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ABSTRACT

Media reports predicted that the stock market decline in October 2008 would cause changes in retirement intentions, due to declines in retirement assets. We use panel data from the Health and Retirement Study to investigate the relationship between stock market performance and retirement intentions during 1998-2008, a period that includes the recent crisis. While we find a weak negative correlation between stock returns and retirement intentions, further investigation suggests that this relationship is not driven by wealth shocks brought about by stock market fluctuations, but by other factors that are correlated with both the stock market and retirement intentions.

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I. Introduction

The share of private sector employees who participated in defined benefit plans declined from 38 percent in 1980 to 20 percent in 2008, while the share participating in defined contribution plans rose from eight percent to 31 percent over the same time span (Butrica et al. 2009). The decline of the defined benefit pension plan and the rise of the defined contribution plan have dramatically shifted the responsibility of planning for retirement to workers, who must make decisions regarding the amount to contribute to defined contribution plans and how to allocate the investments. While the spread of defined contribution plans has offered workers more labor market flexibility and control over their investments, it has also led to an increase in equity exposure among households and shifted the risk of poor investment experience from employers to employees.

This increase in equity exposure is particularly important given the high volatility markets have experienced over the last decade. The U.S. stock market experienced double-digit returns in the late 1990s, followed by a loss of 37 percent of the value of the S&P 500 index between March 2000 and September 2001. More recently, the S&P 500 index lost more than 50 percent of its value from its peak in October 2007 to its bottom in March 2009. A 2009 survey by the Pew Research Center found that 56 percent of individuals aged 65 and over, and 75 percent of individuals aged 50-64, report that the financial crisis and recession that began in 2007 "will make it harder to meet retirement needs" (Taylor et al. 2009).

The life-cycle model predicts that unanticipated changes in wealth would change intentions regarding labor supply and retirement behavior. This sentiment is seen in press reports, which suggest that the declines in wealth brought about by the steep fall in asset values forced households to delay retirement. As the Wall Street Journal reported in April 2008, "Investment

advisers and retirement planners … say they are seeing large numbers of older workers put off retirement as the housing and stock-market troubles have deepened" (Levitz 2008). By September 2008, the problem had only gotten worse: "With nest eggs shrinking, housing prices still falling and anxieties about their financial future growing, the oldest members of the baby-boom generation are putting the brakes on plans to leave the office" (Greene 2008). Similar ideas were expressed earlier in the decade: Time magazine's July 29, 2002 cover article was entitled, "Will You Ever Be Able to Retire?"

However, stock market fluctuations do not always represent exogenous shocks to wealth. As discussed in Campbell (1991), stock market downturns are thought to be caused by one of two factors: an increase in discount rates (for example, due to an increase in interest rates, risk aversion or the perceived amount of risk in equities) or a decline in the expected value of future earnings of a broad portfolio of firms. The predictions of the life cycle model would apply in the latter case, as declining firm profitability reduces household wealth and increases labor supply through the income effect. In the former case, however, the relationship we would expect to observe is theoretically ambiguous, as changes in risk aversion or the perceived amount of risk may directly alter labor market behavior as well. For example, an increase in risk aversion could be associated with more sharply diminishing marginal utility of income, which may directly affect labor supply or its elasticity (for example, Chetty 2006). In addition, stock market fluctuations of either type may be correlated with other unobservable factors – such as the general level of optimism or pessimism about the future of the economy – that may also affect one's retirement intentions. For instance, while the reduction in stock market valuation may reduce one's retirement wealth and lead one to expect to work longer, the poor economic conditions may lead to a reduction in the expected future demand for labor and therefore the

probabilities of future work. Thus, the relationship between stock market performance and retirement conflates a number of factors and may vary depending on the time period studied. Indeed, previous work on the effect of stock market gains on labor supply behavior has found mixed results.

In this paper, we examine how intentions regarding labor force participation and retirement changed when stock market values fluctuated during the 1998-2008 period. We also explore whether exogenous shocks to wealth – through changes in firm profitability – provide a plausible mechanism for this relationship. We utilize the Health and Retirement Study (HRS), a longitudinal panel study conducted every two years that is intended to be representative of the over-50 population. The HRS contains detailed information about individuals' wealth, income, and demographic characteristics, as well as self-reported measures of retirement intentions (the probability of working after age 62, the probability of working after age 65, and the expected retirement age). We examine within-year changes in the value of the S&P 500 index and determine whether individuals who were surveyed on days when the S&P 500 index was lower, or had delivered a lower return over the previous year, changed their intentions of labor force behavior relative to individuals who were surveyed when the stock market was higher in value. The panel nature of the data allows us to control for unobserved heterogeneity in tastes for working, and detailed information on each respondent's location allows us to control for local (MSA and county level) housing and labor market conditions. Our study period includes the recent financial crisis, as well as additional market fluctuations between 1998 and 2008.

Overall, we find weak evidence of a negative correlation between stock market performance (measured by the level of stock values or the recent rate of return on stocks) and intentions for retirement (measured by the probability of working at age 62 or age 65, and the expected age of

retirement). The coefficients we estimate are consistently negative, though not statistically significant for all measures. We find evidence of a stronger negative relationship between stock market performance and retirement intentions when we restrict attention to those interviewed when the S&P 500 index experienced negative growth in the year prior to the interview, and when we examine those closer to retirement age.

To further investigate the mechanism linking stock market performance and retirement intentions, we study the behavior of particular subsets of the population. If the effect of stock market fluctuations on intended labor supply decisions operates through declines in wealth, we would expect individuals who are more exposed to stock market fluctuations to respond more than the general population. These groups include individuals with a defined contribution (DC) retirement plan, those who have assets in an individual retirement account (IRA), and those who own stocks. We find little evidence of significantly stronger correlations between stock market performance and retirement intentions for these more exposed groups. Thus, we conclude that the effect of stock market fluctuations on labor supply decisions is not likely to be operating through fluctuations in wealth that result from stock market volatility over the study period.

While we are certainly not the first to use HRS data – or the questions about retirement intentions – to study the relationship between stock market fluctuations and retirement intentions, our paper contributes to the existing literature in several ways. First, by requesting permission to use restricted HRS data, which contains the exact interview dates for each respondent, we are able to get a more precise measure of individuals' stock market experience. In other words, we can compare how intentions regarding retirement changed for respondents who experienced a large gain in the value of the stock market between their previous and current interview relative to respondents who saw a large loss. For example, the interviews for the 2008

HRS took place between March 2008 and February 2009. While the average respondent from the 2008 wave experienced a loss in the S&P 500 of 25 points (1.7 percent) since their previous interview, depending on the timing of interviews, the change ranged from a loss of 648 points (44.9 percent) to a gain of 190 points (15.5 percent). Respondents in other waves also have a wide range of stock market experiences depending on their interview date.

In addition, through use of geographic identifiers in the restricted HRS data, we are able to control for local labor and housing market conditions in a more precise way than previous studies. We can match respondents with county-level unemployment rates and MSA-level house price indices.[1] This is important because the weak labor market brought on by the recession may increase the amount of involuntary retirements, offsetting any delays in retirement as a result of the stock market (Gustman, Steinmeier, and Tabatabai 2009a; Gustman, Steinmeier, and Tabatabai 2009b; Coile and Levine 2009). Furthermore, failing to control adequately for shocks to housing wealth (which are likely to be positively correlated with shocks to stock market wealth) may cause one to overestimate the impact of stock market valuations on retirement decisions. Finally, we examine the channel underlying the relationship between stock market fluctuations and retirement intentions by investigating the behavior of groups that would be more likely to respond to changes in stock values under the assumption that the main channel is changes in wealth.

The remainder of this paper proceeds as follows. Section II provides an overview of the literature on the stock market and retirement, wealth and retirement more generally, and the recent financial crisis. In Section III, we describe the data used in this study, and provide our empirical strategy in Section IV. Section V presents our results, and Section VI concludes.

II. Previous Literature

A number of earlier studies have examined the relationship between stock market behavior and retirement. Studies from the early 2000s have examined the impact of the late 1990s stock market boom and subsequent decline. Cheng and French (2000) and Gustman and Steinmeier (2002) estimate structural models that indicate that high stock market returns increase retirement rates. Coronado and Perozek (2003) find that holders of corporate equity retired approximately seven months earlier than expected due to the bull market of the 1990s, and Sevak (2002) finds evidence that workers with DC plans retired earlier than workers with DB plans when the stock market increased in value. However, Hurd and Reti (2001) and Hurd, Reti, and Rohwedder (2009) find no effect of increased stock market wealth on retirement intentions, and Coile and Levine (2006) show that the stock market decline which began in 2000 did not drive aggregate increases in labor supply among older workers in the early 2000s. In addition, Kezdi and Sevak (2004) find evidence that changes in stock market wealth may affect consumption more than leisure, and Khitatrakun (2003) finds that other constraints, such as penalties from defined benefit pension plans for retiring early or the loss of employer-sponsored health coverage, may attenuate the effect of wealth shocks on retirement behavior. Less directly, Engen, Gale and Uccello (2005) find no relationship between the adequacy of retirement savings and aggregate equity values. This result is explained by the fact that equity holdings are concentrated among households with significant amounts of other wealth.

More recently, the events surrounding the financial crisis between 2007 and 2009 have spurred additional research regarding the impact of the crisis on elderly workers and retirees. Some of the recent work has attempted to quantify the impact on the asset holdings of older Americans. Butrica, Smith and Toder (2009a; 2009b) and Bosworth and Smart (2009) simulate the impact of the 2008 stock market crash on future retirement savings, and Bosworth and Smart

also examine the expected impact of the collapse of the housing market. Johnson, Soto, and Zedlewski (2008) and Soto (2008) estimate the losses in retirement account assets and home values, and survey the evidence on how these losses, combined with weak labor markets, might affect retirement intentions and retiree well-being. Coile and Levine (2010) estimate the impact of stock market performance, as well as labor market conditions, around the time of retirement on retirement income. They find that stock market performance has a significant impact on investment income during retirement, while labor market conditions have a significant impact on Social Security income. On the other hand, Gustman, Steinmeier, and Tabatabai (2009a; 2009b) suggest that the average person approaching retirement age is not likely to have suffered a substantial financial shock from the stock market downturn in 2008-2009 because the current generation of retirees do not have a large amount of their wealth in defined contribution plans.

Coile and Levine (2009) use cross-sectional Current Population Survey data to show that longer-term changes in stock market valuations appear to affect the retirement of workers aged 62 to 69, particularly those with more education (which they argue proxies for stock market exposure). However, they find no such evidence for workers aged 55-61. Moreover, the increase in labor force participation caused by the stock market crash is more than offset by the reduction in labor force participation (concentrated among less-educated workers) as a result of the weak labor market. They do not find a relationship between retirement behavior and a regional house price index, even for homeowners. Goda, Shoven, and Slavov's (2011) findings for the recent crisis are similar. There appears to be a negative relationship between recent stock market performance and the probability of retiring after age 62, particularly for workers who are closer to retirement. However, these delays in retirement are likely to be largely – if not completely – offset by the impact of the weak labor market. Similarly, Helppie (2010) finds that

declines in wealth during the recent crisis are associated with expected delays in retirement. A series of telephone surveys sponsored by the Society of Actuaries has found that the fraction of near-retirees and retirees stating that they planned to work longer to increase financial security has not significantly changed between surveys conducted in June 2007 and July 2009. However, when primed with references to the recent recession, 23 percent of retirees and 64 percent of pre-retirees sampled in 2009 responded that they felt they would have to reenter the labor force or delay retirement as a result of recent economic events (Matthew Greenwald and Associates, Inc. and Employee Benefit Research Institute 2010).

As discussed earlier, one channel by which the stock market may affect retirement behavior is an exogenous decline in wealth due to reduced expected future earnings by firms. There has been a large amount of interest in the effect of wealth on retirement behavior more generally. Sources of variation have included lottery winnings (Imbens, Rubin, and Sacerdote 2001), inheritance receipt (Holtz-Eakin, Joulfaian, and Rosen 1993; Joulfaian and Wilhelm 1994; Brown, Coile, and Weisbenner 2010), housing wealth (Farnham and Sevak 2007), and Social Security "notch" cohorts who saw a large change in Social Security wealth (Krueger and Pischke 1992). Holtz-Eakin, Joulfaian, and Rosen (1993); Imbens, Rubin, and Sacerdote (2001); Brown, Coile, and Weisbenner (2010); and Farnham and Sevak (2007) find evidence of labor supply responses to changes in wealth. By contrast, Krueger and Pischke (1992) and Joulfaian and Wilhelm (1994) find little to no response in labor supply and retirement behavior from changes in wealth.

III. Data

Like many of the studies cited previously, we use data from the Health and Retirement Study (HRS), a longitudinal panel study with a wealth of information about the elderly and near-

elderly population. The HRS began in 1992 by surveying a nationally representative sample of individuals age 51 to 61 in 1992 and their spouses. The HRS is conducted every two years, and has been periodically refreshed with additional cohorts to be representative of the over 50 population. The survey asks respondents a wide variety of questions regarding income, work, assets, pension plans, health insurance, and disability and physical health. We utilize the RAND version of the HRS dataset which provides consistent variables and definitions across the waves of the survey.

We merge several supplemental datasets with the HRS data. First, we obtained the exact date of interview and detailed geographic identifiers from HRS by applying for restricted access. Second, we use the S&P 500 index to capture aggregate fluctuations in the value of the stock market and obtain daily closing values of the index from Yahoo! Finance which are merged by date of interview.[2] For some specifications, we compute the percent change in the S&P 500 in the year preceding the interview date. Third, we include controls for housing market fluctuations using the Federal Housing Finance Agency (FHFA) index based on all-transactions published on a quarterly basis for the respondent's local area. For individuals living in a metropolitan statistical area (MSA), we use an MSA-level index. For individuals not living in an MSA, we use a state-level non-MSA index.[3] Fourth, we merge in county-level unemployment rates during the month of interview.[4] Finally, we merge data files underlying the tables in Gustman, Steinmeier and Tabatabai (2010) which are made available through the HRS data downloads page. These files contain information regarding balances in defined contribution accounts.[5]

Beginning in 1998 and continuing for subsequent waves, respondents are asked to estimate the probability that they will work full-time after age 62 (P62), the probability that they will

work full-time after age 65 (P65), and the age at which they expect to stop working (E(R)).[6] We use the responses to these questions as measures of respondents' retirement intentions. The first two measures are asked only of those who have not attained age 62 or 65, respectively, and all measures are only asked among respondents who are still working. Other studies that use these intentions measures include Khitatrakun (2003) (who uses E(R)); Hurd and Reti (2001) and Hurd, Reti, and Rohwedder (2009) (who use P62); and Coronado and Perozek (2003) (who use E(R)).

The primary advantage of examining intentions is that it allows us to examine changes within respondents over time and eliminate bias from unobserved individual heterogeneity that may arise if only one observation of actual retirement behavior were used. The primary disadvantage is that self-reported intentions may not correlate with actual behavior; however, previous studies suggest this is not a concern. For example, Hurd, Reti, and Rohwedder (2009) show that among the 62-year olds who were working full time in the 2002 wave, the average P62 reported in the 1994 wave is 58.2 percent; in contrast, among the 62-year-olds who were not working full time in the 2002 wave, the average P62 reported in the 1994 wave is only 37.3 percent. Thus, P62 is predictive of actual working behavior at age 62, even six years in advance. Similarly, Khitatrakun (2003) shows that E(R) is a good predictor of actual retirement age: approximately 70 percent of respondents who reported an expected retirement age in 1992 retired within one year of their actual year of retirement as measured in subsequent surveys. In addition, the modal and median differences between expected and actual retirement dates are generally zero (Khitatrakun 2003). Therefore, we conclude that examining changes in expected labor supply allows us to learn about effects on actual labor supply behavior.

We report results using all three measures of retirement intentions. The three measures are positively correlated with one another – people who report higher P62 and P65 values also report higher expected retirement ages. However, the questions are asked at different points in the survey and there are inconsistencies in responses. For example, some people report that they will definitely be working after age 62 (P62=100 percent), while they expect to retire at an age that is considerably less than 62; others report a zero probability of working full-time after age 62, but an expected retirement age that is much greater than 62. Our view is that P62 and P65 are better measures of individuals' expected labor supply behavior for several reasons. First, the questions underlying E(R) refer to the age at which the respondent "plans" or "thinks" that he or she will stop working. It is not clear how to interpret the responses to these questions. One possibility that individuals provide the expected value their retirement age based on the probability distribution of possible retirement ages; another possibility is that they report the mode of the probability distribution. Second, for P62 and P65, the underlying questions explicitly refer to full-time work after the relevant age, while for E(R) they are more vague.[7] Finally, E(R) is missing if the individual reports that he or she will never stop working.

As the retirement intentions questions are only asked among individuals who are still working, following Khitatrakun (2003), we replace E(R) with the actual retirement age for the wave immediately following the retirement of the respondent. That is, we replace E(R) in wave *t* with the actual retirement age if an individual retired between waves *t-1* and *t*, but preserve E(R) as missing for that individual in all subsequent waves. Thus, in our first-difference approach, the change in E(R) for a respondent who retired since the previous wave is constructed by differencing the actual retirement age and the expected retirement age reported in wave *t-1*. We do not do this for P62 and P65 because it entails replacing the probability of an

event with its realization. Thus, for the regressions explaining P62 and P65, we do not use any observations in which an individual is retired. In our sensitivity analyses described in Section V, we examine the implications of substituting the actual retirement age for retired individuals in the E(R) regressions, as well as the sample selection that results from dropping individuals who retire in the P62 and P65 regressions.

Table 1 provides summary statistics for all variables used in our regressions. Each observation represents a person-wave combination, and the summary statistics are based on all observations with a nonmissing value for P65. The S&P 500 variable reflects the value of the S&P 500 index on the date of interview reported in the restricted HRS data. We construct the percent change in the value of the index for the 12-month period prior to the interview as well as the percent change since the respondent was last interviewed (which could represent between 11 and 35 months depending on the respective interview dates). The reported probability of working full-time at age 62 is 49.7 percent across all waves of the survey, and when asked about the probability of working full-time at age 65, the probability is lower, approximately 31.4 percent. The expected retirement age is approximately 65 years old for our sample, but as noted above, this variable is coded as missing if the individual says that he or she will never retire. This and other data limitations result in many missing values for the expected retirement age outcome variable. While we report summary statistics for demographics such gender, race, and education, our first-difference approach will omit time-invariant characteristics in the estimation.

Table 2 shows how our three indicators of intended labor supply behavior vary across different subsamples. Relative to the full sample, those age 58 and over have slightly higher probabilities of working at age 62 and 65, and an expected retirement age that is almost one

year higher. Participants in DC plans and owners of IRAs have similar measures of intended labor supply behavior as the full sample, but those who own stocks or mutual funds report slightly lower probabilities of working and an earlier expected retirement age.

To provide an idea of the amount of variation in stock market performance we find in the data, Figure 1 shows the S&P 500 over time, and Figure 2 shows the distribution of growth rates in the S&P 500 over the prior year for each person-year observation in our sample, separately for each wave of the survey. Figure 2 highlights the fact that individuals had considerably different stock market experiences as a result of differences in interview dates, even within each wave of the survey.

Figure 3 shows the probability of working after age 62 plotted against the value of the S&P 500 index over each wave of the survey. Without controlling for other covariates or accounting for unobserved heterogeneity, the relationship across waves appears inconsistent.[8] We do observe cross-wave differences in the probability of working after age 62, which appear to be correlated with cross-wave differences in the S&P 500. For example, between the 2006 and 2008 waves, the average probability of working after age 62 rose from 42 percent to 55 percent, while the S&P 500 fell. Between the 2000 and 2002 waves as well, the average probability of working after age 62 rose from 52 percent to 53 percent, while the S&P 500 fell. However, the correlation within waves is less clear. The next section formalizes the analysis of this relationship.

IV. Methods

We focus primarily on two specifications:

(1) $$Y_{it} = \alpha_1 \ln\left(S\&P500_{it}\right) + \alpha_2 \ln\left(FHFA_{it}\right) + \alpha_3 \ln\left(unemp_{it}\right) + \alpha_4 X_{it} + \theta s_{it} + \rho w_t + \pi_i + \varepsilon_{it}$$

(2)

$$Y_{it} = \beta_1 PercentChangeS\&P500_{it} + \beta_2 \ln\left(FHFA_{it}\right) + \beta_3 \ln\left(unemp_{it}\right) + \beta_4 X_{it} + \gamma s_{it} + \delta w_t + \lambda_i + u_{it},$$

where Y_{it} is our measure of retirement intentions (either P62, P65, or E(R)) for individual *i* in wave *t*; $S\&P500_{it}$ is the level of the S&P 500 index on individual *i*'s interview date in wave *t*; $PercentChangeS\&P500_{it}$ is the percent change in the S&P 500 in the year preceding individual *i*'s interview date in wave *t*; $FHFA_{it}$ is the level of the housing index in individual *i*'s state during the quarter of individual *i*'s interview in wave *t*; $unemp_{it}$ is the unemployment rate in individual *i*'s county during the month of individual *i*'s interview in wave *t*; X_{it} is a vector of controls; s_{it} is a vector of state dummies; w_t is a vector of wave dummies; λ_i and π_i represent unobserved individual heterogeneity; and ε_{it} and u_{it} are stochastic error terms. X_{it} includes age, marital status, retirement status of spouse (if married), homeownership status, self-reported health status, length of tenure at the current job, an indicator for whether the current employer offers retiree health insurance, an interaction between homeownership status and the natural log of the housing index, and an interaction between high school completion or less and the natural log of the unemployment rate.[9] We take first differences of both equations to eliminate the individual heterogeneity, λ_i and π_i. If there were only two waves of data, first differencing would be computationally identical to including individual fixed effects. With more than two waves, these approaches are not computationally identical, but both provide consistent estimates of the parameters in (1) and (2). We report robust standard errors clustered at the household level.

If stock market fluctuations represent exogenous shocks to wealth, caused by changes in expected profitability, we would expect $\alpha_1, \beta_1 < 0$. That is, positive shocks to financial wealth reduce the probabilities of working after age 62 and 65, as well as the expected retirement age.

The difference between (1) and (2) is that, in (1), individuals are assumed to react to the level of the S&P 500, while in (2), individuals are assumed to react to the growth in the S&P 500 over the previous year. For example, the closing value of the S&P 500 index was 1335.49 on June 11, 2008, representing a decline of 11.5 percent from its value one year earlier. The closing value was almost the same (1333.7) on March 5, 2008, but this represented only a 2.9 percent decline from its value one year earlier. Specification (1) implies that an individual will report similar retirement intentions if interviewed on March 5 and June 11 (holding the other covariates constant). Specification (2) implies that an individual will report lower probabilities of working after age 62 and 65, and a lower expected retirement age, if interviewed on March 5 rather than June 11. Because we think that both reactions are possible, we estimate both specifications.

We also explore the possibility that individuals may react asymmetrically to positive and negative stock market changes. There are several reasons why this might occur. Loss aversion may induce individuals to react more strongly to recoup losses in their retirement income. As discussed by Khitatrakun (2003), the structure of DB plans, liquidity constraints, and employment-based health insurance may induce a similar effect. Individuals who retire early may face loss of employer-sponsored health insurance and penalties based on their DB plan rules. Moreover, early retirees may be unable to finance an adequate level of consumption if they cannot borrow against future DB and Social Security income. Thus, delaying retirement may be easier than moving it forward. To check if this is the case, we estimate (1) and (2) separately for individuals who experienced positive and negative changes in the S&P 500 over the preceding year.

However, merely finding the expected correlation between stock market performance and retirement intentions does not establish the mechanism underlying the relationship. As

mentioned earlier, it is possible that changes in risk aversion, the perceived amount of risk in stocks, or expectations of future economic conditions may be driving both stock market performance and retirement intentions. These factors may also operate asymmetrically with regard to gains and losses in the stock market.

If the effect of stock market changes on labor supply intentions operate primarily through reductions in the profitability of firms, then we would expect to find a stronger relationship among individuals with greater exposure to the stock market. We therefore attempt to identify groups that have higher levels of stock market exposure and estimate (1) and (2) including interaction terms for these groups. We hypothesize that individuals who own stocks outside of their retirement accounts are more exposed to equity markets and therefore more likely to react to stock market fluctuations. Furthermore, individuals who participate in defined contribution plans or hold individual retirement accounts are more likely to have retirement assets invested in equities. Thus, we focus on three groups: (1) individuals who hold assets in an individual retirement account, (2) individuals who participate in a defined contribution plan, and (3) individuals who own stocks outside their retirement accounts. As shown in Table 1, group (1) includes approximately 49 percent of the sample, group (2) includes approximately 29 percent of the sample, and group (3) includes approximately 34 percent of the sample. For all groups, we select our sample based on the value of the characteristic in the initial wave of the first-difference.

V. Results

A. Baseline Results

The first three columns of Table 3 report results from estimating equation (1), and the last three columns report results from estimating equation (2). We report only the coefficients on the

S&P 500 level or growth rate, the unemployment rate, the housing index, and interactions including them. While the S&P 500 coefficients in all six columns are negative, indicating that stock market declines tend to increase the planned age of retirement, only the estimate in column (5) that relates to the impact of changes in the S&P 500 on the probability of working full time past age 65 is statistically significant. The interpretation of the coefficient in column (5) is that a 20 percentage point increase in the growth rate of the S&P 500 (roughly the standard deviation of the S&P 500) lowers the probability of working after age 65 by 1.3512 percentage points (0.20 x 6.756), an approximately four percent reduction (1.35/31.4 = 4.3 percent). The P62 point estimates of columns (1) and (4) are the same sign and about two-thirds as large, but they are not statistically different from zero. The standard errors of these coefficients are such that we cannot rule out either that a one standard deviation change in the stock market has no effect on the probability of working or a positive effect of up to four percent.

As discussed in section IV, it is possible that individuals respond differently to positive and negative changes. In order to test this hypothesis, we estimate the effects of positive and negative effects of the S&P 500 over the past year and provide the results in Table 4. Columns 1-3 and 7-9 include observations with positive changes and columns 4-6 and 10-12 include only observations where the S&P 500 has fallen over the 12 months preceding the interview. The point estimates of the S&P 500 coefficients are consistently more negative for the "down" sample than for the "up" sample, and the probability of working past 62 seems to increase in a statistically significant manner for cases where the stock index has fallen (columns 4 and 10). The magnitude of the effect is meaningful. For instance, column 4 indicates if the S&P drops by 20 percent, then the probability of working past 62 increases by 1.8352 percentage points, or

almost four percent. While not all of the coefficients are statistically significant, once again the point estimates for the "down" samples are all negative.

The sample used in Tables 3 and 4 includes individuals of all ages. However, it is plausible that stock market fluctuations may not affect the retirement intentions of younger individuals much, regardless of the mechanism underlying the correlation. If stock market fluctuations represent exogenous shocks to wealth, such individuals have a longer period to recover from the shock. Moreover, even if the stock market is merely correlated with other factors that affect retirement intentions – for example, the level of optimism or pessimism about future economic conditions – we are still less likely to observe a relationship for younger workers as these conditions are more likely to have changed when they approach retirement. Thus, in Tables 5 and 6, we re-estimate the models of Tables 3 and 4 for individuals aged 58 and older.

Looking at Table 5 we see that, once again, the S&P 500 coefficients are all negative and statistically significant when the outcome variable is the probability of working at age 62 (columns 1 and 4) and in the percent change specification when the outcome variable is the probability of working at age 65 (column 5). Roughly speaking, all three of those coefficients indicate that a 20 percent move in the market would cause an approximately two percentage point move in the opposite direction in the probability of working at the particular milestone age. In Table 6, we find consistently negative coefficients on the stock market variable in the "down" cases, and the results are highly significant in columns 4 and 10 (for the probability of working full time at age 62), as well as column 11 (for the probability of working at age 65). Relative to Tables 3 and 4, the point estimates are magnified by focusing on the older group. For instance, column 10 indicates that a 20 percentage point decrease in the growth of the S&P 500 would lead to a 5.676 percentage point increase in the probability of working full time at age 62,

roughly a 11 percent increase. The estimates in columns 1 and 2 suggest that a stock market increase could lead to an increase in the probability of working for those 58 and over, which may suggest that stock market fluctuations do not influence labor supply behavior through changes in wealth in upward trending markets. Both the results in Tables 4 and 6 support the idea that the response to rising and falling stock markets is asymmetric.

To investigate the underlying mechanism behind the correlation between stock market fluctuations and retirement intentions, Table 7 presents results from estimating (1) and (2) including interactions for characteristics that may lead labor supply decisions to be more responsive to stock market fluctuations if they are occurring primarily through changes in retirement wealth. The first panel of Table 7 shows how the results in Table 3 differ across IRA ownership. The second panel shows how the results in Table 3 differ across DC plan participation. Finally, the third panel examines whether the results differ across stock ownership. Only two of the coefficients on the interaction terms are negative and significant at the ten percent level. In particular, the first panel shows that individuals who own IRAs respond more negatively to stock market changes than non-IRA owners when reporting the probability of working at age 65. Similarly, the third panel suggests that stockowners appear to respond more negatively to stock market changes than non-stockowners when reporting the probability of working at age 62. However, the majority of the interaction effects are statistically insignificant, and one (in the second panel) is even positive and significant at the ten percent level. Overall, we would not interpret this as clear evidence in favor of the wealth shocks channel.

Our results are consistent with those reported in Hurd and Reti (2001) and Hurd, Reti, and Rohwedder (2009), who find that while stockowners and individuals with high wealth retire earlier, analyzing changes in the probability of working shows no systematic relationship

between the change in wealth and the change in P62. While we do find a correlation between stock market performance and retirement intentions, there is not strong evidence that it is changes in wealth that underlie this relationship. Khitatrakun (2003) analyzes E(R) and shows that the stock market boom of the late 1990s led to negative changes in E(R) for those with high stock holdings and no constraints on retirement behavior; however, the limited sample period does not allow analysis of the stock market bust that followed.

Goda, Shoven, and Slavov (2011) use a methodology similar to the one in this paper and find a stronger, more consistent negative relationship between stock market performance and the probability of working at 62 among HRS respondents during the recent financial crisis (that is, between the 2006 and 2008 survey waves), particularly for those aged 58 and older. This difference is possibly due to different underlying causes of stock market changes across different periods. Campbell, Giglio, and Polk (2010) present evidence to suggest that the stock market boom of the late 1990s, as well as the downturn of 2000-2002, were caused primarily by changes in the discount factor. On the other hand, the recent downturn was caused primarily by a change in expected firm profitability, while the preceding boom was caused by a combination of changes in the discount factor and expected firm profitability. Based on this evidence, one could speculate that the relationship uncovered by Goda, Shoven, and Slavov (2011) is more likely to reflect the wealth shocks channel, while the weaker and less consistent relationship found in this paper is more likely to reflect other channels. An alternative explanation is that the stronger relationship found in the most recent waves is driven by factors that were correlated with stock market performance during the crisis (for example, the level of pessimism about the economy or expectations about future labor market conditions), or by media coverage that made stock market performance more salient.

Our result that individuals closer to retirement are more responsive to stock market fluctuations is consistent with Coile and Levine (2009). However, we cannot conclude that the relationship is driven by changes in wealth due to changes in the expected profitability of firms, and we also do not find evidence that more educated individuals (even within the older group) are more responsive to the stock market. Our empirical approach is quite different from that of Coile and Levine (2009) because we use panel data and self-reported retirement intentions rather than cross-sectional CPS data and actual retirement behavior.

B. Sensitivity Analysis

Thus far, the results show a weak negative relationship between shocks to the stock market and retirement intentions, but no strong evidence that the channel underlying this relationship is exogenous wealth shocks. To test whether this finding is sensitive to our specification of the model and definitions of variables, we perform a number of robustness checks. The full regression results from this sensitivity analysis are not reported, but are available upon request.

First, our estimation of equation (2) uses one-year changes in the S&P 500. The one-year horizon is somewhat arbitrary. Using a shorter horizon (for example, one month prior to the interview) would give us more individual variation in S&P 500 growth rate. On the other hand, previous work has found that individuals are sensitive to stock market returns over longer periods (Coile and Levine 2009). To test whether individuals respond to stock market performance over a longer or shorter time horizon, we re-estimate equation (2), but replace the one-year growth rate in the S&P 500 with the one-month growth rate and the five-year growth rate. We continue to find negative coefficients that are largely statistically insignificant on the one-month and five-year growth rates of the S&P 500.

Second, by including wave dummies in our regressions, we are using within-wave variation in stock market performance to identify the relationship between the stock market and retirement intentions. There is no particular reason to restrict attention to within-wave variation. We could, alternatively, use within-month variation by including month dummies. Or, we could use all of the temporal variation in stock market performance by not including any time dummies. To test the sensitivity to our choice of time-period dummies, we re-estimate equations (1) and (2) using month dummies and no time dummies. We find that replacing wave dummies with month dummies leads to estimates of the stock market index on intended labor supply behavior that are consistently negative and slightly larger in magnitude than those reported in Table 3, though not always statistically significant. When time dummies are removed entirely, the coefficients on the S&P index increase, and are occasionally positive. These results suggest that intentions regarding labor supply behavior may respond more to high-frequency variation than low-frequency variation.

Third, we examine whether individuals respond differently across thresholds other than zero percent. For example, it is possible that the relevant threshold is not zero percent but rather the average historical annual stock market return over several years. We therefore estimate specifications (1) and (2) separately for observations that experienced an annual gain on either side of 7.1 percent, the average return of the S&P 500 index between the beginning of 1950 and mid-2010. Our results are quantitatively and qualitatively similar to those reported in Table 4.

Fourth, the HRS only asks individuals who are currently working to report P62, P65, and E(R). This causes a potential sample selection problem. As discussed in Section III, if an individual retires between waves *t-1* and *t*, he or she would have responses to the questions about retirement intentions in wave *t-1*, but not in wave *t*. Thus, if we focus only on intentions of

working full-time at age 62 or age 65, we are forced to drop individuals who retire between waves. This issue does not exist for E(R), as we replace E(R) in wave *t* with the actual retirement age for individuals who retired between waves *t-1* and *t*. This sample selection may make it difficult to detect a response of retirement intentions on stock market changes, particularly during periods of stock market increases. If there is a stock market boom, individuals who are sensitive to stock market changes leave the labor force. Thus, only the less sensitive individuals are observed, and they report similar values of P62 and P65 compared to before the boom. This might cause us to conclude, incorrectly, that there is little relationship between the stock market and retirement intentions. We think this is unlikely because of the lack of a statistically significant relationship between expected retirement age (which is not subject to the sample selection problem) and stock market performance. But to confirm, we reestimate the regressions in Table 2 using only those individuals who remained in the labor force until they reached the relevant age (62 or 65). Our estimates of the coefficients on the stock market variables are similar in magnitude and statistical significance to those reported in Table 3.

VI. Conclusion

Consistent with media reports, we find weak evidence of a negative relationship between the market and retirement intentions for the whole sample HRS sample of working people over the age of 50. We characterize the evidence as weak because only one of the six specifications we examine is statistically significantly different from zero, though all of the relevant coefficients are negative. When we allow people's response to be different to market gains and losses, we find stronger and more significant negative connections between retirement intentions and the market in the case of market declines. These results could be explained by a psychological phenomenon of loss aversion or the relative ease of postponing retirement rather than

accelerating it. We also find a stronger relationship between stock market performance and retirement intentions for people 58 and over, and this relationship is amplified for market declines.

However, we find little evidence of a stronger relationship over the 1998-2008 period as a whole among groups that are more exposed to the stock market . These results suggest that the primary channel underlying the weak negative relationship we estimate between the stock market and labor supply behavior is unlikely to be primarily driven by fluctuations in wealth from stock market changes. While it is possible that individuals who have more assets exposed to market risk differ from the general population, our estimation strategy controls for unobserved heterogeneity by estimating our results in first differences.

Thus, in contrast to media reports, we believe it is unlikely that wealth shocks are the primary channel underlying the weak negative relationship we uncovered between the stock market and labor supply behavior. Rather, it may be that most stock market fluctuations over the period result from changes in the discount factor due to changes in the perceived amount of risk or changes in the level of risk aversion, both of which may independently affect labor supply. Furthermore, while the HRS combined with detailed geographic identifiers allows us to control for unobserved individual heterogeneity as well as fluctuations in housing values and unemployment rates, it is possible that there are other unobservable factors that are correlated with the stock market and retirement behavior. For instance, the general level of optimism, the salience of stock market fluctuations (for example, through media coverage), and expectations about future labor market conditions may also be changing in conjunction with the stock market index. These alternative explanations remain important areas for future research.

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1. The public release version of the HRS contains only the month of interview and Census region for each respondent.

2. When an interview took place on a day that the market was closed, we substitute the closing value on the previous trading day.

3. This index was downloaded from http://www.fhfa.gov, and is estimated using both sales prices and appraisal data.

4. Monthly county-level unemployment rates were obtained by creating custom tables at http://www.bls.gov/lau/, the website of the Bureau of Labor Statistics (BLS) Local Area Unemployment Statistics Program. We thank Sally Anderson at BLS for help with matching the BLS county-level unemployment series with the corresponding county Federal Information Processing Standards (FIPS) codes.

5. The information regarding balances in defined contribution accounts is contained in Dataset 9, and is only available for the current job. We combine this information with the RAND variables

indicating the types of pension plans in which the respondent participates through the current job. If the RAND variables indicate that the respondent does not have a DC pension, or if no pension information is available, we assume that the individual has a zero DC balance. If the RAND variables indicate that the respondent participates in a DC pension, but pension information is missing in Dataset 9, we set the value of the individual's DC balance to missing.

6. The expected retirement age is constructed using the year of planned retirement and the month and year of birth of the respondent. Retirements are assumed to occur on July 1 of the planned retirement year.

7. Individuals are first asked about their retirement plans. If the respondent reports that he or she plans to stop working entirely, the follow-up question is, "At what age do you plan to stop working?" If the respondent reports not having a retirement plan or not having thought about it, the follow-up question is, "At what age do you think you will stop working?" In the RAND version of the data, E(R) is constructed by combining responses to the two follow-up questions. Note that the second follow-up question – "At what age do you think you will stop working?" – does not specify full-time versus part-time work.

8. While not shown, an analogous figure plotting the probability of working after age 65 rather than 62 displays similar relationships.

9. As discussed in Section II, Coile and Levine (2009, 2010) find that less educated individuals are more affected by labor market conditions.

Table 1

Summary Statistics

	Mean	Standard Deviation	Minimum	Maximum
S&P 500	1220.58	156.25	752.44	1527.46
Percent Change in S&P 500 (previous 12 months)	6.0	16.9	-47.7	50.6
Percent Change in S&P 500 (since last interview)[a]	8.3	20.4	-48.0	59.2
P62[b]	49.7	38.8	0	100
P65	31.4	35.0	0	100
E(R)[c]	65.1	4.6	49.7	95.4
Positive Change in S&P 500 (previous 12 months)	0.720	0.449	0	1
County Unemployment Rate	5.1	1.9	1.1	32.9
Local Housing Index (FHFA)	323.0	122.0	133.6	722.5
Age	57.5	3.6	23.7	88.6
Male	0.481	0.500	0	1
Race = White	0.859	0.348	0	1
Race = African American	0.093	0.291	0	1
Race = Other	0.048	0.213	0	1
Education = High School or Less	0.092	0.289	0	1
Education = High School Graduate	0.322	0.467	0	1
Education = Some College	0.277	0.447	0	1
Education = College or More	0.308	0.462	0	1
Married - Spouse Working	0.503	0.500	0	1
Married - Spouse Home	0.153	0.360	0	1
Married - Spouse Information Missing	0.070	0.256	0	1
Single	0.274	0.446	0	1
Health Status Good or Better	0.837	0.370	0	1
Homeowner	0.857	0.351	0	1
Job Tenure in Current Job	10.911	11.308	0	49.3
Owns Stocks/Mutual funds	0.342	0.474	0	1
Owns Individual Retirement Account	0.487	0.500	0	1
Participates in Defined Contribution plan	0.294	0.456	0	1

Notes: Observations at person-year level using 1998-2008 Waves of HRS as specified. Summary statistics based on observations with a nonmissing value for P65 and, except where noted, N= 24,733.

a. N=17,427.

b. N=21,547.

c. N=11,122.

Table 2

Measures of Intended Labor Supply across Subsamples

	Full Sample	58 and Older	DC Participants	IRA owners	Stock/mutual fund owners
P62	49.7	51.6	58.6	50.0	47.9
P65	31.4	31.7	36.5	31.1	29.1
E(R)	65.1	66.0	65.3	65.0	64.8

Table 3

Effect of S&P 500 on Intended Labor Supply, Full Sample

VARIABLES	(1) P62	(2) P65	(3) E(R)	(4) P62	(5) P65	(6) E(R)
ln(S&P 500)	-4.128	-0.552	-0.104			
	(3.808)	(3.441)	(0.512)			
Percent Change S&P 500				-4.707	-6.756**	-0.210
				(3.583)	(3.254)	(0.499)
ln(unemp)	-1.242	3.073*	0.352	-1.220	2.675	0.348
	(1.763)	(1.675)	(0.241)	(1.756)	(1.677)	(0.240)
ln(unemp) X High School or Less	-0.510	-1.601	-0.206	-0.503	-1.495	-0.206
	(2.508)	(2.201)	(0.319)	(2.507)	(2.199)	(0.318)
ln(FHFA)	-2.862	-1.416	-1.480*	-3.058	-1.609	-1.487*
	(5.048)	(4.636)	(0.895)	(5.052)	(4.642)	(0.897)
ln(FHFA) X Homeowner	5.623	4.387	1.549*	5.613	4.359	1.551*
	(4.264)	(4.100)	(0.810)	(4.263)	(4.101)	(0.810)
Observations	12,374	14,506	8,015	12,374	14,506	8,015
R-squared	0.028	0.027	0.171	0.028	0.027	0.171

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Notes: Dependent variable indicated on column heading. P62 denotes probability of working full-time at age 62, P65 denotes probability of working full-time at age 65, and E(R) denotes expected retirement age. S&P 500 denotes value of S&P 500 index on

interview date. Percent Change in S&P 500 denotes annual growth rate in S&P 500 during 12 months prior to interview date. Monthly unemployment rates measured at the county level and quarterly housing index measured at the MSA level. All regressions include controls for age, marital status, retirement status of spouse (if married), homeownership status, self-reported health status, length of tenure at the current job, and an indicator for whether the current employer offers retiree health insurance. All regressions are run in first differences. Standard errors clustered at the household level. See text for more details.

Table 4

Percent Change Above and Below 0 Percent, Full Sample

VARIABLES	(1) P62	(2) P65	(3) E(R)	(4) P62	(5) P65	(6) E(R)
ln(S&P 500)	8.516	6.746	-0.109	-9.176**	-2.323	-0.190
	(6.699)	(5.806)	(0.861)	(4.496)	(4.067)	(0.627)
	(7) P62	(8) P65	(9) E(R)	(10) P62	(11) P65	(12) E(R)
Percent Change S&P 500	-0.461	-5.503	0.116	-14.66**	-7.690	-0.625
	(4.324)	(3.905)	(0.621)	(6.049)	(5.284)	(0.848)
Observations	7,690	9,098	4,988	4,684	5,408	3,027
Relationship to Threshold	Above	Above	Above	Below	Below	Below

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Notes: Dependent variable indicated on column heading. P62 denotes probability of working full-time at age 62, P65 denotes probability of working full-time at age 65, and E(R) denotes expected retirement age. S&P 500 denotes value of S&P 500 index on interview date. Percent Change in S&P 500 denotes annual growth rate in S&P 500 during 12 months prior to interview date. All regressions include controls for age, marital status, retirement status of spouse (if married), homeownership status, self-reported health status, length of tenure at the current job, an indicator for whether the current employer offers retiree health insurance, the natural log

of the unemployment rate, the natural log of the house price index, an interaction between homeownership status and the housing index, and an interaction between high school completion or less and the natural log of the unemployment rate. Monthly unemployment rates measured at the county level and quarterly housing index measured at the MSA level. All regressions are run in first differences. Standard errors clustered at the household level. Relationship to threshold denotes whether S&P 500 growth rate during 12 months prior to interview date was above or below 0 percent. See text for more details.

Table 5

Effect of S&P 500 on Intended Labor Supply by Age

VARIABLES	(1) P62	(2) P65	(3) E(R)	(4) P62	(5) P65	(6) E(R)
ln(S&P 500)	-10.40*	-2.165	-0.170			
	(5.558)	(4.419)	(0.587)			
Percent Change S&P 500				-13.50**	-9.331**	-0.590
				(5.507)	(4.514)	(0.593)
ln(unemp)	-2.011	4.660**	0.376	-2.154	4.074*	0.353
	(2.628)	(2.254)	(0.298)	(2.615)	(2.258)	(0.297)
ln(unemp) X High School or Less	-0.496	-0.577	0.195	-0.454	-0.427	0.197
	(3.609)	(2.976)	(0.378)	(3.609)	(2.978)	(0.378)
ln(FHFA)	-8.716	4.329	-1.531	-9.302	3.993	-1.538
	(8.284)	(5.894)	(1.184)	(8.288)	(5.872)	(1.183)
ln(FHFA) X Homeowner	2.846	-2.226	1.742	2.913	-2.226	1.736
	(6.920)	(5.183)	(1.074)	(6.913)	(5.165)	(1.070)
Observations	6,098	8,267	5,844	6,098	8,267	5,844
R-squared	0.040	0.039	0.177	0.040	0.040	0.178

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Notes: See notes for Table 3. Regressions performed for subsample aged 58 and above.

Table 6

Percent Change Above and Below 0 Percent, Individuals Age 58 and Over

	(1)	(2)	(3)	(4)	(5)	(6)
VARIABLES	P62	P65	E(R)	P62	P65	E(R)
ln(S&P 500)	17.24	17.29**	-0.0666	-16.09**	-7.247	-0.125
	(10.99)	(8.291)	(1.011)	(6.469)	(5.074)	(0.714)
	(7)	(8)	(9)	(10)	(11)	(12)
	P62	P65	E(R)	P62	P65	E(R)
Percent Change S&P 500	0.470	-1.251	-0.633	-28.38***	-15.67**	-0.492
	(7.075)	(5.899)	(0.738)	(8.617)	(6.544)	(0.965)
Observations	3,482	4,911	3,499	2,616	3,356	2,345
Relationship to Threshold	Above	Above	Above	Below	Below	Below

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Notes: See notes for Table 4. Regressions performed for subsample aged 58 and above.

Table 7

Effect of S&P 500 on Intended Labor Supply by IRA Ownership, DC Participation, and Stock Ownership

VARIABLES	(1) P62	(2) P65	(3) E(R)	(4) P62	(5) P65	(6) E(R)
			IRA Ownership			
ln(S&P 500)	-3.268	-0.291	-0.0325			
	(4.116)	(3.842)	(0.563)			
IRA owner X ln(S&P 500)	-1.728	-0.520	-0.163			
	(2.978)	(2.826)	(0.409)			
Percent Change S&P 500				-3.732	-4.560	-0.129
				(3.902)	(3.573)	(0.538)
IRA owner X Percent Change S&P 500				-1.944	-4.338*	-0.172
				(2.723)	(2.441)	(0.369)
			DC Plan Participation			
ln(S&P 500)	-3.993	-2.137	-0.348			
	(3.959)	(3.573)	(0.545)			
DC Participation X ln(S&P 500)	-0.384	4.568	0.656*			
	(3.028)	(2.783)	(0.385)			
Percent Change S&P 500				-3.891	-6.984**	-0.0866
				(3.736)	(3.408)	(0.534)
DC Participation X Percent Change S&P 500				-2.399	0.667	-0.361
				(2.794)	(2.505)	(0.351)
			Stock Ownership			
ln(S&P 500)	-3.567	-0.151	0.0190			
	(3.994)	(3.636)	(0.545)			
Stockowner X ln(S&P 500)	-1.562	-1.126	-0.329			
	(2.946)	(2.757)	(0.419)			
Percent Change S&P 500				-2.826	-5.641*	-0.141
				(3.785)	(3.413)	(0.511)
Stockowner X Percent Change S&P 500				-4.685*	-2.759	-0.177
				(2.693)	(2.416)	(0.394)
Observations	12,374	14,506	8,015	12,374	14,506	8,015

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Notes: See notes for Table 4.

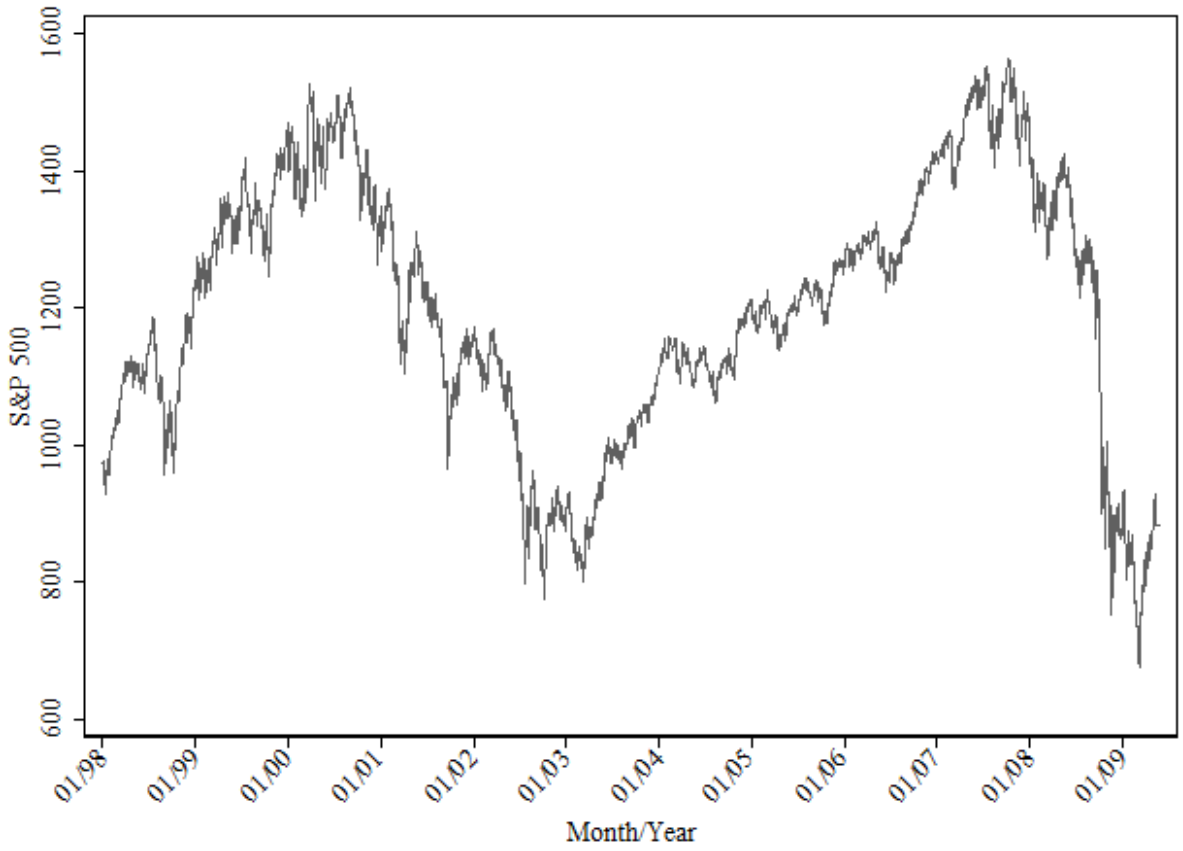

Figure 1

Level of S&P 500 Index between 1998 and 2009

Source: Yahoo! Finance.

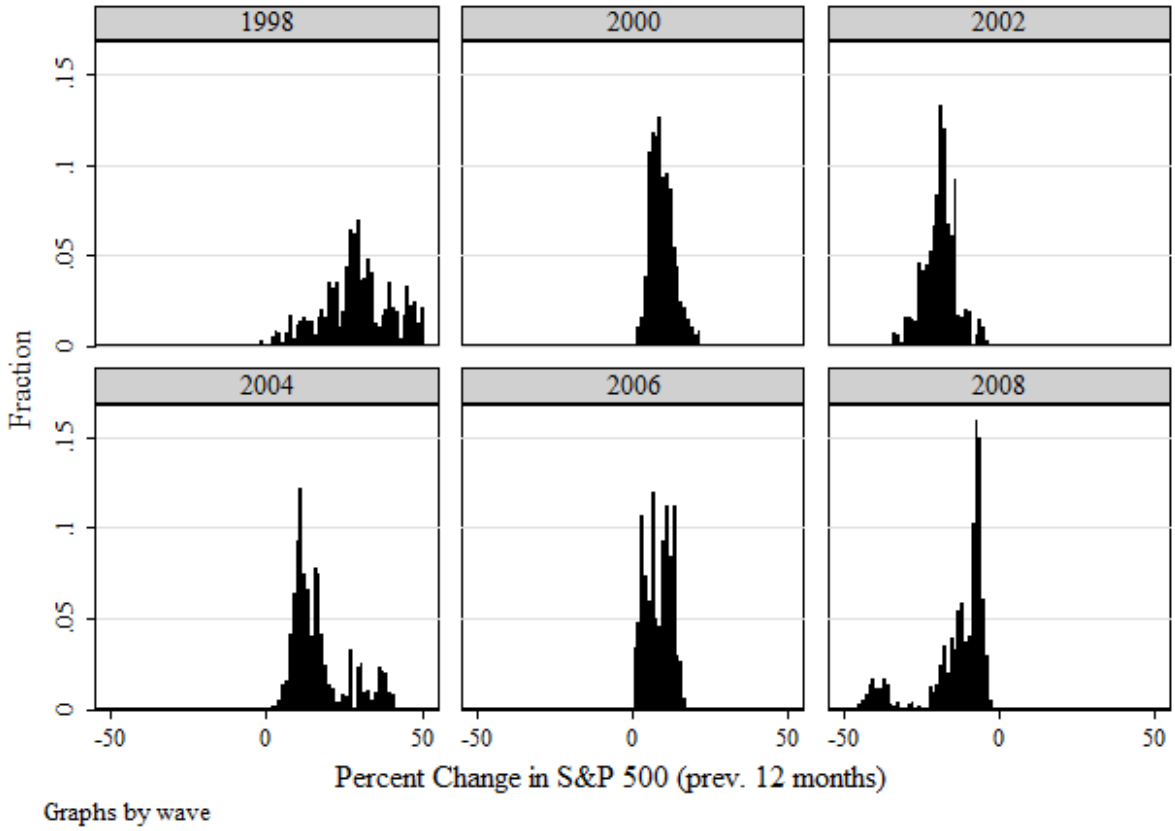

Figure 2

Distribution of Growth Rates in S&P 500 Index for 12 Months Preceding Interview Date by Wave

Notes: Growth rate in S&P index calculated for 12 months prior to interview date for each respondent in HRS.

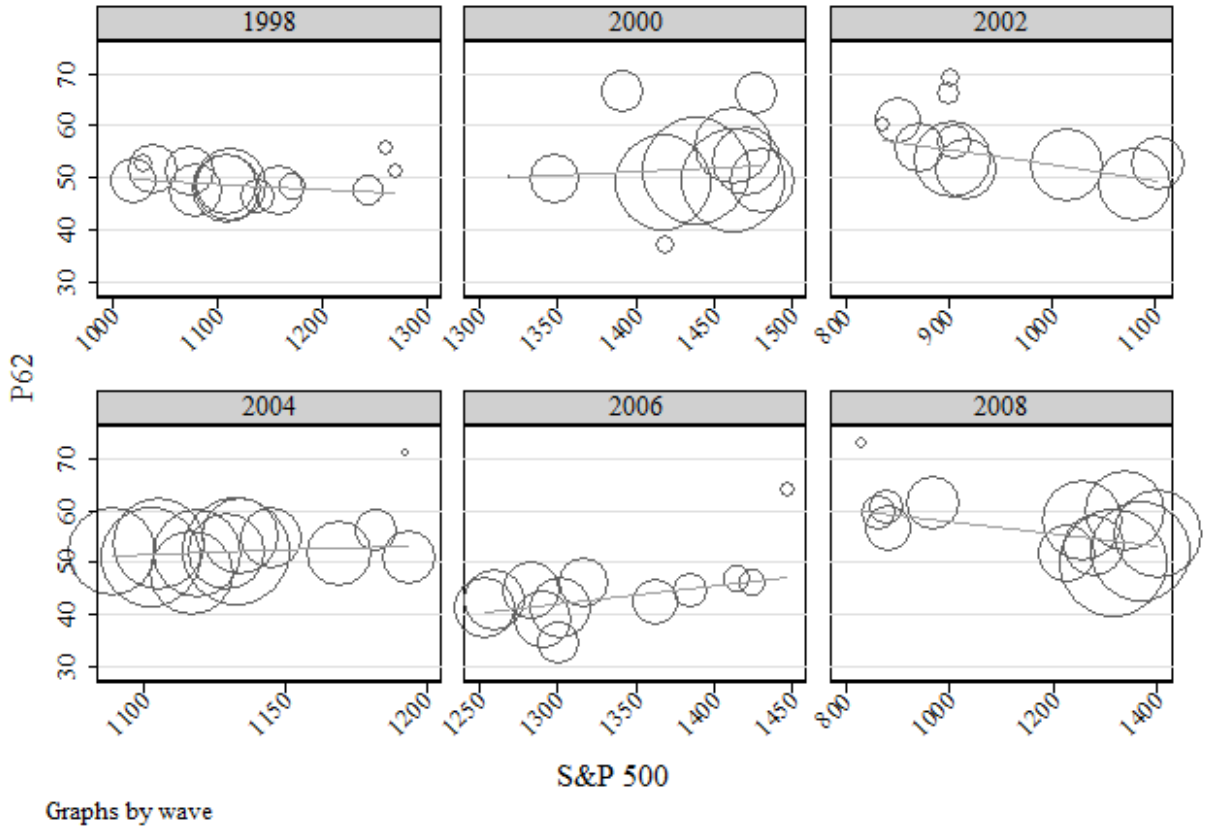

Figure 3

Relationship between P62 and S&P 500 Index on Interview Date by Wave

Notes: P62 denotes probability of working full-time at age 62. P62 and S&P 500 averaged over month of interview. Size of circle represents weight of observations in each month. Line represents best fit linear regression line between P62 and S&P 500 for each wave.