8 | 378.6 | 37.8 | 131.1 | 0.0 | 0 | 0.0 |
| 5 | 1,042 | 76.0 | 399.5 | 103.4 | 100.2 | 66.2 | 1042 | 100.0 |
| 6 | 1,042 | 62.2 | 336.8 | 43.2 | 118.6 | 0.0 | 0 | 0.0 |

*Source:* Authors' calculations, based on HRS.

*Note:* Financial wealth, measured in nominal dollars, is the sum of the holdings of stocks, checking and savings accounts, bonds, certificates of deposit, and other, minus debt. See table 4.3 for detailed listings.

persons over the two-year period between waves 1 and 2. The income of the households of those respondents increased from about $46.8 thousand to $50.5 thousand, an increase of about 8 percent. This compares with a cross-section two-year change from $46.1 to $50.5 (table 4.1). Overall, the change in the panel is about the same as the change in the cross-section, which shows that differential mortality and differential sample attrition are not very important determinants of the characteristics of the HRS sample.[7] As far as the wealth components are concerned, they also changed in the panel in about the same way as in the cross-section.

The second panel of table 4.2 shows income and wealth of those who were owners of stocks in both of two consecutive waves. A comparison of income in wave 2 among the 2,417 who survived in the panel from wave 1 to wave 2 ($81.0) with the income in wave 2 of the 2,401 who survived from wave 2 to wave 3 ($81.5) shows that the panel aspects of the income data are not very important at the aggregate level. Similar comparisons across the other waves lead to the same conclusion.

The levels of total wealth and financial wealth of stockholders were much greater than average wealth. For example, in wave 1 stock owners had total wealth of about $395,500 whereas average wealth was just $209,000. Furthermore, the growth of wealth between the waves was much

7. Although differential morality is rather strong, the total number of deaths is too small to have much influence on the sample characteristics.

greater, especially between waves 3 and 4 and 4 and 5. Possibly more relevant than the rate is the absolute level of the wealth of stockholders: wealth increased by about $115,000 between waves 3 and 4, and by $116,000 between waves 4 and 5. Only a relatively small fraction of the increase could have come from saving out of income, because the two-year total income was only about $175,000 between waves 3 and 4 and $200,000 between waves 4 and 5. This relationship between wealth increase and income is in sharp contrast to the wealth change of the entire sample: for everyone, wealth increased by $42,000, yet total income was about $55,000 per year, or $110,000 over the two years between waves. Thus, for stockholders, the achieved saving rate out of pretax income between waves 3 and 4 including capital gains was about 65 percent, whereas for the entire sample it was about 39 percent.

Among stock owners, wealth in housing was considerably higher than average, and the growth rate was somewhat higher over the six waves, about 115 percent compared with 80 percent for everyone. Whether housing wealth increased by converting some of the stock gains to housing would require study of the detailed transactions. In any event, the gains are only modestly larger among stockholders: for example, between waves 3 and 4, the housing wealth of stockholders increased by 26 percent compared with a gain of 18 percent among nonstockholders.

Among stockholders in both waves, stock wealth increased between waves 3 and 4 by about $45,000, or 40 percent. Over this same approximate period the New York Stock Exchange Composite Index increased by 57 percent.[8] We do not know whether to attribute the difference in the rates of return to difference in portfolios or to a rebalancing of portfolios.

The third panel shows the financial situation of those who did not own stock in either of two successive waves. For example, 4,994 persons were in households that did not own stock either in wave 1 or wave 2. It is apparent that this group had much lower levels of income and of all types of assets, including housing, and that the rates of growth of assets were approximately zero. Furthermore, this is the largest group of those considered here, about 60 percent of the sample.

The next panel shows income and wealth of those who did not own stock in a baseline wave but did own stock in the succeeding wave. The average income in this group was mostly higher than of the entire sample, and considerably higher than the income of those who were not stock owners, but it was lower than the income of stock owners in both waves. This group had large wealth increases, especially between waves 3 and 4, and 4 and 5: about $160,000, even more than among stock owners in both waves. Even among this group, which had very large wealth gains, little if any was put

8. June 1, 1996 to June 1, 1998.

into housing. For example, even though total wealth increased by about 53 percent between waves 3 and 4, average housing wealth increased by about 16 percent. The gain is similar to those who do not hold stocks: their housing wealth gain was 10 percent.

The final panel of table 4.2 shows the financial information of those who owned stock in a baseline wave but not in the succeeding wave. Thus, 664 persons were in households that exited from the stock market between waves 1 and 2. The overall pattern is one of fairly high wealth levels at the baseline wave but substantially lower wealth at the next wave. Thus, ownership of stock predicts high wealth in cross-section, but eliminating stock from the portfolio predicts a fall in wealth. Furthermore, the decline in wealth was greater than the decline in the value of stockholdings. For example, between waves 1 and 2, stock wealth declined by about $24,000 but total wealth declined by about $30,000. Housing wealth declined particularly between waves 1 and 2. Overall, these figures suggest some financial distress, leading the households to sell off their stockholdings and even reduce their housing wealth.

In summary, table 4.2 shows very active wealth dynamics, with some groups gaining considerable wealth and some groups losing considerable wealth. From the point of view of wealth inequality, the groups with the highest initial wealth had the greatest wealth gains, both in absolute terms and relative terms. These results suggest increasing wealth inequality over time in the HRS cohort.

Because of the very large wealth changes between waves 4 and 5, we show in table 4.3 the detailed components of wealth in the panel over those waves. Among all households, the value of IRAs, housing, and stock wealth increased notably. The large increase in IRAs was probably at least partly due to the stock market boom, but the HRS does not have very good information about the composition of IRAs.[9] The other components of wealth were little changed.

Among those who owned stocks in both waves, the value of IRAs, stock wealth, and housing increased. Holdings of CDs, checking and saving and bonds changed very little, suggesting little rebalancing of portfolios in response to the stock market gains.

Among those who were not stock owners, average holdings of each type of wealth was small, with the exception of housing. Furthermore, except for a 37 percent increase in IRAs, none of the wealth components increased substantially. While this group, which constitutes about 60 percent of our sample, has rather low levels of financial assets, it includes many people who are still in their fifties and still have time to save before

9. From 1998 on HRS asks whether an IRA held stocks. If so, whether the IRA is held mostly in interest-bearing assets, mostly in stocks or about half in each.

**Table 4.3** **Wealth and wealth components, waves 4 and 5 (thousand)**

| | All $N = 10,202$ | | | Stock owners both waves $N = 2,593$ | | | Stock owners neither wave $N = 5,899$ | | | Stock owners Wave 4 only $N = 877$ | | | Stock owners Wave 3 only $N = 833$ | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Wave 4 | Wave 5 | Change | Wave 4 | Wave 5 | Change | Wave 4 | Wave 5 | Change | Wave 4 | Wave 5 | Change | Wave 4 | Wave 5 | Change |
| Bond | 6.8 | 6.0 | –0.7 | 20.9 | 17.2 | –3.7 | 0.8 | 0.6 | –0.1 | 5.8 | 11.8 | 6.0 | 6.1 | 3.4 | –2.7 |
| Business | 32.2 | 37.7 | 5.5 | 57.3 | 68.1 | 10.8 | 17.5 | 16.3 | –1.2 | 28.2 | 53.7 | 25.6 | 62.2 | 77.2 | 15.0 |
| CD | 7.4 | 9.2 | 1.8 | 14.3 | 18.0 | 3.7 | 3.7 | 5.2 | 1.5 | 8.1 | 10.7 | 2.6 | 10.5 | 8.3 | –2.2 |
| Check | 16.9 | 19.3 | 2.5 | 33.2 | 35.7 | 2.4 | 8.7 | 10.8 | 2.1 | 18.9 | 25.7 | 6.8 | 21.5 | 22.3 | 0.8 |
| Debt | 4.4 | 3.6 | –0.8 | 3.2 | 2.9 | –0.3 | 4.5 | 3.9 | –0.7 | 4.6 | 3.9 | –0.7 | 7.2 | 4.1 | –3.1 |
| IRA | 46.9 | 64.0 | 17.1 | 102.7 | 142.2 | 39.5 | 17.7 | 24.3 | 6.6 | 56.2 | 76.8 | 20.6 | 70.6 | 88.1 | 17.4 |
| Nethouse | 85.3 | 97.5 | 12.2 | 133.6 | 161.7 | 28.2 | 53.1 | 59.8 | 6.8 | 96.2 | 123.8 | 27.6 | 152.2 | 136.4 | –15.8 |
| Real estate | 41.3 | 46.1 | 4.8 | 82.3 | 93.4 | 11.1 | 17.1 | 20.6 | 3.5 | 62.7 | 74.1 | 11.4 | 61.9 | 49.8 | –12.1 |
| Other | 10.9 | 10.8 | –0.1 | 27.5 | 23.6 | –3.9 | 3.7 | 4.3 | 0.6 | 9.3 | 18.4 | 9.1 | 11.4 | 8.4 | –3.0 |
| Stock | 50.0 | 62.9 | 12.9 | 173.5 | 216.2 | 42.7 | 0.0 | 0.0 | 0.0 | 0.0 | 91.9 | 91.9 | 72.3 | 0.0 | –72.3 |
| Transp | 15.4 | 15.8 | 0.3 | 24.3 | 25.1 | 0.8 | 10.9 | 10.8 | –0.1 | 17.1 | 19.5 | 2.3 | 18.5 | 17.9 | –0.6 |
| Total | 308.5 | 365.5 | 57.0 | 666.3 | 798.4 | 132.1 | 128.6 | 148.9 | 20.3 | 298.0 | 502.6 | 204.6 | 480.1 | 407.7 | –72.3 |

*Source:* Authors' calculations, based on HRS.

retirement. Furthermore, they are likely to be qualified for Social Security benefits, and some may anticipate pension income. However, because of the positive correlation between household wealth and pension eligibility, it is likely that many of the households in this group do not have rights to a pension.

Among new entrants to the stock market, there were very substantial gains in wealth. Aside from the increase in stock wealth, there were large increases in business wealth, IRAs, and housing.

Those who left the stock market between waves had large declines in housing and real estate as well as in stocks. The notable exception to the overall fall in wealth was an increase in IRAs. Apparently IRAs were shielded from the economic distress that is evident from the large wealth decline.

## 4.3 Labor Force Participation in the HRS

Work status is derived from a self-report: whether working for pay, hours worked, and a self-classification as to retired, partially retired, or not retired. From this, people are coded as working full-time, part-time, unemployed, partly retired, retired, or not in the labor force. A combination of the first four categories corresponds to the current population survey (CPS) definition of labor force participation.

Across the six waves of the HRS, we observe a decline in the percentage of people working full time and part time (table 4.4), with a small up-tick between waves 3 and 4 because of the inclusion of the younger War Baby cohort, which is reflected in the increase in sample size. The percentage of the sample retired increased across waves for both full and partial retirement. Labor force participation declined with age (fig. 4.1). When compared with the labor force participation rates from the CPS, the HRS indicates slightly higher participation rates, although the trend line is mirrored (not shown). Labor force participation at each age was relatively constant for all interview years of the HRS (not shown). An exception is labor force participation by those aged approximately sixty-two to sixty-seven, where participation increased especially between waves 4 and 5. At the gross level of population participation this increase is at odds with a substantial stock market wealth effect.

Table 4.5 shows transitions from full-time work. About 79 percent of full-time workers in wave 1 were working full time in wave 2. With the exception of 1998, when the War Baby cohort was added, in each successive wave the transition rate to full-time work decreased and the rates of retirement increased. There was some part-time work, but the dominant route to retirement among full-time workers was to complete withdrawal from the labor force.

**Table 4.4 Labor force status**

| | 1992 | | 1994 | | 1996 | | 1998 | | 2000 | | 2002 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | *N* | Percent | *N* | Percent | *N* | Percent | *N* | Percent | *N* | Percent | *N* | Percent |
| Full time | 5,394 | 55 | 4,333 | 49 | 3,592 | 42 | 4,856 | 43 | 3,921 | 37 | 3,070 | 30 |
| Part time | 989 | 10 | 832 | 9 | 612 | 7 | 861 | 8 | 754 | 7 | 659 | 6 |
| Unemployed | 254 | 3 | 216 | 2 | 134 | 2 | 141 | 1 | 127 | 1 | 135 | 1 |
| Partly retired | 330 | 3 | 444 | 5 | 621 | 7 | 794 | 7 | 865 | 8 | 950 | 9 |
| Retired | 1,308 | 13 | 1,861 | 21 | 2,273 | 27 | 2,870 | 26 | 3,305 | 31 | 3,997 | 39 |
| Not in labor force, not retired | 1,494 | 15 | 1,158 | 13 | 1,235 | 15 | 1,669 | 15 | 1,612 | 15 | 1,473 | 14 |
| Total | 9,769 | 100 | 8,844 | 100 | 8,467 | 100 | 11,191 | 100 | 10,584 | 100 | 10,284 | 100 |

*Source:* Authors' calculations, based on HRS.

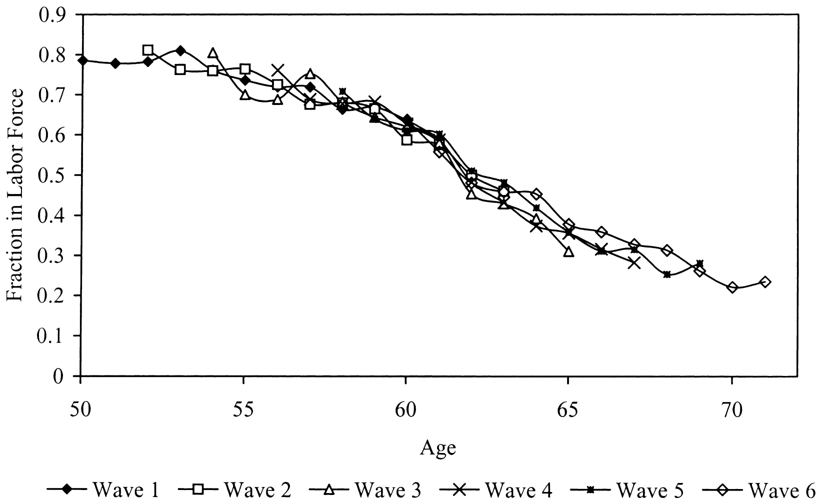


**Fig. 4.1 Labor force participation rates, cross-section**

**Table 4.5 Transition rates from full-time work**

| | Employment status in following wave | | | | | All | |
|---|---|---|---|---|---|---|---|
| Baseline | Full time | Part time | Unemployed | Partly retired | Not in labor force | *N* | Percent |
| 1992 | 79.3 | 5.4 | 1.9 | 3.0 | 10.4 | 4,903 | 100 |
| 1994 | 76.0 | 4.6 | 1.2 | 4.9 | 13.3 | 3,992 | 100 |
| 1996 | 74.0 | 4.5 | 1.2 | 5.7 | 14.6 | 3,302 | 100 |
| 1998 | 75.4 | 5.0 | 1.1 | 4.7 | 13.9 | 4,462 | 100 |
| 2000 | 70.1 | 5.8 | 1.9 | 6.0 | 16.3 | 3,644 | 100 |

*Source:* Authors' calculations, based on HRS.

## 4.4 Anticipated Retirement

A major strength of the HRS is that it asks about anticipated retirement. This is especially important for this research, as we can study the change in anticipated retirement and compare actual retirement with anticipated. We will base anticipated retirement on the subjective probability of working past age sixty-two. It was asked of all workers in the following way:

> Thinking about work generally and not just your present job, what do you think are the chances that you will be working full time after you reach age sixty-two?

The respondents had already been told to evaluate their chances "On a scale of 0 to 100 where 0 equals absolutely no chance and 100 equals absolutely certain . . ." If the chances of working after age sixty-two were positive, the worker was asked about the chances of working after age sixty-five. Because of the high rates of retirement at or near sixty-two, we will base our measure of anticipated retirement on the chances of working after age sixty-two, which we call P62.

In waves 2 to 6 the subjective probability question was asked on a 101-point schedule. In wave 1 scaling was on an eleven-point scale, 0–10. We have analyzed the change in P62 from waves 1 to 2 and found an unexplained decline in P62 among those who worked in both waves. We found no declines in other waves and the decline is not according to the laws of probability: among those who remain in the labor force, P62 should increase in panel as it does in other waves. Because of this unexplained decline we will not make comparisons between waves 1 and 2. For the purposes of this chapter, dropping this comparison is not important, because the stock market boom did not begin until approximately wave 3 in 1996.

As far as the validity of P62 is concerned, it has been shown to vary in cross-section with variables that induce retirement or are related to retirement. For example, eligibility for a DB benefit before age sixty-two is associated with actual retirement prior to age sixty-two, and it reduces P62 (Hurd and McGarry 1993). The implication is that P62 will predict actual retirement, and, indeed, it has considerable predictive power for retirement in the HRS panel (Hurd 1999). While these results indicate that P62 has validity in a qualitative sense, in this chapter we would like to establish the validity of P62 as a predictor of the quantity of full-time work at age sixty-two. To do that, we would like to answer two main questions: Does P62 predict continuation of workers in full-time work? Is it properly scaled; that is, does it predict the level of full-time work at or shortly after age sixty-two?

The first question, whether it predicts continuation in full-time work, can be addressed by finding whether those with lower subjective probabilities tend to leave full-time work before age sixty-two at a higher rate than those with higher subjective probabilities. Even if the subjective probability of working past sixty-two is not properly scaled, it could still be an adequate predictor of continuation in full-time work until age sixty-two.

Table 4.6 shows the average P62 as reported in earlier waves as a function of work status in later waves. For example, 193 respondents who were age sixty-two in wave 6 (2002) and working full time reported an average P62 of 58.2 percent in wave 2 when they were approximately age fifty-four. They can be compared with 291 respondents who were not working full time in wave 6: they reported an average P62 of 37.3 percent in wave 2. This and other similar comparisons show that P62 is a rather consistent predictor of working full time after age sixty-two, even when assessed up to eight years earlier.

The second question—whether P62 is properly scaled, could in principle

**Table 4.6** ***P62* as a qualitative predictor of labor force participation: mean *P62* by age and work status in 2002. Panel data, age-eligible cohort**

| | | Full time in 2002 | | Not working full time in 2002 | |
|---|---|---|---|---|---|
| Baseline wave | Age in 2002 | Observations | Mean P62 | Observations | Mean P62 |
| Wave 2 | 61 | 252 | 55.8 | 239 | 36.0 |
| | 62 | 193 | 58.2 | 291 | 37.3 |
| | 63 | 140 | 61.9 | 294 | 37.7 |
| | 64 | 143 | 61.1 | 262 | 33.9 |
| Wave 3 | 61 | 267 | 58.5 | 209 | 34.4 |
| | 62 | 187 | 57.1 | 257 | 36.3 |
| | 63 | 147 | 62.2 | 285 | 34.0 |
| | 64 | 147 | 63.7 | 245 | 40.6 |
| Wave 4 | 61 | 263 | 57.1 | 191 | 35.4 |
| | 62 | 194 | 65.8 | 241 | 31.7 |
| | 63 | 140 | 67.4 | 250 | 38.1 |
| | 64 | 149 | 70.1 | 221 | 41.1 |
| Wave 5 | 61 | 260 | 63.8 | 152 | 36.7 |
| | 62 | 191 | 74.7 | 188 | 40.2 |
| | 63 | 135 | 82.1 | 203 | 40.2 |
| | 64 | 34 | 75.6 | 29 | 47.9 |

*Source:* Authors' calculations, based on HRS.

be answered by comparing the average of P62 in some population with the average rate of full-time work when that population reaches sixty-two. This would be a valid comparison, because the expected participation rate of each individual at age sixty-two is just P62, so the average population participation rate would be approximately the average P62.[10] There are, however, several obstacles to carrying out this comparison. First, even if each individual correctly states his or her probability of working past sixty-two, intervening events, such as an unexpected change in health status, will cause a revision in P62. By itself, such a revision will not cause a divergence between the average of the subjective probabilities and the average population rate of working full time after age 62. If a population were fully informed of the probabilities of events that could influence retirement, these contingencies would be included in the calculation of P62. Thus, under rational expectations in a stationary environment, the average P62 should accurately predict the average rate of full-time work after age sixty-two. However, if there were unanticipated events that affect the entire population, the average of the subjective probability of working past sixty-two would

10. Actual participation at age sixty-two is a binomial random variable that takes the value of 1 with probability *P*62 and the value of 0 with probability 1–*P*62. Then, the expected value of the average of the random variables will be the average of the *P*62.

no longer predict the average rate of working full time after sixty-two. Such events might be an unanticipated improvement in health in the population or an unanticipated increase or decrease in wealth, such as that which resulted from the stock market gains during the 1990s and subsequent losses.

We can test for proper scaling in two ways. First, we observe part of the population in, say, wave 2 that will reach age sixty-two in some future wave. The average P62 among workers in wave 2 should approximate the fraction of those same workers who are working full time at age sixty-two. Similar calculations can be made for other waves. Unfortunately, the query about P62 is somewhat ambiguous, and could be interpreted as working full time shortly after the sixty-second birthday or by the end of the year in which the person was sixty-two years old. Our response to the ambiguity will be to find the fraction of sixty-two-year-olds working full time and the fraction of sixty-three-year-olds working full-time.

Table 4.7 shows averages of P62 and actual rates of working full-time at ages sixty-two and sixty-three. The averages of P62 were calculated over workers in waves 2, 3, 4, or 5 who at the time of interview were less than age sixty-two; the actual rates of full-time work were calculated over data from

**Table 4.7 P62 as a quantitative predictor of labor force participation. Panel data, age-eligible cohort**

| | Age in 1996 | | Age in 1998 | | Age in 2000 | | Age in 2002 | |
|---|---|---|---|---|---|---|---|---|
| Baseline wave | 62 | 63 | 62 | 63 | 62 | 63 | 62 | 63 |
| Wave 2 | | | | | | | | |
| Observations | 347 | 322 | 420 | 371 | 416 | 411 | 484 | 434 |
| Mean P62 | 51.3 | 54.9 | 45.5 | 51.2 | 46.9 | 41.9 | 45.6 | 45.5 |
| Percent working full time | 45.8 | 42.2 | 41.7 | 38.8 | 43.3 | 37.7 | 39.9 | 32.3 |
| Wave 3 | | | | | | | | |
| Observations | | | 391 | 274 | 392 | 394 | 444 | 432 |
| Mean P62 | | | 49.9 | 60.7 | 50.1 | 45.9 | 45.0 | 43.6 |
| Percent working full time | | | 46.3 | 47.4 | 45.7 | 40.9 | 42.1 | 34.0 |
| Wave 4 | | | | | | | | |
| Observations | | | | | 370 | 313 | 435 | 390 |
| Mean P62 | | | | | 51.5 | 53.9 | 46.9 | 48.6 |
| Percent working full time | | | | | 48.4 | 46.0 | 44.6 | 35.9 |
| Wave 5 | | | | | | | | |
| Observations | | | | | | | 379 | 338 |
| Mean P62 | | | | | | | 57.6 | 57.0 |
| Percent working full time | | | | | | | 50.4 | 39.9 |

*Source:* Authors' calculations, based on HRS.

later waves of workers who had passed their sixty-second birthday. For example, we identified 347 people who were age sixty-two in wave 3 and who were working in wave 2 when they would have been approximately age sixty. In wave 2, their average subjective probability of working past sixty-two was 51.3 percent, yet just 45.8 percent were observed working full time when they were age sixty-two in wave 3. Similarly, we identified 322 people who were age sixty-three in wave 3 and were working in wave 2 when they would have been approximately age sixty-one. Their average subjective probability of working past sixty-two was 54.9 percent, but just 42.2 percent were actually working full time in wave 3. The divergence between P62 and the percentage working full time is much greater in the second column than in the first column because some left full-time work while age sixty-two. A comparison in the other waves between the average subjective probability of working past sixty-two and the actual rate of full-time work shows similar discrepancies: the average of the subjective probability is about 4.2 percentage points higher than the actual rate of full-time work at age sixty-two and about 10.3 percentage points higher than the rate at age sixty-three. We conclude that the most plausible target age is age sixty-two, and that the main reason for the difference between P62 and the rate of full-time work among respondents who are sixty-two is due to retirement shortly after reaching age sixty-two. Even so, the differences are small enough that they do not raise serious questions about the validity of the P62 measure. Of course, it is plausible that unanticipated macro-events caused the entire population to leave the labor force earlier than anticipated.

A second method of studying P62 for proper scaling is based on the population properties of P62 and how they evolve in the panel. The population properties of P62 are broadly of two types: successive cross-sections and panel. To see how they evolve, consider two extreme situations: in the first retirement is a completely controlled process with no uncertainty. At wave 1 all workers know their retirement ages, and if it is less than sixty-two, P62 is zero; if it is greater than sixty-two, P62 is 1. Between waves 1 and 2 some workers reach their retirement ages and retire. Under the assumption that no one reenters the labor force, the probability that the leavers would work past sixty-two is zero, but because they correctly knew they would be leaving the labor force between waves 1 and 2, they would have reported P62 to be zero in wave 1. Thus were we to assign P62 to be zero in wave 2, it would be unchanging in the panel over this group.

Those who remained in the labor force from wave 1 to 2 continue to anticipate retiring at the same age as in wave 1, so P62 is either zero or 1, as it was in wave 1. In panel the average P62 would be constant over this group. Therefore, the average P62 would be constant in panel when averaged over the population of both workers and leavers and the cross-section average would be the same in both waves. The cross-section average calculated only over workers would of necessity increase, because in wave 2 that average excludes the leavers and they all reported P62 to be zero in wave 1.

Now consider the other extreme, where retirement is completely stochastic—caused by a random health event or a random layoff. Under the assumption of rationality (workers know the probabilities of all events), P62 at time $t$ given that someone is in the labor force would be calculated as

$$(1) \quad (P62_t | LF_t) = (P62_{t+1} | not\ LF_{t+1})P(not\ LF_{t+1}) + (P62_{t+1} | LF_{t+1})P(LF_{t+1}).$$

If

$$(P62_t | LF_t) < (P62_{t+1} | LF_{t+1})$$

then

$$(P62_{t+1} | not\ LF_{t+1}) < (P62_{t+1} | LF_{t+1}).$$

This relationship holds at the individual level, so that when P62 is averaged over those who are in the labor force both at $t$ and at $t + 1$, P62 will increase in the panel.

The population average of P62 in wave $t + 1$ regardless of labor force status is

$$\frac{1}{n}\sum(P62_{t+1}) = \frac{1}{n}\sum[(P62_{t+1} | not\ LF_{t+1})P(not\ LF_{t+1}) + (P62_{t+1} | LF_{t+1})P(LF_{t+1})]$$

But the terms on the right-hand side of this equation are the same as the right-hand side of (1), so that the average P62 is constant in panel when calculated over the population, regardless of labor force status in $t + 1$. This implies that the cross-section average over the whole population will be unchanging.[11]

The average P62 over workers in cross-section will increase from wave to wave provided the average P62 reported in wave 1 by the leavers is the same or smaller than the average reported by stayers. This condition will hold provided P62 has explanatory power for retirement.

We would expect the actual situation to lie somewhere between the two extremes: some workers are quite sure of their retirement age because of pension provisions or tastes. Others have only weakly defined retirement preferences and wait for random events to unfold. Nonetheless, the predictions are the same: in a stable environment, average P62 should remain constant as a cohort ages. Even though new information may arrive at the individual level, causing individuals to reassess their own subjective prob-

11. Assuming no entry into or exit from the population.

ability, the revisions should roughly sum to zero, because individuals will have correctly forecast the average probabilities of the new information and the resulting revisions.

Were the probability of reentry to the labor force zero, it would be rather easy to test for panel consistency of average P62. We would first find the average over workers in wave $t$. Under stationarity

$$\overline{P62_t} = \frac{1}{n_1}\sum P62_t = \frac{1}{n_t}\sum P62_{t+1},$$

where there are $n_t$ workers at $t$. Then

$$\frac{1}{n_t}\sum P62_{t+1} = \frac{1}{n_t}\left[\sum(P62_{t+1}\,|\,LF_{t+1}) + \sum(P62_{t+1}\,|\,not\ LF_{t+1})\right].$$

Under the assumption that

$$\sum(P62_{t+1}\,|\,not\ LF_{t+1}) = 0$$

the observed average over the working population would be

$$\text{(2)}\qquad \overline{P62_t} = \frac{n_{t+1}}{n_t}\frac{1}{n_{t+1}}\sum(P62_{t+1}\,|\,LF_{t+1}) = \frac{n_{t+1}}{n_t}\times\overline{P62_{t+1}}.$$

If $(n_{t+1})/(n_t)$, which is the retention rate in the labor force, is less than 1, as it would be among those in their fifties, the average P62 will increase with age. A test of stationarity (with rational expectations) is that the average of P62 among those in the labor force evolves according to (2).

It is likely, however, that some who leave the labor force will return; hence the probability of working past sixty-two among those who left the labor force between a baseline wave and the succeeding wave is not zero. Because P62 is only asked of those who are working, we have no respondent reports by those who left the labor force on the probability of working past sixty-two. The HRS does, however, ask nonworkers about reentry into the labor force (date not specified), which should be powerfully related to their probability of working at age sixty-two. Therefore we estimate P62 among those who are working at wave $t$ but have left the labor force by wave $t + 1$ as follows.

We want $P62_t$ for the population that was working at $t$ (and reported $P62_t$) but was not working at $t + 1$. Our method is to fit a predictive model of working at age sixty-two over the population that was working at age $a$ but not working at age $a + 1$. The covariates in this model are age and the response to the following question:

> P016 (On this same 0 to 100 scale), what are the chances that you will be working for pay at some time in the future?

The left-hand variable is an indicator variable for whether the person is observed to be working at age sixty-two. For example, someone age fifty-

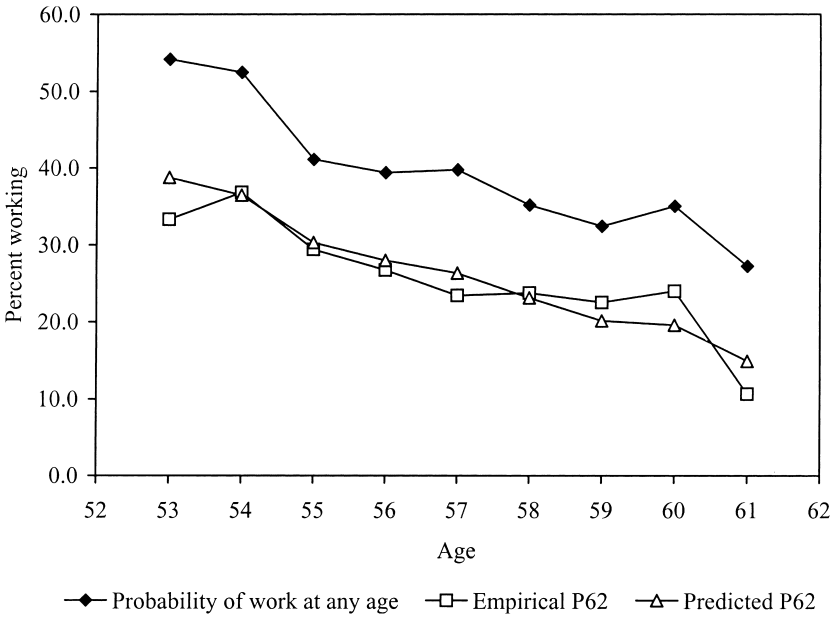


**Fig. 4.2 Actual and fitted probability of working at 62**

five and working in 1994 reported P62, but was not working in 1996. In the HRS such a person would be asked about the probability of working at some time in the future. In HRS 2002, when he was sixty-three, we observe whether this person was working in 2001 when he turned sixty-two. If so, the left-hand variable takes the value of 1, otherwise 0. The probability for working sometime in the future has high predictive power for working at age sixty-two: the estimated coefficient and standard error are 0.42 and 0.03, respectively. The interpretation is that a change in the subjective probability of working for pay from 0 to 100 will change the predicted probability of working full time after the age of sixty-two by 42 percentage points. We use this fitted equation to estimate $P62_{t+1}$ for the population that was working at $t$ (and reported $P62_t$) but was not working at $t + 1$.

Figure 4.2 shows the fitted and actual probabilities of working at age sixty-two among those in the labor force at $t$ but not in the labor force at $t + 1$, and the average values of P016.

Having calculated P62 for those who leave the labor force between wave $t$ and $t + 1$, we can find the panel change in P62 for all who were in the labor force at wave $t$ whether or not they remained in the labor force to wave $t + 1$.

Table 4.8 shows the results of our calculations of P62 in the panel. Among the 752 who were age fifty-four to fifty-five in wave 3, were work-

**Table 4.8 Average subjective probability of working after age 62; panel among those working at time $t$**

| Age and labor force status in wave $t + 1$ | Wave 2 to 3 | | | Wave 3 to 4 | | | Wave 4 to 5 | | | Wave 5 to 6 | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | $N$ | Wave $t$ | Wave $t + 1$ | $N$ | Wave $t$ | Wave $t + 1$ | $N$ | Wave $t$ | Wave $t + 1$ | $N$ | Wave $t$ | Wave $t + 1$ |
| Age 52–53 | | | | | | | | | | | | |
| Not in labor force | | | | | | | 43 | 34.3 | 39.2 | | | |
| In labor force | | | | | | | 509 | 48.5 | 46.5 | | | |
| All | | | | | | | 552 | 47.4 | 45.9 | | | |
| Age 54–55 | | | | | | | | | | | | |
| Not in labor force | 81 | 31.3 | 31.4 | | | | 64 | 28.3 | 33.0 | 53 | 29.3 | 33.7 |
| In labor force | 671 | 47.4 | 46.6 | | | | 490 | 45.9 | 47.1 | 416 | 47.8 | 48.9 |
| All | 752 | 45.7 | 45.0 | | | | 554 | 43.9 | 45.4 | 469 | 45.7 | 47.2 |
| Age 56–57 | | | | | | | | | | | | |
| Not in labor force | 107 | 28.7 | 26.6 | 72 | 28.9 | 28.1 | 73 | 22.8 | 23.4 | 80 | 29.5 | 28.9 |
| In labor force | 900 | 46.0 | 45.7 | 688 | 48.0 | 48.2 | 596 | 47.9 | 49.1 | 445 | 48.7 | 49.5 |
| All | 1007 | 44.2 | 43.6 | 760 | 46.2 | 46.3 | 669 | 45.1 | 46.3 | 525 | 45.8 | 46.3 |
| Age 58–59 | | | | | | | | | | | | |
| Not in labor force | 109 | 32.0 | 22.0 | 115 | 31.5 | 21.1 | 118 | 30.0 | 25.1 | 102 | 33.3 | 20.5 |
| In labor force | 765 | 46.4 | 48.3 | 787 | 46.9 | 47.7 | 747 | 48.3 | 52.9 | 481 | 51.0 | 52.7 |
| All | 874 | 44.6 | 45.0 | 902 | 45.0 | 44.3 | 865 | 45.8 | 49.1 | 583 | 47.9 | 47.1 |
| Age 60–61 | | | | | | | | | | | | |
| Not in labor force | 143 | 28.2 | 17.4 | 112 | 25.8 | 14.6 | 128 | 27.3 | 18.0 | 123 | 36.4 | 18.9 |
| In labor force | 689 | 50.2 | 55.8 | 676 | 51.7 | 53.2 | 674 | 52.3 | 58.6 | 626 | 55.0 | 56.3 |
| All | 832 | 46.4 | 49.2 | 788 | 48.0 | 47.7 | 802 | 48.3 | 52.1 | 749 | 51.9 | 50.1 |
| All ages | | | | | | | | | | | | |
| Not in labor force | 440 | 29.8 | 23.4 | 299 | 28.8 | 20.3 | 426 | 28.1 | 25.3 | 358 | 32.9 | 23.8 |
| In labor force | 3025 | 47.4 | 48.8 | 2151 | 48.8 | 49.6 | 3016 | 48.8 | 51.4 | 1968 | 51.1 | 52.3 |
| All | 3465 | 45.1 | 45.6 | 2450 | 46.3 | 46.0 | 3442 | 46.2 | 48.2 | 2326 | 48.3 | 47.9 |

*Source:* Authors' calculations, based on HRS.

*Note:* Wave $t$ refers to one of waves 2–5; wave $t + 1$ refers to one of waves 3–6. Subjective probability of working after age 62 in wave $t$ and in wave $t + 1$ is either reported by those still in the labor force or calculated for those not in the labor force.

ing in wave 2, and reported a value of P62 in that wave, the average value of P62 was 45.7 percent. This average is composed of 81 reports by those who left the labor force between wave 2 and 3 and of 671 by those who remained in the labor force. The average P62 of those who left was just 31.3 percent in wave 2. This shows again that P62 has considerable predictive power for labor force participation even at ages considerably less than sixty-two. Taking possible reentry into account, for that group we calculate P62 in wave 3 to be 31.4 percent. The average in wave 2 of those who remained in the labor force was 47.4 percent and the average in wave 3 was 46.6 percent. The overall average was 45.0 percent; therefore, the average probability of the cohort declined by 0.7 percentage points between the waves.

Because for this age group the predicted P62 in wave 3 among the leavers is about the same as their average in wave 2, stationarity in P62 requires that the average P62 of those who remained in the labor force also remain constant between the waves as it did.

Similar calculations for those who were fifty-six to fifty-seven in wave 3, and so forth show a sharply declining P62 by age among those who leave the labor force between the waves. This is mainly a consequence of the sharp decline in the probability of reentry, as shown in fig. 4.2. If workers knew the exact age at which they would retire, their reports of P62 would not change in the panel so that P62 would be constant among those who remained in the work force. If there are stochastic events that have positive probability of occurring and that can cause a worker to leave the labor force, the fact that a worker remained in the labor force should cause an upward revision in P62. Just as in a life table, survival for two years in the labor force increases the probability of survival in the labor force to any fixed age, such as sixty-two. We see this pattern in the age bands of fifty-eight to fifty-nine and sixty to sixty-one.

We cannot make similar calculations for those aged fifty-four to fifty-five in wave 4 because almost all of the age-eligibles were past that age by wave 4. For the other age groups, the patterns are similar, and for all ages taken together P62 was almost exactly constant across waves.

The War Babies were added to HRS in 1998 (wave 4). In most age bands the average P62 increased between waves 4 and 5.

At a broad level, the changes in P62 do not show any support for the hypothesis that the large capital gains, especially between waves 3 and 4, and 4 and 5 were used to finance early retirement or led to a reduction in P62. As shown in the last line of the table, the average change from wave 2 to 3 was 0.5, from wave 3 to 4 was –0.3, from wave 4 to 5 was 2.0, and from wave 5 to 6 was 0.4. The only substantial change was from wave 4 to 5, when the stock market increased sharply. A wealth effect would cause a reduction in P62 rather than an increase.

**Table 4.9** **Average wealth (thousands) of age-eligibles who are in the labor force at time *t* and report P62; panel**

| | *N* | Total household income | Total wealth | Financial | Housing | Stock | Number stock owners | Percent stock owners |
|---|---|---|---|---|---|---|---|---|
| Wave | | | | | | | | |
| 2 | 3,465 | 60.5 | 238.6 | 55.8 | 68.9 | 24.0 | 1,470 | 42.4 |
| 3 | 3,465 | 66.3 | 266.4 | 66.9 | 73.1 | 33.6 | 1,500 | 43.3 |
| Wave | | | | | | | | |
| 3 | 2,450 | 69.7 | 268.8 | 63.8 | 74.8 | 32.7 | 1,092 | 44.6 |
| 4 | 2,450 | 72.5 | 339.9 | 96.5 | 100.1 | 54.2 | 1,101 | 44.9 |
| Wave | | | | | | | | |
| 4 | 3,442 | 78.5 | 306.7 | 75.8 | 92.2 | 45.1 | 1,732 | 50.3 |
| 5 | 3,442 | 84.3 | 379.5 | 100.9 | 103.3 | 63.1 | 1,764 | 51.2 |
| Wave | | | | | | | | |
| 5 | 2,326 | 89.8 | 380.2 | 103.5 | 103.9 | 68.7 | 1,288 | 55.4 |
| 6 | 2,326 | 88.5 | 381.0 | 96.9 | 118.6 | 54.3 | 1,203 | 51.7 |

*Source:* Authors' calculations, based on HRS.

## 4.5 Wealth Change and Retirement Probabilities

We can, of course, perform a much sharper test of our hypothesis by studying wealth change at a more disaggregated level. So, we divided the sample according to whether a household held stocks either directly or held them indirectly in DC pension plans.[12] Table 4.9 has financial information about our analytical sample. The sample is composed of those who were working and reported P62 in wave *t*, and either reported P62 in wave $t + 1$ or left the labor force, allowing us to calculate P62 as we described earlier.[13] The income levels of this group are considerably higher than for the entire HRS population as reported in table 4.2, especially in the later waves. For example, average incomes in table 4.9 in waves 3 and 4 were about \$69.7 thousand and \$72.5 thousand, whereas for the entire population they were \$54.6 thousand and \$54.9 thousand. The main reason for the difference is that everyone in table 4.9 was working at baseline.

Wealth increased very substantially between waves 3 and 4, and 4 and 5. As would be expected from the run-up in the stock market, wealth in stocks increased, with a corresponding increase in financial wealth. But the increase in financial wealth only accounted for about one-third to one-half

12. The HRS did not record stock ownership in IRAs prior to 1998, so we have not included such ownership.
13. The sample size varies across tables because of missing values and sample selection. For example, table 4.9 includes all age-eligibles, but table 4.8 includes only those in the specified age bands, which excludes some age-eligibles.

of the total increase; other important components were housing and business wealth (not shown separately). Between wave 5 and 6, stock wealth declined, and when contrasted with the growth in prior waves, the rate of decline was substantial: taking the average growth rate in stock wealth between waves 3 and 5 would predict wave 6 stock wealth of about $105,000 rather than the actual $54,300.

The rate of stock ownership is much higher than in table 4.2, partly a reflection of the higher wealth of workers and the strong positive correlation between wealth and the propensity to hold stocks. Also, the table includes stock ownership via DC plans.

In table 4.10 we show the changes in the probability of working past sixty-two that are associated with the large wealth changes. As discussed earlier, the relevant population in each baseline wave is the working population, selected to include those who report P62 and also selected to include those for whom we have a value (either reported by the respondent or calculated) of P62 in the succeeding wave. We call the baseline wave $t$ and the succeeding wave $t + 1$. In waves 2 and 3 we observed 3,465 workers who satisfied these criteria (and for whom we had observations on household wealth, including their stock ownership status in both waves). Their average household wealth in wave $t$, which is wave 2 in this case, was $238,600, and their nominal wealth increased by 11.6% by wave $t + 1$ (wave 3). On average, P62 increased from 45.1 to 45.6. The average P62 in wave 3 is calculated over actual reports by those who remained in the labor force, and over our estimate of the probability of working past sixty-two among those who left the labor force between waves.

There were 1,206 respondents who were in households that owned stocks in both waves 2 and 3. These households had an average increase in wealth of 14.5 percent. Among the 1,701 respondents who did not own stocks in either wave, wealth increased by 5.2 percent. New entrants into stockholding had large wealth gains, and exiters from stockholding had almost constant nominal wealth.

In cross-section high wealth is associated with earlier expected retirement: those who owned stocks in both waves $t$ and $t + 1$ had the most wealth in wave $t$, and also the lowest average P62; those who owned stock in neither wave had both the lowest wealth and the highest P62. However, in the panel there is no systematic relationship between wealth change and the change in P62: stockowners in both waves and new entrants into stockholding both had large gains in wealth; yet in one case P62 was almost constant and in the other case it increased. Those who did not own stocks or those who left stockholding both had small or little wealth increases, yet P62 increased in one case and declined in the other.

Averaged over all respondents, wealth increased by 26.5 percent between waves 3 and 4, and 23.7 percent between waves 4 and 5. Comparing the overall change in wealth and P62 from waves 2 to 3 with the overall

**Table 4.10 Wealth (thousands) and the subjective probability of retirement; panel comparison**

| | Waves 2–3 | | | Waves 3–4 | | | Waves 4–5 | | | Waves 5–6 | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | *N* | Wealth | P62 | *N* | Wealth | P62 | *N* | Wealth | P62 | *N* | Wealth | P62 |
| All | | | | | | | | | | | | |
| Wave *t* | 3,465 | 238.6 | 45.1 | 2450 | 268.8 | 46.3 | 3442 | 306.7 | 46.2 | 2326 | 380.2 | 48.3 |
| Wave *t* + 1 | 3,465 | 266.4 | 45.6 | 2450 | 339.9 | 46.0 | 3442 | 379.5 | 48.2 | 2326 | 381.0 | 47.9 |
| Percentage change | | 11.6 | 1.0 | | 26.5 | –0.7 | | 23.7 | 4.2 | | 0.2 | –0.8 |
| Stock owners in both waves | | | | | | | | | | | | |
| Wave *t* | 1,206 | 404.6 | 43.5 | 890 | 449.7 | 44.6 | 1415 | 458.5 | 45.1 | 987 | 577.6 | 47.4 |
| Wave *t* + 1 | 1,206 | 463.5 | 43.7 | 890 | 594.7 | 45.9 | 1415 | 584.5 | 47.7 | 987 | 576.6 | 49.1 |
| Percentage change | | 14.5 | 0.5 | | 32.2 | 2.8 | | 27.5 | 5.8 | | –0.2 | 3.7 |
| Stock owners in neither wave | | | | | | | | | | | | |
| Wave *t* | 1,701 | 120.5 | 46.0 | 1147 | 125.0 | 46.7 | 1361 | 137.1 | 46.3 | 822 | 148.0 | 48.5 |
| Wave *t* + 1 | 1,701 | 126.8 | 46.5 | 1147 | 127.2 | 46.7 | 1361 | 161.3 | 47.9 | 822 | 161.0 | 47.0 |
| Percentage change | | 5.2 | 1.1 | | 1.7 | –0.1 | | 17.7 | 3.5 | | 8.8 | –3.2 |
| Entrant to stockownership | | | | | | | | | | | | |
| Wave *tw* | 294 | 201.3 | 47.8 | 211 | 300.6 | 51.2 | 349 | 222.7 | 54.1 | 216 | 421.7 | 50.4 |
| Wave *t* + 1 | 294 | 247.0 | 49.8 | 211 | 512.8 | 44.1 | 349 | 342.6 | 52.6 | 216 | 455.4 | 48.7 |
| Percentage change | | 22.7 | 4.2 | | 70.6 | –13.8 | | 53.8 | –2.7 | | 8.0 | –3.4 |
| Exiters from stockownership | | | | | | | | | | | | |
| Wave *t* | 264 | 283.3 | 44.2 | 202 | 254.3 | 46.5 | 317 | 449.9 | 42.5 | 301 | 337.5 | 49.0 |
| Wave *t* + 1 | 264 | 287.1 | 43.7 | 202 | 244.7 | 44.8 | 317 | 441.7 | 46.3 | 301 | 286.9 | 46.0 |
| Percentage change | | 1.3 | –1.3 | | –3.8 | –3.7 | | –1.8 | 9.1 | | –15.0 | –6.3 |

*Source:* Authors' calculations, based on HRS.

*Note:* Wave *t* refers to either of waves 2–6 and wave *t* + 1 refers to either of waves 3–6. Sample is those in the labor force in wave *t*. In wave *t* P62 is reported; in wave *t* + 1 P62 is reported for those who remain in the labor force; P62 is calculated for those who have left the labor force. Age-eligible population.

change in wealth and P62 from waves 3 to 4 and 4 to 5 we find little support for the idea that large changes in wealth led to earlier retirement: in the normal period between waves 2 and 3 wealth increased by 12 percent and P62 increased slightly; in the two succeeding abnormal periods, when wealth increased by 24 to 27 percent, P62 was approximately constant or increased.

This conclusion is reinforced when we compare the wealth change of stock owners with the wealth change of those who owned in neither wave. Among those who owned in both waves 3 and 4, wealth increased by $145,000, or 32.2 percent, yet P62 increased by 1.3 percentage points. Among those who owned in neither wave, both wealth and P62 were approximately constant. If we consider those who owned stock in neither wave to be a control group that on average had its expectations realized with respect to health, earnings, and so forth, its lack of revision in P62 suggests stationarity. Under our hypothesis, stock owners should then have revised downward the probabilities of working past 62: instead they revised them upward. Similarly, between waves 4 and 5 those who did not own stocks had an increase in wealth of $24,000 and an increase in P62 of 1.6 percentage points. Stock owners had a much larger increase in wealth ($126,000) yet a larger increase in P62 (2.6 percentage points).

Only in waves 5 to 6 do we see a suggestion of a wealth effect: owners of stock had no wealth change, which was likely much below expectations, and an increase in P62 of 1.7 percentage points. Those who did not own stocks had an increase in wealth of $13,000 and a decline of P62 of 1.5 percentage points. Taking non-stock owners as the control group, we would calculate a stock market effect on P62 of 3.2 percentage points.

A possible explanation for the lack of a wealth effect on P62 is that we have not controlled for age. To do that we limit the presentation to a comparison between those who owned stocks in both waves and those who owned stock in neither wave. In that these two groups experienced the greatest difference in wealth change, we expect that they will have the greatest difference in the change in retirement expectations.

Table 4.11 shows these changes. As an example of the overall results, consider those who were fifty-eight to fifty-nine in wave 4. Between waves 3 and 4,323 stock owners had a remarkable wealth increase of about $190 thousand, or 45.7 percent, while 418 non-stock owners had approximately constant wealth. Stock owners increased P62 by 0.7 percentage points and non-stock owners increased P62 by 0.6 percentage points. This comparison is not consistent with the hypothesis that some of the large wealth gains will be used to finance earlier retirement. Similar comparisons in waves 4 to 5 show, if anything, greater increases in P62 among stock owners than among non-stock owners.

However, between waves 5 and 6 in every age band P62 increased among stock owners, but with one exception it decreased among nonowners. For

**Table 4.11 Wealth (thousands) and subjective retirement probabilities: panel**

| | Waves 2–3 | | | | | | Waves 3–4 | | | | | | Waves 4–5 | | | | | | Waves 5–6 | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Stock owners | | | Nonstock owners | | | Stock owners | | | Nonstock owners | | | Stock owners | | | Nonstock owners | | | Stock owners | | | Nonstock owners | | |
| Ages in wave $t + 1$ | $N$ | Wealth | P62 | $N$ | Wealth | P62 | $N$ | Wealth | P62 | $N$ | Wealth | P62 | $N$ | Wealth | P62 | $N$ | Wealth | P62 | $N$ | Wealth | P62 | $N$ | Wealth | P62 |
| Ages 52–53 | | | | | | | | | | | | | | | | | | | | | | | | |
| Wave $t$ | | | | | | | | | | | | | 268 | 354.4 | 42.8 | 191 | 115.5 | 48.9 | | | | | | |
| Wave $t + 1$ | | | | | | | | | | | | | 268 | 467.0 | 44.2 | 191 | 142.4 | 45.4 | | | | | | |
| Percentage change | | | | | | | | | | | | | | 31.8 | 3.1 | | 23.3 | –7.2 | | | | | | |
| Ages 54–55 | | | | | | | | | | | | | | | | | | | | | | | | |
| Wave $t$ | 285 | 387.3 | 43.9 | 337 | 110.2 | 48.5 | | | | | | | 253 | 378.0 | 44.8 | 191 | 169.7 | 41.5 | 216 | 431.8 | 44.1 | 153 | 149.1 | 46.9 |
| Wave $t + 1$ | 285 | 420.1 | 43.9 | 337 | 118.5 | 45.4 | | | | | | | 253 | 511.4 | 47.1 | 191 | 187.8 | 41.9 | 216 | 457.1 | 46.4 | 153 | 142.0 | 47.5 |
| Percentage change | | 8.5 | 0.0 | | 7.5 | –6.4 | | | | | | | | 35.3 | 5.0 | | 10.7 | 0.8 | | 5.9 | 5.1 | | –4.8 | 1.2 |
| Ages 56–57 | | | | | | | | | | | | | | | | | | | | | | | | |
| Wave $t$ | 335 | 357.8 | 41.3 | 502 | 124.4 | 45.4 | 286 | 397.3 | 43.1 | 342 | 137.7 | 46.9 | 287 | 449.5 | 43.1 | 248 | 138.6 | 48.1 | 234 | 495.7 | 44.9 | 172 | 178.3 | 46.6 |
| Wave $t + 1$ | 335 | 414.6 | 41.2 | 502 | 133.7 | 45.2 | 286 | 563.8 | 43.8 | 342 | 142.4 | 47.6 | 287 | 590.5 | 44.9 | 248 | 149.4 | 47.7 | 234 | 484.8 | 47.3 | 172 | 180.4 | 44.5 |
| Percentage change | | 15.9 | –0.1 | | 7.4 | –0.5 | | 41.9 | 1.7 | | 3.4 | 1.5 | | 31.4 | 4.0 | | 7.9 | –0.8 | | –2.2 | 5.3 | | 1.2 | –4.5 |
| Ages 58–59 | | | | | | | | | | | | | | | | | | | | | | | | |
| Wave $t$ | 304 | 445.0 | 41.8 | 444 | 129.0 | 46.4 | 323 | 415.2 | 43.9 | 418 | 131.4 | 44.3 | 316 | 542.8 | 45.1 | 364 | 138.5 | 45.3 | 246 | 569.7 | 48.1 | 208 | 148.8 | 47.4 |
| Wave $t + 1$ | 304 | 512.8 | 43.3 | 444 | 124.0 | 46.1 | 323 | 604.9 | 44.2 | 418 | 136.4 | 44.9 | 316 | 682.0 | 47.6 | 364 | 170.8 | 49.3 | 246 | 600.9 | 49.4 | 208 | 161.3 | 46.6 |
| Percentage change | | 15.2 | 3.5 | | –3.9 | –0.6 | | 45.7 | 0.7 | | 3.8 | 1.3 | | 25.6 | 5.5 | | 23.3 | 8.8 | | 5.5 | 2.6 | | 8.4 | –1.6 |
| Ages 60–61 | | | | | | | | | | | | | | | | | | | | | | | | |
| Wave $t$ | 282 | 434.1 | 47.5 | 418 | 115.0 | 44.4 | 281 | 542.8 | 47.0 | 387 | 107.0 | 49.2 | 291 | 541.6 | 49.2 | 367 | 129.0 | 47.1 | 291 | 758.2 | 51.2 | 289 | 128.9 | 51.4 |
| Wave $t + 1$ | 282 | 512.1 | 46.9 | 418 | 128.1 | 49.5 | 281 | 614.4 | 49.9 | 387 | 103.7 | 47.9 | 291 | 644.5 | 54.4 | 367 | 156.0 | 51.2 | 291 | 718.7 | 52.4 | 289 | 159.5 | 48.4 |
| Percentage change | | 18.0 | –1.1 | | 11.4 | 11.5 | | 13.2 | 6.0 | | –3.1 | –2.7 | | 19.0 | 10.6 | | 20.8 | 8.6 | | –5.2 | 2.4 | | 23.7 | –5.8 |
| All | | | | | | | | | | | | | | | | | | | | | | | | |
| Wave $t$ | 1206 | 404.6 | 43.5 | 1701 | 120.5 | 46.0 | 890 | 449.7 | 44.6 | 1147 | 125.0 | 46.7 | 1415 | 458.5 | 45.1 | 1361 | 137.1 | 46.3 | 987 | 577.6 | 47.4 | 822 | 148.0 | 48.5 |
| Wave $t + 1$ | 1206 | 463.5 | 43.7 | 1701 | 126.8 | 46.5 | 890 | 594.7 | 45.9 | 1147 | 127.2 | 46.7 | 1415 | 584.5 | 47.7 | 1361 | 161.3 | 47.9 | 987 | 576.6 | 49.1 | 822 | 161.0 | 47.0 |
| Percentage change | | 14.5 | 0.5 | | 5.2 | 1.1 | | 32.2 | 2.8 | | 1.7 | –0.1 | | 27.5 | 5.8 | | 17.7 | 3.5 | | –0.2 | 3.7 | | 8.8 | –3.2 |

*Source:* Authors' calculations, based on HRS.

example, among sixty- to sixty-one-year-olds, P62 increased by 1.2 percentage points among owners but declined by 3.0 percentage points among nonowners. Over all age groups the average increase among owners was 1.7 percentage points and the average decrease among nonowners was 1.5 percentage points. Thus our estimate of the stock market effect between waves 5 and 6 would be 3.2 percentage points.

We will use a Cox proportional hazards model to estimate the effect on years of full-time work, which may be a more natural concept to quantify than P62.

Let $f_t$ be the survival curve in full-time work, and let $h_t$ be the hazard out of full-time work.

$$h_t = -\frac{d \ln f_t}{dt}$$

and

$$-\ln f_t = \int h_t dt + c.$$

At some beginning age (say, fifty-one) $f_t = 1$ so that $c = 0$.

Suppose that during a time of surprising stock market gains or losses

$$h_{t,s} = h_t e^{\alpha_t s}$$

where $s = 1$ if a stock owner and 0 otherwise. During an era when stock market gains are normal, $\alpha_t = 0$ and we can estimate $h_t$ directly from data. The strategy will be to use panel data on the number working full time at time $t + 2$ and the number working full time at $t$. Because of reentry into the labor force they need not be the same people. Thus the hazard will be the net hazard. We would like one-year hazards $h_t$ from $t$ to $t + 1$, but the data panel span two years. Thus a two-year empirical hazard that spans ages $t$ to $t + 2$ will include $h_t$ and $h_{t+1}$. Our solution will be to use an average of the hazards from $t - 1$ to $t + 1$ and from $t$ to $t + 2$ normalized to an annual hazard.

Let $n_t$ be the number working full-time at age $t$. In panel we observe pairs $(n_t, n_{t+2})$ in adjacent waves. The average one-year hazard is

$$\frac{1}{2}\left(\frac{n_t - n_{t+2}}{n_t}\right).$$

Estimate $h_t$ as

$$\frac{1}{2}\left[\frac{1}{2}\left(\frac{n_{t-1} - n_{t+1}}{n_{t-1}}\right) + \frac{1}{2}\left(\frac{n_t - n_{t+2}}{n_t}\right)\right],$$

which is the average of the one-year hazards centered on $t$. Then

$$f_t \approx e^{-\Sigma_{t=0}^{t} h_t}.$$

The area to the left of this curve is the expected years of full-time work:

$$E(\text{years full time}) = \Sigma f_t$$

In an era of unexpected losses in the stock market, we have estimated $f_{62,s} - f_{62} = k$ where $k \approx -0.032$.

According to the Cox proportional hazard model

$$f_{t,s} = e^{-e^{\alpha s}\int h_t dt} = (f_t)^{e^{\alpha s}}$$

then

$$\ln(f_{62,s}) = e^{\alpha s}\ln(f_{62}) = \ln(k + f_{62})$$

and

$$e^{\alpha s} = \frac{\ln(k + f_{62})}{\ln(f_{62})}.$$

For example, if $k = 0.032$ and $f_{62} = 0.45$, then $e^{\alpha s} = 0.913$ and

$$f_{t,s} = f_t^{0.913}.$$

Figure 4.3 shows a curve for estimated survival in full-time work beginning at age fifty-one, and a survival curve for those with an increased P62 due to stock market loss ($k = 0.032$). The vertical distance between the two curves at age sixty-two is 0.032. The effect of the stock market loss on expected full-time work is the area between the two curves. This area is approximately 0.38 year out of an estimated remaining life expectancy in full-time work of 8.7 years.

Although the results in table 4.11 for the change between waves 5 and 6

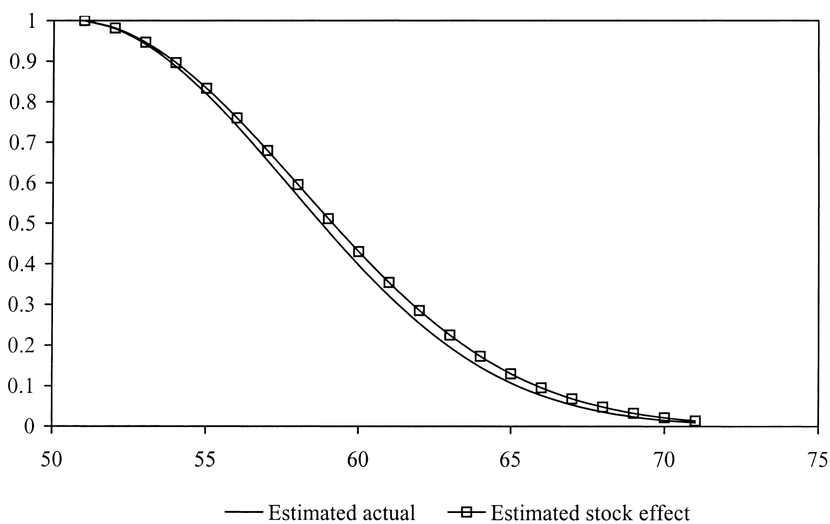


**Fig. 4.3 Survival in full-time work**

are suggestive, we would like a more formal statistical analysis. Therefore, we estimated the regression of the change in P62 at the individual level on categorical age indicators and on stock ownership indicators interacted with wave transition indicators. Table 4.12 shows the results from that regression for four wave transitions. The results broadly mirror what is in table 4.11. For example, between waves 5 and 6 the change in P62 among stock owners was 3.4 percentage points greater than the change in P62 among nonowners. However, the estimated standard error of that difference is 2.1, so the difference is not statistically significant. Furthermore, the differences in the waves 3 to 5 are positive, whereas the gain in the stock market suggests a downward adjustment to P62, which would lead to negative differences.

Thinking that noise in P62 may increase the standard errors substantially, we investigated the qualitative change in P62: whether the change in P62 is positive. We estimated the regression of an indicator variable for a positive change on age and ownership indicators, as in table 4.12. The results are in table 4.13. The pattern is identical to the pattern in table 4.12, but the scaling is different: table 4.12 refers to a change in P62 that is scaled 0 to 100, whereas table 4.13 refers to the probability of an increase in P62

**Table 4.12** **Regression results: Change in P62 by wave. Stock owners and nonstock owners**

| | Stock owners | Nonowners | Difference | Standard error of difference |
|---|---|---|---|---|
| Wave 2 to 3 | –0.22 | 0.00 | –0.22 | 1.38 |
| Wave 3 to 4 | 0.45 | –0.86 | 1.31 | 2.08 |
| Wave 4 to 5 | 2.77 | 1.48 | 1.29 | 1.92 |
| Wave 5 to 6 | 1.18 | –2.22 | 3.41 | 2.13 |

*Source:* Authors' calculations, based on HRS.
*Note:* Pooled regression across four wave transitions.

**Table 4.13** **Regression results: Probability of an increase in P62. Stock owners and nonstock owners**

| | Stock owners | Nonowners | Difference | Standard error of difference |
|---|---|---|---|---|
| Wave 2 to 3 | 0.000 | 0.000 | 0.000 | 0.032 |
| Wave 3 to 4 | 0.030 | –0.004 | 0.034 | 0.048 |
| Wave 4 to 5 | 0.082 | 0.042 | 0.039 | 0.044 |
| Wave 5 to 6 | 0.051 | –0.048 | 0.099 | 0.049 |

*Source:* Authors' calculations, based on HRS.
*Note:* The left-hand variable equals 1 if P62 increased between waves and equals 0 otherwise.

that is scaled 0 to 1.0. Thus, between waves 3 and 4 the probability is 0.034 greater among stockholders that the revision in P62 will be positive than among nonowners. The difference in the probability of a gain between waves 5 and 6 is 0.099, which is statistically significant; that is, stock owners were almost ten percentage points more likely to report an increase in P62 between waves 5 and 6 as nonowners. This difference is consistent with stock market losses causing an increase in retirement age.

We have been treating all stock owners as if they were the same, even though stock wealth is highly skewed. We imagine that the stock wealth increase would have to be substantial relative to total wealth to induce a detectable change in retirement behavior. Accordingly, we constructed indicator variables for total wealth and stock wealth quartiles and repeated the type of regression reported in table 4.12 but with interactions between total wealth and stock wealth quartiles all interacted with the wave transition. Table 4.14 shows the variation in the change in P62 as a function of the quartiles relative to nonowners. For example, in the top wealth and top stock wealth quartiles in wave 3, P62 increased by 4.6 percentage points more among owners than among nonowners. The table shows some suggestive patterns: during the boom times of waves 3 to 5, P62 declined among those in the top stock wealth quartile and the third wealth quartile relative to nonowners. During the bust times of waves 5 to 6, P62 increased among those in the same quartiles. These patterns would be expected according to a wealth change argument especially because the intersection of those quartiles contains those respondents with relatively great stock market exposure. However, other entries in the table do not follow any such easily interpretable pattern; furthermore, none of the entries is statistically significant.

**Table 4.14** **Regression results: Change in P62 among stock owners relative to nonstock owners by stock wealth and total wealth quartiles**

| | Wealth quartile | |
|---|---|---|
| Wave and stock wealth quartile | 3 | 4 |
| Wave 3 to 4 | | |
| 3 | 4.46 | 2.99 |
| 4 | –4.73 | 4.63 |
| Wave 4 to 5 | | |
| 3 | 2.58 | 3.67 |
| 4 | –2.79 | –0.29 |
| Wave 5 to 6 | | |
| 3 | 0.80 | 1.57 |
| 4 | 5.14 | 4.91 |

*Source:* Authors' calculations, based on HRS.
*Note:* Pooled regression across four wave transitions.

We have been using the interview wave to group observations because of the strong relationship between wave and stock market change. But within a wave the actual interview date varied by as much as a year, so that the stock market level varied a great deal even within a wave. Accordingly, the change in the stock index varied greatly from observation to observation, depending on interview date in both waves.

We addressed this problem by finding the level of the stock index during the month of interview so that we can construct the actual change in the stock index between interviews for each respondent. This provides additional variation in the change in stock prices and allows us to combine observations from different waves.

We imagine that the effect of stock price change on P62 could be nonlinear: variation in change within a normal range would have little effect; only large deviations from historical change would be interpreted by respondents as an unexpected wealth effect. Based on stock price change data over about thirty years, we calculated the two-year stock price change distribution. From this we generated individual indicator variables to show whether the interview-to-interview change in the stock price was in one of the percentile intervals 0 to 5, 5 to 10, 10 to 50, 50 to 90, 90 to 95, 95 to 100. For example, all the observations based on waves 5 to 6 fell in the first two intervals, which represent the bottom 10 percent of historical stock price changes.

Table 4.15 shows the results of the regression of the change in P62 on variables that indicate in which of the stock change bands the actual change in the stock index belonged. The coefficients for nonowners control for macro events so the difference is what is relevant. Thus stock owners who were interviewed when the change in the stock market was in the lowest 5 percent of historical stock changes revised upward P62 by 2.34 percentage points relative to nonowners who were interviewed at similar times. We see that, indeed, there is little difference between owners and

**Table 4.15** **Regression results: change in P62 according to stock index change since last interview: stock owners and nonstock owners**

| Percentile of stock index change | Owners | Not owners | Difference | Standard Error of difference |
|---|---|---|---|---|
| 0–5 | 1.88 | –0.46 | 2.34 | 3.02 |
| 5–10 | –1.54 | –2.14 | 0.60 | 3.05 |
| 10–50 | 1.26 | 1.84 | –0.59 | 1.94 |
| 50–90 | | | | |
| 90–95 | –0.15 | 1.42 | –1.57 | 2.61 |
| 95–100 | –1.44 | 0.01 | –1.44 | 2.61 |

*Source:* Authors' calculations, based on HRS.

nonowners when stock change was in the middle of the distribution. At the extremes, the differences are what would be expected from an unexpected wealth gain. However, as the standard errors show, none of the differences is statistically significant.[14]

A more direct way to estimate a wealth effect is from the regression of the change in P62 on the change in wealth. As noted in the introduction, however, changes in wealth that are induced by a shock to health and that simultaneously cause a change in retirement will lead to biased ordinary least squares (OLS) estimates of a wealth effect. In this example, we might see in panel a decline in wealth and a reduction in retirement age. Therefore, we use predicted change in stock market wealth since the last interview as an instrumental variable. That is, we specify

$$\Delta P62 = \alpha \Delta wealth + u$$

and

$$\Delta wealth = \beta \Delta stockindex \times stockwealth$$

We believe $u$ and $\Delta wealth$ are likely to be correlated.

In actual estimation, our instrumental variable is highly predictive of the change in wealth. However, our estimates of $\alpha$ are not of a consistent sign and are not statistically significant, so we do not report them.

## 4.6 Conclusions

Between waves 3 and 5 of the HRS the stock market increased in value at substantially greater rates than in recent history, and, accordingly, we observe a large increase in the asset holdings of HRS households. We assumed that much of the increase in wealth was unanticipated, because of the very much greater rates of return than had been experienced in prior years. Our major question was to find whether households used this wealth gain to retire earlier than anticipated.

We found no evidence that workers in those households which had large gains retired earlier than they had anticipated or that they revised their retirement expectations compared with workers in households that had no large gains. We can compare these results with those of Imbens, Rubin, and Sacerdote (2001). They estimated the effect of windfall gains in wealth from the behavior of lottery winners. Their basic finding was that large gains induced a reduction in labor force participation. Based on a comparison of the change in labor force participation of winners with the

14. We repeated these regressions, but with linear splines with knots at the percentile points, as shown in table 4.15. The results are approximately the same and also lack statistical significance, so we do not show them.

change in labor force participation of losers (Imbens, Rubin, and Sacerdote, 2001, table 2) we calculate that a windfall gain of about $300,000, which is approximately the wealth gain between waves 3 and 4 of stockholders in both waves, would reduce labor force participation by about one percentage point. We interpret this to be a rather small effect, basically indistinguishable from our main finding.

Holtz-Eakin, Joulfaian, and Rosen (1993) used IRS data on inheritances to estimate the effect of large wealth gains on labor force participation. Based on their estimates we calculate that a wealth gain of about $300,000 would reduce participation by about seven percentage points. This is a substantially different magnitude from what we actually found.

We realize that in making these comparisons we have assumed that the entire gain in wealth by stockholders was unanticipated whereas in reality at least some of the gains would have been anticipated. We have no method of separating anticipated from unanticipated gains, but were we able to isolate unanticipated gains, the difference between our results and the results from Holtz-Eakin, Joulfaian, and Rosen would be reduced.

Guided by the life-cycle model, we began this research with the expectation that the large wealth gains would be at least partly spent on earlier retirement and that the losses would delay retirement. Our thinking was that the gains were analogous to the thought experiment of giving a relatively large group of older workers a windfall wealth shock. What actually happened was probably more complicated. There was, indeed, a large wealth gain that we believe was largely unanticipated. But most likely the gain was accompanied by a change in the expectation of the normal rate of return on the stock market. Evidence for this conjecture is partly anecdotal. In addition, however, without such a change in expectations it would be difficult to explain the increase in the rate of stockholding. For example, between waves 1 and 4 the rate of stock ownership in the HRS increased by about four percentage points, or about 15 percent. If indeed the anticipated rate of return from holding stocks increased substantially, the life-cycle model cannot make a prediction about a contemporaneous increase in consumption: the substitution toward saving induced by the large increase in the reward from saving could overcome the income effect resulting from the large gains to wealth.

We found some suggestion that the decline in the stock market led to an increase in the expected retirement age. Supposing that is the case, we have no good explanation about the asymmetry: why there should be no response to a stock gain and a possible response to a stock loss. Part of the answer undoubtedly lies in expectations about future rates of return. There may be, however, psychological explanations that are outside of the life-cycle model, such as an unwillingness to reduce spending or asymmetries with respect to gains and losses.

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