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BULLS, BEARS, AND RETIREMENT BEHAVIOR

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ABSTRACT

The historic boom and bust in the stock market over the past decade had the potential to significantly alter the retirement behavior of older workers. Previous research examining the impact of wealth shocks on labor supply supports the plausibility of this hypothesis. In this paper, we examine the relationship between stock market performance and retirement behavior using the Health and Retirement Study (HRS), Current Population Survey (CPS), and Survey of Consumer Finances (SCF). We first present a descriptive analysis of the wealth holdings of older households and simulate the labor supply response among stockholders necessary to generate observed patterns in retirement. We show that few households have substantial stock holdings and that they would have to be extremely responsive to market fluctuations to explain observed labor force patterns. We then exploit the unique pattern of boom and bust along with variation in stock exposure to generate a double quasi-experiment, comparing the retirement and labor force re-entry patterns over time of those more and less exposed to the market. Any difference in behavior that emerged during the boom should have reversed itself during the bust. We find no evidence that changes in the stock market drive aggregate trends in labor supply.

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I. INTRODUCTION

After posting record gains in the late 1990s, the U.S. stock market dropped precipitously starting in the year 2000, as illustrated in Figure 1. In the twelve months following the market peak in March 2000, the benchmark S&P 500 Index lost over one-quarter of its value and the NASDAQ Composite Index lost over 60 percent of its value; by October 2002, the S&P 500 had fallen by 50 percent from its peak and the NASDAQ had fallen by nearly 80 percent.

This remarkable decline in stock value occurred at a time when more Americans were exposed to the stock market than ever before, often through participation in their pension plans. Friedberg and Webb (2003) report that 79 percent of full-time workers with pensions had a 401(k) plan or other type of defined contribution plan in 1998, rising from 40 percent in 1983. Poterba (2001) finds that 52 percent of households held some stock in 1998, either through direct ownership of individual stocks or stock mutual funds or in their defined contribution plan or individual retirement account (IRA), up from 36 percent in 1989. As a result, it was widely predicted that the stock market drop would force many older workers to postpone retirement.[1] In fact, in an AARP (2002) study of 50 to 70 year old stock holders, 21 percent of those who had lost money in stocks and not yet retired reported that they have postponed retirement.

Aggregate labor force statistics appear to offer some support for this hypothesis. Eschtruth and Gemus (2002) note that the two percentage point increase in labor force participation rate for older workers (aged 55 to 64) that occurred between early 2000 and early 2002 is unprecedented in the U.S. since World War II and is particularly noteworthy for having occurred during a recession, when labor force participation is typically flat or declining. They

[1]For instance, in response to plummeting stock prices the July 29, 2002 cover of Time Magazine asked, "Will You Ever Be Able to Retire?"

suggest that "plunging stock portfolios may have caused some older workers to postpone retirement and convinced some early retirees to rejoin the labor force."

However, there are reasons to be skeptical that the drop in the stock market had much of an impact on aggregate labor force behavior. First, if the bear market led people to delay retirement, one may have predicted that the bull market in the late 1990s would have led individuals to retire earlier. Yet data from the Bureau of Labor Statistics indicate that the labor force participation rate for individuals 55 to 64 actually *rose* by about 2 percentage points during the 1995 to 1999 boom years.[2] Moreover, while significantly more workers have stock market holdings now than in the past, many workers may not yet have accumulated large balances in these accounts and thus may be unlikely to respond to even a sizeable drop in the market. While individual investors may have altered their retirement plans, the ability of stock fluctuations to drive aggregate labor force patterns may be limited.

In this paper, we examine the relationship between stock market performance and retirement behavior over the past two decades, paying particular attention to the boom and bust periods of 1995-1999 and 2000-2002, respectively. For our analysis, we use data from the first six waves (1992-2002) of the Health and Retirement Study (HRS), from the March 1981 to 2003 Current Population Surveys (CPS), and from the 1992, 1995, and 1998 Surveys of Consumer Finances (SCF). We first provide a descriptive analysis that begins by documenting trends in retirement patterns using the CPS and HRS data. We also present descriptive statistics detailing the stock market holdings of older households in the late 1990s and then provide a "back-of-the-envelope" calculation to simulate the magnitude of the response to the recent stock market

[2] These data were accessed from the Bureau's customized table-maker, available at data.bls.gov and accessed on July 5, 2004. Although this pattern may be partly attributable to the robust economy during the period, our own calculations (described subsequently) show that even cyclically-adjusted annual retirement rates were unaffected by the boom.

decline that would be required to generate the observed drop in retirement rates. Second, we undertake a reduced-form analysis to compare the effect of the stock market on the retirement behavior of individuals who are likely to have been differentially affected by changes in the market, such as persons with and without defined contribution pension plans. Evidence supporting an impact of the stock market on retirement behavior would require that those who are more likely to own stock are also more likely to retire in booms and less like to retire in busts. We also apply the same empirical strategy to an analysis of labor force re-entry decisions.

This paper makes several contributions to the existing literature on the stock market and retirement. First, along with Kezdi and Sevak (2004), we are the first to look at both the boom period of the late 1990s and the bust period that followed. But our methodology more directly imbeds these two periods into a quasi-experimental framework, taking advantage of what amounts to a double experiment in which differences across groups that are predicted to emerge during the boom are also predicted to reverse during the bust. Second, we focus on the aggregate response to market movements rather than estimating individual wealth effects. Our goal is to estimate the relationship between market fluctuations and aggregate changes in retirement rather than the relationship between wealth and retirement.

Our results suggest that the stock market has very little influence on aggregate labor market behavior. This conclusion is based on the relatively small number of households with sizeable stock holdings, the magnitude of their retirement response that would be required to generate the types of retirement patterns observed recently, and the fact that we are unable to find any evidence that population subgroups who should be more responsive to market fluctuations are more responsive. This is not to say that changes in an individual's wealth are

unrelated to his/her decision to remain in the labor market, but that the number of individuals for whom market fluctuations are meaningful is simply too small to drive any aggregate patterns.

II. LITERATURE REVIEW

Economic theory suggests that the consumption of leisure, like the consumption of goods and services, should increase when the household experiences a positive wealth shock and likewise decrease when the household experiences a negative wealth shock. For households nearing retirement age, a positive (negative) wealth shock may lead family members to retire earlier (later), especially if workers lack the flexibility to change the number of hours they work at their current job. Dramatic and arguably unexpected changes in stock market returns may generate shocks of this nature. Therefore, the broader literature on the impact of wealth shocks as well as those studies directly examining the role of stock market fluctuations can inform this study.

Recent research examining the role of wealth shocks more broadly has relied on sources of variation in retirement wealth that are exogenous to an individual's preferences for leisure. For instance, several authors have focused on inheritances and lottery winnings. Joulfaian and Wilhelm (1994) estimate relatively modest effects of inheritances on the retirement decisions of older men, while Holtz-Eakin, Joulfaian, and Rosen (1993) find that working-age individuals receiving large inheritances are three to four times more likely to exit the labor force than individuals receiving small inheritances. Imbens, Rubin, and Sacerdote (2001) estimate that lottery winners consume about 11 percent of their winnings in the form of reduced labor earnings and that the effect is about one-third larger for individuals aged 55 to 65. Other authors have exploited natural experiments resulting from policy changes. Krueger and Pischke (1992) find

little evidence of an increase in labor supply for workers born between 1917 and 1921, who experienced a dramatic reduction in Social Security benefits due to a law change. Thus the general evidence regarding wealth effects on labor supply is mixed.

A second related strand of the literature explores the impact of unexpected changes in wealth associated with stock market fluctuations, and largely the boom of the late 1990s, on retirement decisions. Coronado and Perozek (2003) find that those who received unanticipated equity gains during the market boom of the late 1990s retired earlier than they had anticipated. Sevak (2001) finds a relationship between unexpected capital gains and retirement as well. Yet she also recognizes that the relationship between unexpected wealth gains and earlier retirement are relevant only for the reasonably small share of the population that has considerable holdings in stocks. She reports that "the data finds quite large wealth effects, (but) because many individuals have negligible wealth gains over the period, the aggregate effect is quite small." These studies are subject to the critique that differences in unexpected gains are strongly (if not perfectly) correlated with previous differences in the amount of stock ownership. These differences may be correlated with other unobservable characteristics, like individuals' preferences for leisure or their ability to plan for retirement.[3]

A third set of analyses has introduced quasi-experimental methods, examining whether retirement behavior responds differently to market variation among those with more and less exposure to the stock market.[4] Sevak (2001) finds that men in defined contribution (DC) pension plans were more likely to retire between 1996 and 1998 compared to men with defined benefit

[3] Coronado and Perozek (2003) acknowledge a related concern, stating that their results "might be biased if unobservable characteristics are correlated with both stock ownership and a willingness to revise retirement plans." Although they find no evidence of this with regard to a measure of risk aversion, other such characteristics may still present problems.

[4] Hurd and Reti (2001) use similar methods to examine the impact of market fluctuations on the subjective probability of retirement after age 62. They find no evidence that changes between 1996 and 1998 in this measure differ by stock ownership status or pension plan type.

(DB) pensions, using the difference in the retirement rates of these groups in an earlier period to control for any underlying difference in their propensities to retire. One limitation of this analysis is that it does not control for possible differences in underlying trends in retirement behavior between groups. For example, if workers with DB pensions are initially more likely to be eligible for retiree health insurance but employers start to drop this coverage during the 1990s, workers in DB plans would begin to retire relatively later for reasons unrelated to the stock market. One feature that may contribute to this problem is the restriction that baseline retirement hazards are the same for the different groups, as any difference in underlying trends could bias the results.[5] Our double experiment addresses this problem.

In a later paper also incorporating the bust period, Kezdi and Sevak (2004) find that CPS respondents with dividend income are less likely to retire in 2001 and 2002 than respondents without dividend income. Unfortunately, those with dividend income represent a small fraction of those exposed to stock fluctuations. Moreover, their results also indicate that this group is less likely to retire during the boom, suggesting that differences in underlying preferences for retirement explain their findings, and not market fluctuations. The authors also find that the labor force transition rates for HRS respondents with risky assets (stocks, mutual funds, DC plans, or IRAs) are not significantly different in the 1998-2000 and 2000-2002 periods. This analysis is the most similar to ours, except that we look over a longer time period, allow baseline hazards to vary by group, and use additional measures of stock exposure. Taken as a whole, the

[5] Sevak (2001) acknowledges our concern, stating that her method provides an "unbiased estimate as long as there were no other unobserved changes occurring over the time period that differentially affected the retirement patterns of DC workers." Beyond ambiguous types of unobservable heterogeneity, it also seems to us that mechanical features of the different types of plans will create such problems. Individuals in defined contribution and defined benefit pension plans have different underlying incentives to retire at particular ages, so as the HRS sample grows older, the surges in retirement may occur at different times for different groups (as discussed in Friedberg and Webb, 2003). Sevak talks about the different pension incentives, but does not relate them to the limitations of her identification strategy.

evidence for greater labor supply responses to changes in the stock market for those with more exposure to the market is far from conclusive.[6]

This paper offers a number of contributions relative to past research. First, along with Kezdi and Sevak (2004), we explore the relationship between the stock market and retirement in both the boom and bust period. Beyond extending the time frame of the analysis, the second contribution of our analysis is to use both the boom and the bust in our quasi-experimental framework to provide a stronger causal test of the impact of market fluctuations. These two periods provide a unique double experiment. Any differences that emerge in retirement behavior across groups during the boom of the late 1990s should be reversed during the bust of the early 2000s if stock market fluctuations cause individuals to change their retirement behavior. This approach enables us to dismiss the possibility that differences in the labor market trends in groups with more and less stock market exposure may confound estimates of the effect of market fluctuations. Third, our quasi-experimental approach builds upon those employed in past studies by using more measures of potential stock market exposure and estimating regressions separately for each of these groups using data from both the CPS and HRS. Finally, while many previous papers have been primarily concerned with estimating the effect of stock market wealth on labor supply for the relatively small number of people experiencing large changes in wealth, we are primarily concerned with exploring whether wealth effects can explain observed aggregate movements in labor supply.

[6] Other studies have also examined stock market fluctuations and retirement behavior using an approach where relevant elasticities are either taken from other studies or estimated within the framework of a structural retirement model and then used to predict responses to market fluctuations (Cheng and French, 2003; Gustman and Steinmeier, 2002). The labor supply responses to the stock market boom and bust estimated in these papers are quite large, on the order of 2 to 3 percentage points. However, the methodological approaches employed in these papers are sufficiently distinct from that which we apply in our analysis that we do not discuss them in further detail here.

III. DATA AND EMPIRICAL STRATEGY

We utilize three different sources of data, each of which has distinct strengths and weaknesses that make it better suited for certain parts of the analysis. Where possible, each analysis is replicated using a second data source to confirm the results.

The first data set is the Health and Retirement Study (HRS). The HRS began in 1992 as a longitudinal study of persons born between 1931 and 1941 and their spouses, with re-interviews of these 7,500 households every two years; in 1998, additional birth cohorts were added to the survey so that it now includes persons born in all years through 1947. The HRS contains richly detailed information on demographics, labor supply, finances, and health. The principal advantage of the HRS is that it provides comprehensive data for a sample of near-retirement age households and follows them over time.

In this paper, we use two main components of the HRS: information on retirement behavior and on wealth holdings. For our analysis of retirement behavior, we use longitudinal data on wave 1 (1992) respondents for the first six waves of the survey (1992-2002). In one part of that analysis, respondents contribute person-year observations for all years between 1992 and 2001 in which they were aged 55 to 70, were working at the beginning of the calendar year, and had not previously retired; retirement is defined as reporting a labor force status of retired or disabled by the end of the calendar year.[7] In a second part of that analysis, we construct an analogous sample of person-month observations, making use of the availability of data on month of retirement. We also present a descriptive analysis of household wealth holdings; we use wave

[7] The sample is constructed using HRS respondents who are working at wave 1, so respondents who retire in 1992 prior to their interview are not in the sample. Persons who exit the labor force by other pathways (e.g., exit to homemaker status, exit to other or no labor force status, or leave survey) do not provide a retirement date and thus are used in the sample only for the years in which it is known they worked the full year and omitted thereafter. Results are very similar if exits to disability are treated in the same manner. If persons report multiple labor force status codes at a point in time, the following hierarchy is used: working, retired, disabled, all other.

4 (1998) data for that because it is the last interview available prior to the stock market crash.[8] In both the descriptive and retirement analyses, several variables are used to proxy for likely exposure to the stock market: educational attainment, ownership of a DC plan or IRA within the household, and ownership of individual stocks or stock-based mutual funds.[9] A designation of having "high value" DC and IRA or stock balances refers to having balances in excess of $50,000 in 2003 dollars.

The Current Population Survey (CPS) is a monthly survey of approximately 50,000 households and forms the basis for most published U.S. labor statistics; we use data from annual March CPS surveys from 1981 to 2003, referencing behavior in 1980 through 2002. Compared to the HRS, the CPS includes a roughly similar number of older households but it collects less information on them and does not follow the same households over time. CPS data, however, are available for a longer period of time so that we can observe greater cyclical variability in the stock market to compare to retirement behavior. The March surveys not only provide current labor market activity, but they also provide retrospective reports from the past calendar year. From these data, we define a transition into retirement as one in which an individual reports working at least 13 weeks in the preceding calendar year, but s/he is currently out of the labor force on the survey date.[10] Although data on the wealth holdings of CPS respondents are limited, we are able to use some information on whether or not the individual was included in a pension

[8] We acknowledge that the values of these holdings immediately prior to the bust would likely be somewhat higher due to continued growth in the market through March 2000.

[9] IRA and stock ownership status and asset values come from the RAND HRS data file, which imputes missing values using bracketed data (e.g., does your account amount to more or less than $10,000) and other information. Because asset allocation of DC balances is observed for only a small fraction of DC plans, DC plan participation is used as a proxy for stock market wealth in the analysis, though of course not all participants will invest their DC balances in stock. In the regression analysis, asset ownership is determined based on ownership at wave 1, so as to be exogenous to the subsequent boom and bust in the stock market. In the descriptive analysis, asset ownership is based on ownership at wave 4, as the point of the exercise is to describe assets in the pre-crash period.

[10] Assuming those 13 weeks worked last year all took place in the first quarter, then this definition is comparable to an annual window where retirements are observed between March of one year and the next.

plan (defined benefit or defined contribution) and on their educational attainment to provide a rough proxy for stock holdings.

The Survey of Consumer Finances (SCF) is a survey of about 4,500 households conducted every three years to collect detailed data on the finances of U.S. households. Compared to the HRS, the SCF has more in-depth information on stock holdings. It provides no information that would enable us to detect retirement transitions, however, so these data can only contribute to our descriptive analysis of wealth holdings. In the analysis, data from the 1992, 1995, and 1998 SCF is pooled to generate a sample sufficiently large to estimate descriptive statistics of the wealth holdings of older households and of subgroups of this population.

Our empirical analysis of the link between the stock market and retirement is divided into two parts, a descriptive analysis and a reduced-form analysis. The goal of the descriptive analysis is to explore the plausibility of a large labor supply response to the recent drop in the stock market. First, we present detailed statistics on the wealth holdings of older households in the late 1990s to examine the level of stock market exposure in this population. Second, we conduct a "back-of-the-envelope" calculation to estimate the magnitude of the response to the stock market shock that would be necessary to explain the drop in the average retirement rate; this exercise is described in more detail below.

In the reduced-form analysis, the empirical strategy is to compare the response to changes in the stock market among individuals likely to have been differentially affected by such changes. The identification of stock market effects relies on quasi-experimental variation in exposure to the stock market, which comes from factors such as education level, participation in a defined contribution pension plan or IRA, and ownership of stocks or stock mutual funds. We hypothesize that if the stock market affects people's retirement behavior, then the response to

changes in the stock market should be larger among groups with greater exposure to the stock market. Importantly, any differential in retirement behavior across groups generated during the boom should be reversed during the bust. Findings to that effect in response to this double experiment would provide strong evidence of a causal effect of stock market fluctuations.

Specifically, we estimate regressions of the following form:

$$retire_{ist} = \beta_0 + \beta_1 bust_t + \beta_2 boom_t + \beta_3 X_{ist} + \gamma_s + \varepsilon_{ist} \quad (1)$$

where: *retire* is a dummy variable for whether the individual i residing in state/region s who worked in year t-1 retires in year t, *bust* and *boom* are dummy variables for whether the person-year observation occurs in a bust year (2000-2001 in the HRS or 2000-2002 in the CPS) or a boom year (1995-1999), X is a set of demographic characteristics including exact age dummy variables, race and ethnicity, gender, marital status, the unemployment rate (state-level in the CPS or region-level in the HRS), and state or regional fixed effects. The sample is restricted to individuals working in year t-1 and, in the HRS, to those workers who have not retired previously. Therefore, this model is very similar to a discrete time proportional hazard model.[11] This model is estimated first for all workers aged 55-70. But the true test of the impact of market fluctuations comes by estimating this model separately for groups who may be differentially affected by changes in the stock market and comparing coefficients for the boom and bust periods across groups.[12]

Estimation of equation (1) provides a way to identify whether there is a relationship between the stock market and retirement, but does not determine the magnitude of the impact of

[11] Estimating models like equation (1) using a logit specification is equivalent to estimating a discrete time proportional hazard model (Allison, 1984). We opt to estimate equation (1) as a linear probability model for ease of interpretation of the coefficients; the results using a logit specification are qualitatively similar.

[12] We choose to estimate the model separately by group rather than interacting the group dummy variable with the boom and bust dummies in order to allow the other covariates, notably the age dummies, to differ by group.

market fluctuations on retirement behavior. To do so, a second set of regressions of the following form are estimated:

$$retire_{ist} = \beta_0 + \beta_1 \Delta S\&P500_t + \beta_2 X_{ist} + \gamma_s + \varepsilon_{ist} \quad (2)$$

where ΔS&P500 is the percent change in the S&P 500 Index over the previous twelve months. As before, the model is estimated for all workers and separately for groups of workers likely to have been differentially affected by changes in the stock market. Note that the identification strategy is similar to that underlying equation (1), but this analysis allows for the effect to be parameterized. On the other hand, it loses the value of the double experiment in providing a stronger causal interpretation of the results.

Finally, we explore the effect of stock market fluctuations on the decision to re-enter the labor force following retirement, as this may also constitute an important labor supply response to changes in the market. Specifically, we re-estimate equations (1) and (2) using labor force re-entry as the dependent variable. In the CPS, labor force re-entry is defined as working on the survey date conditional on having worked fewer than 13 weeks in the previous year. In the HRS, labor force re-entry is defined as working at the current wave of the survey conditional on having been out of the labor force at the last wave.[13] We hypothesize that if the market affects re-entry decisions, then those with greater exposure to the market will be relatively less likely to re-enter the labor force during the boom period and relatively more likely to do so during the bust period.

[13] The HRS labor force re-entry analysis is based on a sample of person-wave observations. Creating a person-year sample for this analysis is not feasible because the date of labor force re-entry is either missing or inconsistent (e.g., respondent reports starting current job in 1995 but previously reported self out of labor force in 1996) for about half of all re-entrants. In this analysis, the boom period includes labor force transitions between waves 3 and 4 and waves 4 and 5 (1996-1998, 1998-2000) and the bust period includes transitions between waves 5 and 6 (2000-2002).

IV. RESULTS

A. Descriptive Analysis

We begin our analysis by offering data from the CPS and HRS in Figures 2A and 2B, respectively, which track changes in retirement patterns over time for workers ages 60 to 65. Since the size of exact age cohorts change over time and since the economy moved from a significant expansion in the late 1990s to a period of recession and weak growth in the beginning of the current decade, we use the available data to generate retirement rates adjusted for age composition and business cycle conditions over time.[14] Results from both surveys are consistent with the statistics reported in Eschtruth and Gemus (2002) in that retirement rates took a noticeable and significant drop exactly in 2000, which corresponds with the plunge in the stock market. In both datasets, despite the differences in the definition of retirement transitions, older workers appear to have reduced their likelihood of retiring by about two percentage points during the market bust, or about 15 percent from an approximate baseline retirement rate of about 13 percent.

As previewed earlier, however, there are reasons to be skeptical of a causal relationship between recent market performance and retirement even based on this preliminary analysis. First, the change in the retirement rate in 2000 is quite large, especially considering the timing of the market decline. Although the S&P 500 peaked for the year on March 24th at 1,527 and declined to 1,320 by the end of the year (a 14 percent decline), on September 1, the value stood at 1,521. This means that the most of the retirement response to this drop should have occurred

[14] These estimates are obtained from regression models of the retirement rate on state-level (in the CPS) and region-level (in the HRS) unemployment rates, exact age dummies, and year fixed effects (and no constant); reported results reflect the year fixed effects assuming a 5 percent unemployment rate and an equal share of workers ages 60 through 65. In the CPS, year labels are associated with the survey conducted in March of the following year since most of the retirement that is captured in that survey is likely to reflect behavior that occurred last year, as described above. All HRS figures begin in 1993, as the sample is constructed using wave 1 workers (see above) and does not capture all retirements in 1992.

in the last quarter of the year. Although the argument is not quite as strong with the NASDAQ, which hit its annual peak of 5,049 on March 10th and fell to 2,471 by the end of the year (a 51 percent decline), the market's index stood at 4,234 as late as September 1. This also suggests that much of the response had to take place late in the year and must have represented a very large change in behavior over a very short period of time.

Second, the CPS data provide little evidence of a symmetric response to the booming stock market of the late 1990s. Cyclically adjusted retirement rates between 1995 and 1999 were actually lower over that period than they had been previously despite the greater wealth generated by exceptional stock market returns. However, other time-varying factors may confound this simple analysis of the effect of the stock market on retirement, so this evidence is informative, but far from conclusive.

The limited stock holdings of most older households also suggest that market fluctuations may not have a sizeable effect on aggregate labor market behavior.[15] The nature of these holdings is reported in Tables 1A and 1B, using data from the HRS and SCF, respectively. Statistics reflect the holdings of workers nearing retirement age (55 to 60). Data from the 1998 HRS and from the 1992, 1995, and 1998 SCF are employed to assess holdings prior to the stock market plunge in early 2000.[16]

In the HRS (Table 1A), over two-thirds of older households now have retirement accounts – 46 percent of households have one or more members with a defined contribution (DC) pension plan, 47 percent of households have an IRA, and 68 percent of households have

[15] Engen, et al. (2004) make a similar point regarding the impact of stock market fluctuations on the adequacy of retirement savings, stating "because most stocks are held by households with substantial wealth, and most households hold very little equity, fluctuations in stock market values … have little effect on households' ability to save adequately for retirement."

[16] We have also relaxed the sample restrictions placed on the analysis performed here and verified that we can replicate official SCF results on wealth holdings, published in Kennickel, et al. (2000).

one or both types of retirement account. Yet it is important to keep in mind that these accounts are not necessarily invested entirely, or even mainly, in stocks; older households making more conservative investments based on their age may reduce their holdings in stock-based investments because of their riskier nature. Ownership of individual stocks or stock mutual funds outside of retirement accounts is less prevalent but still significant, with 38 percent of households owning these assets. Overall, 75 percent of families have some type of account (DC pension, IRA, or stocks) that may include stock holdings, although this statistic is also likely to overstate exposure to the stock market.

Median assets values in these accounts are high by historical standards, but still low relative to family income. Among households holding each type of asset, median holdings in DC accounts and IRAs are about $40,000 each, while median stock holdings are $33,900. Among households with any of these three accounts, median combined holdings are $68,900. This represents less than one and a half times median income, which was $48,728 (in 2003$) for households aged 55 to 64 in 1998 (U.S. Census Bureau, 1999).

Moving across Table 1A, it is evident that the distribution of these assets is highly skewed. While 68 percent of families own a DC plan or IRA, only 28 percent of families have combined balances of over $50,000 in these assets, and median combined holdings for this subset of families are $208,800. Similarly, only 17 percent of families have holdings of stocks in excess of $50,000; median combined holdings for these families are $311,600. Asset holdings also vary significantly by education level – 89 percent of college-educated households have some type of account that may include stocks, but only 52 percent of high school dropouts do so. The median combined holdings are $146,700 for college-educated households compared to

$20,300 for high school dropout households. These differences in stock holdings are an important component of our quasi-experimental methodology.

Table 1B replicates these statistics using the SCF. The SCF statistics are broadly similar to those in Table 1A, though ownership of DC pensions and stocks is less prevalent and asset values are somewhat lower, as one would expect given the pooling of data with earlier years. Yet the SCF data provide the advantage that they include better information on whether DC pension and IRA assets are invested in stock. Figure 3 illustrates that the fraction of households reporting that their DC plan or IRA is invested mostly in stocks is consistently less than 50 percent. This is also true for IRA plans as reported in the HRS. When DC pension and IRA assets are counted only if invested mostly in stock, both the fraction of households holding each type of asset and the median value of assets decrease significantly. While 41 percent of households have DC pensions, only 15 percent have pensions invested mostly in stocks; for IRAs, the equivalent figures are 48 percent and 21 percent, respectively. Overall, only 48 percent of households have any assets invested mostly in stock, and the median value of such assets among these households is $42,900, which is less than the 1998 median household income for this age group (in 2003$).

The key point from these descriptive statistics is that the labor supply response to the drop in the stock market in 2000 is unlikely to come from the median person. Fewer than half of older households have any assets invested mostly or all in stock, and median asset holdings for households that do are on the order of one year of household income. It seems unlikely that even a sizeable decrease in the value of these assets would generate a large labor supply response.

To explore this point further, we conduct a "back-of-the-envelope" calculation to estimate the magnitude of the response to the 2000 stock market shock that would be necessary

to explain the observed drop in the average retirement rate; the results of this analysis are shown in Table 2. We first divide the sample of HRS respondents who were aged 55 to 70 and working at the beginning of 2000 according to the value of their stock assets at that time (greater or less than $0, $25,000, $50,000, $100,000, and $250,000), making assumptions that are likely to overstate the value of stocks.[17] We then calculate the monthly annuitized value of the loss incurred in a portfolio of each of these amounts as a result of the stock market drop during 2000. For example, a portfolio invested 70 percent in the S&P 500 Index and 30 percent in the Nasdaq (the approximate relative market capitalization of the two indices at the end of 1999) would have dropped 25 percent between the market peak in March 2000 and the end of the year, resulting in a $6,250 loss on a $25,000 portfolio; annuitized at a 5 percent real interest rate over 20 years, this is equivalent to a $41 decrease in monthly income.

We use these values to help determine which individuals would likely respond to the stock market crash. Clearly, workers with no stock assets should not respond since they lose nothing. Workers under the $25,000 cutoff are also unlikely to respond, as they face a maximum annuitized loss of just $41 per month. Using this logic, it seems reasonable that workers with stock assets up to perhaps $100,000 (and even beyond) may not respond, as they face an annuitized loss of no more than $164 per month.

[17] The HRS has information on how IRAs are invested ("mostly in stock, mostly in interest-earning assets, or about evenly split") but collects such information for only a minority of DC plans, so this information was not used in Table 1A. Here, we assume that invested mostly in stock means 100 percent in stock, mostly in interest-earning means 1/3 in stock, and evenly split means 2/3 in stock. For people with missing DC or IRA asset allocation, we assign the mean stock percentage in this asset class for their education group. For a small number of people with missing DC asset values, we assign the median value for their education group. Asset values are those reported in the 1998 HRS, increased to the year 2000 level using the asset returns between the wave 4 interview date and March 2000 for a portfolio invested 70 percent in the S&P500 and 30 percent in the Nasdaq; values are then adjusted to 2003$ using the CPI.

Next, we estimate a retirement regression model using 1992-1999 HRS data and use it to predict retirement probabilities in the year 2000 if the stock market was unchanged.[18] Finally, using these predicted probabilities for the households below each asset cutoff point, we calculate what the average retirement rate would have to be among those above the cutoff in order to generate a weighted average retirement rate matching that actually observed in the sample in the year 2000, 8.9 percent.[19] For the most conservative assumption that only those without stocks fail to respond to the market crash, we estimate that the average retirement rate in the rest of the sample would need to have dropped from the predicted level of 12.8 percent to 7.0 percent. Under the alternative assumption that individuals in households with up to $25,000, $50,000, or even $100,000 would not respond, the required retirement rate among those above the cutoff falls to 5.3 percent, 3.6 percent, and 1.1 percent, respectively. Using the $100,000 cutoff, it would need to be the case that virtually no one with more than $100,000 in stock assets retired during the year 2000 for the observed drop in the retirement rate to be due to the stock market crash, which seems highly implausible. This problem is intensified when one recognizes that the change in retirement behavior was unlikely to begin until later in 2000 based on the monthly movements in market indices, as described earlier. If the asset cut-off is defined to be $250,000, it is actually impossible to simulate the observed behavior. Overall, this simulation points out that the response to the 2000 stock market decline had to have been extremely strong (and possibly implausible or even impossible) to explain the observed drop-off in retirement rates.

[18] The regression includes the unemployment rate and various demographic characteristics (age dummies, race/ethnicity, gender, region, and marital status).

[19] Note that this statistic is smaller than that displayed in Figure 2B, largely because the sample used here includes workers 55 to 70 compared to a sample of those 60 to 65 in that figure.

B. Reduced-Form Analysis

The hypothesis that some workers should have responded more to the stock market crash than other workers is explored further in a series of figures that preview the regression analysis. Figures 4A and 4B plot the cyclically-adjusted retirement rates over time for workers aged 60 to 65 by educational attainment in the CPS and HRS, respectively. As Tables 1A and 1B show that ownership of stock assets and median stock values rise with education, we expect highly educated workers to increase their probability of retirement during the boom period relative to less educated workers and the reverse during the bust period. The figures show no such pattern. In the CPS figure, there is no noticeable increase in retirement rates for college graduates during the boom period; the biggest drop in retirement rates in 2000 occurs for high school graduates. In the HRS figure, high school dropouts and graduates experience a large drop in retirement rates in 2000, while college graduates do not.

Figures 5A and 5B conduct the same analysis by pension status. In the CPS figure, the drop in retirement rates in 2000 is virtually identical for those with and without a pension and there is no evidence of a jump in retirement rates during the boom for those with pensions. However, the CPS does not distinguish between defined contribution and defined benefit pension plans; only the former would be expected to affect retirement. This shortcoming is addressed in Figure 5B, which uses HRS data, and the result is the same: individuals with no DC plan or IRA, those with a DC plan or IRA, and those with DC and IRA combined balances in excess of $50,000 all experience identical drops in retirement between 1999 and 2000. Individuals with high value DC and IRA balances do have much higher retirement rates in 1996-1998, but that differential disappears in 1999. Moreover, it is not clear whether this is a response to the boom

or simply a difference in the underlying propensity to retire, as the retirement rate is higher for those with a pension or IRA in the pre-boom period as well.

Figure 6 compares retirement rates by an even more direct measure of stock market exposure, whether the household owns individual stocks or stock mutual funds – information that is only available in the HRS. The expected larger response to the stock market drop by those exposed to the market again fails to materialize – in fact, the drop in the retirement rate between 1999 and 2000 is larger for individuals with no stock than for individuals with any stock or with stock holdings in excess of $50,000. The high value stock group has a higher retirement rate in 1997 during the boom, but not during the rest of that period, and also has a higher rate in 1994 before the boom. Overall, the figures provide no support for the hypothesis that workers who were more likely to be affected by the drop in the stock market in 2000 reduced their retirement relative to other workers and inconsistent support at best for the hypothesis that these workers increased their retirement rate in the boom period of the late 1990s.

The regression analysis incorporates the intuition of these figures in a framework that also controls for demographic characteristics, the unemployment rate, and state- or region-specific fixed effects. The first column of Table 3A reports the linear probability model estimates of equation (1) for the full sample of workers in the CPS.[20] This column largely presents a parameterized version of Figure 2A, except that years have been aggregated into periods, demographic controls are included, and we use a sample of workers who are 55 to 70 rather than 60 to 65 to improve our precision. Consistent with that figure, we see that retirement rates fell during the bust period (2000-2002) relative to the baseline (1980-1984), but also fell during the boom period (1995-1999), albeit not to the same extent.

[20] In the CPS regressions, standard errors are clustered at the year level to correct for arbitrary forms of serial correlation in the error term across individuals within the same survey year.

More interesting for our purposes is the comparison of the boom and bust coefficients across columns in the rest of the table. As in the figures, we examine whether the retirement rate fell by more in the bust period and whether it rose by more (or fell by less) relative to the omitted period for groups with greater exposure to the stock market. A comparison of the bust coefficients by pension status contradicts this hypothesis. The retirement rate in the bust period is 2.9 percentage points lower for those without a pension plan and only 1.1 percentage points lower for those with a pension plan. The education specifications generate similar results – the retirement rates is 2.8 percentage points lower for high school dropouts and only 0.8 percentage points lower for college graduates, despite college graduates' much higher exposure to the stock market. We do find that those with pensions retired more frequently than those without pensions during the boom period, but there is no consistent pattern across workers with different levels of educational attainment.

Table 3B repeats this analysis using the HRS, which has better information on which individuals are likely to hold stocks but is only available starting in 1992. Relative to the previous table, the standard errors are larger due to the smaller sample sizes, but the principal findings are similar.[21] Retirement rates are not significantly lower in the bust period for groups with greater exposure to the stock market. For example, the retirement rate in the bust period is 5.0 percentage points lower than in the early 1990s for those who do not own stocks, compared to 3.5 percentage points lower for those who do own stocks and 4.6 percentage points lower for the subset of those with greater than $50,000 in stock assets. In the case of a DC plan or IRA, the retirement rate is 3.7 percentage points lower for individuals without such assets compared to

[21] In all HRS regressions, standard errors are clustered at the household level to correct for arbitrary forms of serial correlation in the error term across individuals within the same household over time. The magnitudes of the coefficients in the HRS and CPS regressions are not expected to be identical, as the omitted time period differs in the two samples.

5.2 percentage points lower for individuals with $50,000 or more in such assets, but the difference is not statistically significant. The education results mirror those in Table 3A. For the boom coefficients, as in Table 3A, there are cases where those with greater exposure to the stock market are more likely to retire in the boom period. But this pattern in point estimates is spotty and the differences across groups are not statistically significant. Overall, we find no evidence in either the CPS or HRS regressions that workers with greater exposure to the stock market reduce their retirement rate during the bust period relative to other workers. Although the evidence is not quite as strong regarding the boom periods, we do not find much support for the notion that those with greater exposure are more likely to retire when the market is doing well.

Tables 4A and 4B present the linear probability model estimates of equation (2), which quantifies the relationship between the stock market and retirement. The key explanatory variable in this specification is the percentage change in the S&P 500 Index over the previous twelve months.[22] The coefficient on this variable is expected to be positive, as workers should be more likely to retire when the stock market rises due to wealth effects. In the full CPS sample, a 10 percent rise in the S&P 500 is associated with a 0.10 percentage point increase in the annual retirement rate, although the effect is not statistically significant.

As in the earlier tables, our primary interest is in testing whether this effect is larger for workers who are more likely to be exposed to the stock market, and once again, the results do not support this hypothesis. The effect of a 10 percent rise in the S&P 500 is smaller for workers with a pension plan than for workers without a pension plan, 0.08 vs. 0.12. The education trend is also the opposite of what is expected – the effect of a 10 percent rise in the S&P is a 0.14

[22] In the HRS, results are qualitatively similar when the key variable is defined as the percentage change in the S&P Index over the previous two or three years, though insignificant when defined as the percentage change over the previous five years.

percentage point increase in the annual retirement rate for high school dropouts compared to 0.06 for college graduates.

Table 4B repeats this analysis using the HRS. The availability of month of retirement in the data allows the analysis to be conducted using person-month observations. Results are similar to those in Table 4A, though the magnitude of the coefficients is smaller, as would be expected when comparing the effect of a given change in the S&P 500 Index on monthly vs. annual retirement rates.[23] For all workers, a 10 percent rise in the S&P is associated with a 0.066 increase in the monthly retirement rate; the effect is statistically significant.

Comparing this coefficient across groups, there is no evidence that groups with greater stock market exposure are more responsive to change in the S&P. For example, a 10 percent rise in the S&P is associated with a 0.059 percentage point increase in the monthly retirement rate for workers with no DC plan or IRA, vs. 0.072 for all workers with such assets and 0.088 for workers with balances of $50,000 or more in such assets, but these differences are small and not statistically significant. The results are even more striking in the case of stock ownership – the S&P coefficients for workers with and without stock are identical and the coefficient for those with stock assets of $50,000 or more is half as large as that for workers with no stock. The education pattern is the reverse of what is expected, with college graduates responding less to an increase in the S&P than high school dropouts. In sum, neither the figures nor the regression results provide support for the hypothesis that those with greater exposure to the stock market alter their retirement behavior in response to changes in market conditions relative to others with less exposure.

[23] When the HRS analysis is conducted using a person-year sample, the magnitude of the coefficients is similar to those in Table 4A and the results are otherwise qualitatively similar to those in Table 4B.

Finally, we examine the effect of market fluctuations on labor force re-entry. The effect is expected to be the opposite of that predicted for retirement: workers should be less likely to re-enter during a stock market boom and more likely during a bust, and the effect should again be larger for those with greater stock market exposure. Tables 5A and 5B present the linear probability model estimates of equation 1 with labor force re-entry as the dependent variable. For reference, the average rate of re-entry is 2.5 percent per year in the CPS and 8.0 percent per wave in the HRS.[24] The coefficients in the first column of Table 5A indicate that CPS workers were less likely to re-enter in the bust period than in the boom, though the difference is insignificant. As before, we are primarily interested in comparing coefficients across columns.[25] In the CPS, there is no consistent pattern by education group in the bust coefficients, and the pattern in the boom coefficients is the opposite of what is expected, though not significant. In the HRS, workers are more likely to re-enter in the bust period than the boom, but the difference is again insignificant. Looking across columns, HRS workers with greater market exposure are less likely to re-enter in the bust, contrary to expectations; there is no consistent pattern in the boom coefficients. Overall, there is no evidence that workers with greater market exposure were less likely to re-enter during the boom and more likely to re-enter in the bust.

Tables 6A and 6B present the parameterized results for labor force re-entry.[26] We expect workers with greater exposure to be relatively less likely to re-enter in response to an increase in the S&P 500 Index. In fact, the opposite pattern is evident in both the HRS and CPS. Thus, we

[24] Part of the discrepancy is that the period between HRS waves is two years, compared to the annual CPS data. Others have noted the relatively high rate of labor force re-entry in the HRS. For example, Bruce, Holtz-Eakin, and Quinn (2000) find that 15% of those who were out of the labor force in 1992 are employed or self-employed in 1996.

[25] Tables 5A and 6A do not include columns for those with and without a pension due to the small number of CPS respondents in the labor force re-entry sample reporting this information.

[26] In HRS analysis, the percentage change in the S&P 500 is the contemporaneous change across waves (e.g., the change from January 2000 to January 2002 is used for labor force transitions between waves 5 and 6, etc.).

are unable to find any evidence that retirees re-entered the labor force as a result of the drop in the stock market in 2000.

C. Extensions

We conduct a number of specification checks to assess the robustness of these results, focusing our discussion on models of retirement for simplicity. First, we consider the argument that there is heterogeneity in workers' responsiveness to stock market fluctuations conditional on the level of stock holdings and that those workers who are most responsive retired during the boom and thus were not in the sample to delay retirement during the bust. This strikes us as a plausible hypothesis, but if true we would expect to see a bigger increase in retirement in the boom period for groups with greater market exposure (as some of the workers in these groups would be the responsive ones who would choose to retire) than for groups with less market exposure. We do not observe this pattern.

Second, we explore the hypothesis that younger workers might have been more responsive to stock market fluctuations, as might be the case if their decisions are based more on finances while older workers' decisions are based more on health status or social norms. To do so, we re-estimate the models separately for workers aged 55-59 and 60-65. In both sub-samples the pattern of boom and bust coefficients are inconsistent with that predicted if the stock market had an impact on retirement behavior.

Third, we explore the effect of the market on a worker's decision to work full-time or part-time. To do so, we re-estimate the model limiting the sample to those working full-time (35 or more hours per week) and define the dependent variable in one specification as moving to part-time work and in a second specification as either moving to part-time work or exiting the

labor force completely. We find no evidence of a greater response to market fluctuations among those with greater market exposure in either of these alternative specifications.

Finally, we perform two other checks. As labor supply is more difficult to measure for the self-employed, we drop them from our analysis and find very similar results. To account for the possibility that some households experienced large increases in their housing wealth at the same time their stock portfolios fell, we include the change in real house value in the regression, but find that its coefficient is insignificant and the coefficients on the boom and bust dummies are unaffected by its inclusion. Overall, none of these extensions change the nature of our earlier findings.

V. CONCLUSIONS

This paper has explored the impact of stock market fluctuations, and particularly the recent boom and bust, on retirement behavior. We take advantage of a unique double experiment which compares labor force exits for groups that were more and less exposed to those fluctuations to determine whether differences emerged during the boom and then reversed in the bust. Our focus is exclusively on the ability of the market to generate changes in aggregate retirement behavior, and not on the estimation of wealth effects for individuals. These two features distinguish our work from that which precedes it. The results of our analysis provide little support for an impact of the boom and bust on retirement or labor force re-entry.

Our results do not necessarily contradict previous studies that have found wealth effects associated with changes in the stock market or other unanticipated wealth shocks. On the contrary, it is almost certainly true that some individuals experienced large drops in wealth because of the market bust and retired later as a result. But we suspect that this is a fairly narrow

segment of the population. As we illustrate in our descriptive analysis, most workers have few if any stock assets; at the other end of the distribution, some workers may have sufficient wealth holdings that even a sizeable financial loss would not alter their retirement behavior. There is a group of workers in the middle whose retirement decisions are affected by stock market fluctuations, but it is a sufficiently small group that we are unable to identify them in conventional data sets. Thus it seems unlikely that even a substantial labor supply response by this group could be driving large changes in aggregate labor market trends.

Our results leave unexplained the drop in labor market activity among older workers in the year 2000. Although we do not know the specific cause of this decline, one possibility is that it is merely a realization of a longer-term decline in retirement among older workers. Burtless and Quinn (2002) state that since the mid 1980s "male participation rates at older ages have stabilized or even increased slightly." A casual examination of the figures we presented earlier is not inconsistent with this hypothesis. Nevertheless, we are able to definitively rebut the idea that the drop in retirement in 2000 was linked to the stock market.

Despite our findings, stock market fluctuations are likely to have broader implications for individuals' behavior and well-being. Recent retirees, workers of near-retirement age, and workers further from retirement all may respond in any number of ways, such as changing their level of consumption, altering savings and investment activities, updating expectations about leaving a bequest, or adjusting longer-term retirement plans or spousal labor supply (for younger workers). Indeed, there is some evidence to suggest that consumption may be sensitive to market fluctuations. Maki and Palumbo (2001) find that households increased consumption by 3.5 to 5 cents per year for each dollar of stock market wealth generated during the market boom of the 1990s, while Kezdi and Sevak (2004) obtain similar results for the bust period, with a

somewhat larger response by retirees. We conclude that the drop in wealth resulting from the market bust in 2000 was likely reflected to a much greater extent in changes in consumption and possibly other behaviors than in changes in labor supply of near-retirement-age workers or recent retirees.

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Table 1A: Financial Holdings of Workers Age 55 to 60 in the 1998 Health and Retirement Study

	All Workers	No DC Pension or IRA	Has DC Pension or IRA	"High Value" DC Pension/ IRA	No Stocks or Stock Mutual Fund	Has Stocks or Stock-Based Funds	"High Value" Stocks or Stock Funds	High School Dropout	High School Graduate	Some College	College Graduate
					% in Category						
	100	31.6	68.4	28.1	61.6	38.4	17.1	17.0	32.9	21.6	28.5
					% Holding						
Stocks/StockFunds	38.4	20.9	46.5	58.3	0	100.0	100.0	14.2	32.4	43.2	55.9
DC Pension	46.2	0	67.5	67.6	41.3	54.0	58.9	36.6	41.0	49.5	55.2
IRA	47.1	0	68.9	81.9	35.5	65.7	71.4	22.7	43.5	49.2	64.3
Any Type	75.0	20.9	100.0	100.0	59.4	100.0	100.0	51.8	72.4	78.3	89.2
					Median Value of Holdings, if Any (in $1,000s of 2003 $)						
Stocks/StockFunds	33.9	18.1	41.9	67.7	0.0	33.9	169.3	16.9	22.6	28.7	73.4
DC Pension	39.5	0.0	39.5	88.0	22.6	67.7	84.7	13.5	29.2	30.5	79.0
IRA	40.6	0.0	40.6	101.6	28.2	56.4	84.7	20.3	29.9	39.5	56.4
All Types	68.9	18.1	80.1	208.8	35.0	125.3	311.6	20.3	45.2	62.1	146.7

Notes: The sample is restricted to households in which the respondent and/or spouse is between age 55 and 60 and is employed on the survey date. "High value" is defined as having at least a $50,000 combined balance in a defined contribution pension plan and IRA account or in stocks and stock-based mutual funds. Statistics reflect the holdings of all individuals in the worker's family.

Table 1B: Financial Holdings of Workers Age 55 to 60 in the 1992, 1995, and 1998 Surveys of Consumer Finances

	All Workers	No DC Pension or IRA	Has DC Pension or IRA	"High Value" DC Pension/ IRA	No Stocks or Stock-Based Funds	Has Stocks or Stock-Based Funds	"High Value" Stocks or Stock-Based Funds	High School Dropout	High School Graduate	Some College	College Graduate
					% in Category						
	100	33.5	66.5	28.0	66.7	33.3	12.3	19.4	31.2	19.9	29.0
					% Holding:						
Stocks/Stock Funds	33.3	16.2	41.9	60.1	0	100	100	9.5	24.8	37.7	55.5
DC Pension	40.6	0	61.0	68.8	37.2	47.3	49.3	33.9	34.2	48.9	46.3
DC Pension (mostly in stocks)	15.0	0	22.5	29.2	10.8	23.3	23.5	8.9	12.4	17.5	20.1
IRA	47.5	0	71.4	82.5	37.3	67.9	76.3	24.2	43.8	47.4	67.3
IRA (mostly in stocks)	20.8	0	31.2	38.5	13.5	35.3	45.3	7.7	16.9	20.6	33.8
Any Types	71.9	16.2	100	100	57.9	100	100	49.7	68.7	79.3	85.3
Any Stock-Based Types	47.5	16.2	63.2	77.9	21.3	100	100	23.1	40.2	53.7	67.4
					Median Value of Holdings, if Any (in $1,000s of 2003 $)						
Stocks/Stock Funds	26.6	21.0	27.5	39.3	0	26.6	120.7	9.2	13.0	22.3	39.3
DC Pension	30.2	0	30.2	90.5	18.1	50.8	90.5	14.5	24.8	18.3	64.0
DC Pension (mostly in stocks)	22.6	0	22.6	72.4	13.3	33.9	72.4	6.2	15.7	22.6	43.9
IRA	30.2	0	30.2	75.6	16.9	47.4	72.1	7.1	21.4	25.3	42.6
IRA (mostly in stocks)	34.4	0	34.4	88.0	20.5	52.4	79.0	8.5	15.2	36.7	52.4
All Types	46.1	21.0	47.4	170.4	26.6	112.8	253.9	17.4	32.8	35.0	106.7
All Stock-Based Types	42.9	21.0	46.1	112.8	21.4	63.3	197.5	8.5	22.6	28.6	78.7

Notes: The sample is restricted to households in which the respondent and/or spouse is between age 55 and 60 and is employed on the survey date. Sampling weights are used to provide nationally representative statistics for this group. "High value" is defined as having at least a $50,000 combined balance in a defined contribution pension plan and IRA account. Statistics reflect the holdings of all individuals in the worker's family.

Table 2: Simulated Retirement Rates for those Aged 55 to 70 Holding Stocks Required to Match Observed Retirement Rates

	Stock Assets at Beginning of 2000 (in 2003$)[A]				
	≥ 0	≥ 25K	≥ 50K	≥ 100K	≥ 250K
1) Monthly annuitized value of loss associated with stock market decline in 2000 at lower bound of range[B]	$0	$41	$82	$164	$409
2) Percent of HRS sample with stock assets at lower bound or greater	67.8	48.8	39.5	31.0	18.2
3) Percent of HRS sample with stock assets below the lower bound	32.3	51.2	60.5	69.0	81.8
4) Predicted 2000 retirement rate for those with stock assets less than lower bound[C]	12.1	12.3	12.3	12.1	12.2
5) Predicted 2000 retirement rate for those with stock assets at lower bound or greater and no response to stock market decline[C]	12.8	12.4	12.4	12.4	12.4
6) Simulated retirement rate for those with stock assets at lower bound or greater.[D]	7.0	5.3	3.6	1.1	-6.5

Notes:

[A] Each column of this table represents the characteristics of the sample whose stock market values at the beginning of 2000 are above or below the defined level. See footnotes in text for greater detail regarding the construction of these values.

[B] The 2000 market decline is calculated as a weighted average of the decline in the S&P 500 (70% weight) and the NASDAQ (30% weight), where the weights are determined according to the relative market values of the two indices at the end of 1999.

[C] Predicted retirement rates represent the rates that would have been expected based on labor market conditions and the demographic characteristics (age, race/ethnicity, gender, region, and marital status) of the sample of respondents still working at the beginning of 2000. These predictions are obtained from regression models of retirement behavior using 1992-1999 HRS data.

[D] Those with stock market assets below the lower bound are assumed to be unaffected by the market decline. The simulated retirement rate for those with stock assets at or above the cut-off is calculated to be the value necessary for the weighted average of the predicted rate for those below the cut-off and the simulated rate for those above the cut-off to match the aggregate rate observed in the 2000 HRS of 8.9 percent.

Table 3A: CPS Estimates of the Impact of Market Cycles on Retirement Behavior, by Group

	(1) All Workers	(2) Not Included in Pension Plan	(3) Included in Pension Plan	(4) HS Dropout	(5) HS Graduate	(6) Attended Some College	(7) College Graduate
Bust (2000-2002)	-2.090	-2.928	-1.084	-2.792	-1.102	-1.759	-0.772
	(0.314)	(0.298)	(0.446)	(0.673)	(0.433)	(0.466)	(0.559)
Boom (1995-1999)	-1.228	-2.028	-0.291	-1.496	-0.332	-0.529	-0.531
	(0.190)	(0.243)	(0.319)	(0.608)	(0.382)	(0.569)	(0.417)
Years 1990-1994	-0.527	-1.181	0.178	-0.705	-0.281	-0.196	0.905
	(0.193)	(0.308)	(0.247)	(0.362)	(0.252)	(0.786)	(0.365)
Years 1985-1989	0.284	-0.058	0.608	0.271	0.695	-0.330	0.985
	(0.200)	(0.293)	(0.297)	(0.389)	(0.283)	(0.391)	(0.555)
# of Obs.	224,472	118,053	106,419	50,974	83,353	40,561	49,584

Notes: The sample includes all respondents between the ages of 55 and 70 who worked at least 13 weeks in the preceding calendar year. Regressions also include controls for race, ethnicity, exact age dummy variables, marital status, gender, the state unemployment rate, and state-specific fixed effects. Coefficients and standard errors (in parentheses) multiplied by 100.

Source: Authors' calculations from the Current Population Survey.

Table 3B: HRS Estimates of the Impact of Market Cycles on Retirement Behavior, by Group

	(1) All Workers	(2) Not Included in DC Pension / IRA	(3) Included in DC Pension / IRA	(4) High Value DC Pension / IRA	(5) Does Not Own Stocks or Stock Funds	(6) Owns Stocks or Stock Funds	(7) High Value Stocks or Stock Funds	(8) HS Dropout	(9) HS Graduate	(10) Attended Some College	(11) College Graduate
Bust (2000-2001)	-4.54 (0.87)	-3.71 (1.31)	-5.04 (1.15)	-5.16 (2.01)	-5.00 (1.04)	-3.48 (1.56)	-4.64 (2.89)	-6.78 (2.00)	-4.82 (1.48)	-2.19 (1.74)	-3.52 (1.70)
Boom (1995-1999)	-0.85 (0.56)	-0.65 (0.86)	-0.94 (0.73)	-0.02 (1.24)	-1.02 (0.68)	-0.45 (1.01)	-1.96 (1.85)	-2.47 (1.27)	-1.02 (0.92)	1.23 (1.15)	-0.89 (1.15)
# of person-year obs.	32,005	12,966	19,039	7,254	22,070	9,935	3,162	7,012	11,164	6,633	7,196

Notes: The sample of person-year observations includes all HRS Wave 1 respondents in all years (from 1992 to 2001) in which they were between the ages of 55 and 70, were working at the beginning of the calendar year and had not previously retired. Participation in DC pension plan, IRA, or stocks is based on ownership of these assets at Wave 1; "high value" indicates Wave 1 assets of $50,000 or more (in 2003 dollars). Regressions also include controls for race, ethnicity, exact age dummy variables, marital status, gender, regional unemployment rates, and region-specific fixed effects. Coefficients and standard errors (in parentheses) multiplied by 100; standard errors are clustered at the household level to correct for arbitrary forms of serial correlation in the error term across individuals within the same household over time.

Source: Authors' calculations from the Health and Retirement Study

Table 4A: Parameterized Estimates of the Impact of Market Cycles on Retirement Behavior from the CPS, by Group

	(1) All Workers	(2) Not Included in Pension Plan	(3) Included in Pension Plan	(4) HS Dropout	(5) HS Graduate	(6) Attended Some College	(7) College Graduate
12 Month Percentage Change in the S&P 500	0.010 (0.010)	0.012 (0.013)	0.008 (0.008)	0.014 (0.013)	0.002 (0.007)	0.025 (0.013)	0.006 (0.012)
# of Observations	224,472	118,053	106,419	50,974	83,353	40,561	49,584

Notes: The sample includes all respondents between the ages of 55 and 70 who worked at least 13 weeks in the preceding calendar year. Regressions also include controls for race, ethnicity, exact age dummy variables, marital status, gender, state unemployment rates, and state-specific fixed effects. Coefficients and standard errors (in parentheses) multiplied by 100.

Source: Authors' calculations from the Current Population Survey.

Table 4B: Parameterized Estimates of the Impact of Market Cycles on Retirement Behavior from the HRS, by Group

	(1) All Workers	(2) Not Included in DC Pension / IRA	(3) Included in DC Pension / IRA	(4) High Value DC Pension / IRA	(5) Does Not Own Stocks or Stock Funds	(6) Owns Stocks or Stock Funds	(7) High Value Stock or Stock Funds	(8) HS Dropout	(9) HS Graduate	(10) Attended Some College	(11) College Graduate
12 Month Percentage Change in the S&P 500	0.0066 (0.0012)	0.0059 (0.0017)	0.0072 (0.0016)	0.0088 (0.0026)	0.0067 (0.0014)	0.0066 (0.0021)	0.0034 (0.0042)	0.0077 (0.0027)	0.0076 (0.0020)	0.0054 (0.0026)	0.0046 (0.0021)
# of person-month obs.	354,482	144,121	210,361	79,978	244,515	109,967	35,070	77,316	123,438	73,760	79,968

Notes: The sample of person-month observations includes all HRS Wave 1 respondents in all months (from 1992 to 2001) in which they were between the ages of 55 and 70, were working at the beginning of the calendar year and had not previously retired. Participation in DC pension plan, IRA, or stocks is based on ownership of these assets at Wave 1; "high value" indicates Wave 1 assets of $50,000 or more (in 2003 dollars). Regressions also include controls for race, ethnicity, exact age dummy variables, marital status, gender, regional unemployment rates, and region-specific fixed effects. Coefficients and standard errors (in parentheses) multiplied by 100; standard errors are clustered at the household level to correct for arbitrary forms of serial correlation in the error term across individuals within the same household over time.

Source: Authors' calculations from the Health and Retirement Study.

Table 5A: CPS Estimates of the Impact of Market Cycles on Labor Force Re-Entry, by Group

	(1)	(4)	(5)	(6)	(7)
	All Workers	HS Dropout	HS Graduate	Attended Some College	College Graduate
Bust (2000-2002)	0.160	-0.488	-0.003	0.067	-0.142
	(0.174)	(0.126)	(0.273)	(0.406)	(0.555)
Boom (1995-1999)	0.414	-0.131	0.189	0.610	0.350
	(0.150)	(0.174)	(0.254)	(0.372)	(0.555)
Years 1990-1994	-0.051	-0.259	-0.261	0.349	-0.572
	(0.166)	(0.174)	(0.311)	(0.407)	(0.354)
Years 1985-1989	0.079	-0.274	0.149	0.126	0.625
	(0.104)	(0.103)	(0.227)	(0.280)	(0.354)
# of Obs.	242,385	92,065	90,757	33,045	26,518

Notes: The sample includes all respondents between the ages of 55 and 70 who worked fewer than 13 weeks in the preceding calendar year. Regressions also include controls for race, ethnicity, exact age dummy variables, marital status, gender, the state unemployment rate, and state-specific fixed effects. Coefficients and standard errors (in parentheses) multiplied by 100.

Source: Authors' calculations from the Current Population Survey.

Table 5B: HRS Estimates of the Impact of Market Cycles on Labor Force Re-Entry Between Waves, by Group

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
	All Workers	Not Included in DC Pension / IRA	Included in DC Pension / IRA	High Value DC Pension / IRA	Does Not Own Stocks or Stock Funds	Owns Stocks or Stock Funds	High Value Stocks or Stock Funds	HS Dropout	HS Graduate	Attended Some College	College Graduate
Bust (wave 6)	-1.08 (0.92)	0.87 (1.22)	-3.27 (1.39)	-1.78 (2.06)	-0.004 (1.08)	-3.44 (1.72)	-5.56 (2.32)	0.88 (1.45)	-2.62 (1.51)	0.97 (2.67)	-5.10 (2.61)
Boom (waves 4-5)	-1.39 (0.88)	-0.74 (1.16)	-2.23 (1.33)	0.82 (1.97)	-1.58 (1.01)	-0.43 (1.74)	-1.70 (2.43)	-0.93 (1.33)	-1.48 (1.44)	-1.08 (2.54)	-3.06 (2.68)
# of person-wave obs.	15,455	8,183	7,272	3,169	11,093	4,362	1,853	5,235	5,676	2,389	2,155

Notes: The sample of person-wave observations includes HRS Wave 1 respondents in all waves (from wave 2 to wave 6) in which they were between the ages of 55 and 70 (during the intra-wave year) and were not working at the previous wave. Participation in DC pension plan, IRA, or stocks is based on ownership of these assets at Wave 1; "high value" indicates Wave 1 assets of $50,000 or more (in 2003 dollars). Regressions also include controls for race, ethnicity, exact age dummy variables, marital status, gender, regional unemployment rates, and region-specific fixed effects. Coefficients and standard errors (in parentheses) multiplied by 100; standard errors are clustered at the household level to correct for arbitrary forms of serial correlation in the error term across individuals within the same household over time.

Source: Authors' calculations from the Health and Retirement Study

Table 6A: Parameterized Estimates of the Impact of Market Cycles on Labor Force Re-Entry from the CPS, by Group

	(1)	(2)	(3)	(4)	(5)
	All Workers	HS Dropout	HS Graduate	Attended Some College	College Graduate
12 Month Percentage	0.004	-0.001	0.002	0.011	0.020
Change in the S&P 500	(0.002)	(0.003)	(0.004)	(0.008)	(0.008)
# of Observations	242,385	92,065	90,757	33,045	26,518

Notes: The sample includes all respondents between the ages of 55 and 70 who worked fewer than 13 weeks in the preceding calendar year. Regressions also include controls for race, ethnicity, exact age dummy variables, marital status, gender, state unemployment rates, and state-specific fixed effects. Coefficients and standard errors (in parentheses) multiplied by 100.

Source: Authors' calculations from the Current Population Survey.

Table 6B: Parameterized Estimates of the Impact of Market Cycles on Labor Force Re-Entry Between Waves from the HRS, by Group

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
	All Workers	Not Included in DC Pension / IRA	Included in DC Pension / IRA	High Value DC Pension / IRA	Does Not Own Stocks or Stock Funds	Owns Stocks or Stock Funds	High Value Stocks or Stock Funds	HS Dropout	HS Graduate	Attended Some College	College Graduate
2 Year % Chg in S&P	0.0001	-0.0152	0.0169	0.0338	-0.0166	0.0440	0.0473	-0.0198	0.0212	-0.0226	0.0293
	(0.0077)	(0.0107)	(0.0112)	(0.0161)	(0.0092)	(0.0139)	(0.0195)	(0.0121)	(0.0126)	(0.0217)	(0.0217)
# of person-wave obs.	15,455	8,183	7,272	3,169	11,093	4,362	1,853	5,235	5,676	2,389	2,155

Notes: The sample of person-wave observations includes HRS Wave 1 respondents in all waves (from wave 2 to wave 6) in which they were between the ages of 55 and 70 (during the intra-wave year) and were not working at the previous wave. The percentage change in S&P 500 is the contemporaneous change across wages (e.g. the change from January 2000 to January 2002 is used for labor force transitions between waves 5 and 6). Participation in DC pension plan, IRA, or stocks is based on ownership of these assets at Wave 1; "high value" indicates Wave 1 assets of $50,000 or more (in 2003 dollars). Regressions also include controls for race, ethnicity, exact age dummy variables, marital status, gender, regional unemployment rates, and region-specific fixed effects. Coefficients and standard errors (in parentheses) multiplied by 100; standard errors are clustered at the household level to correct for arbitrary forms of serial correlation in the error term across individuals within the same household over time.

Source: Authors' calculations from the Health and Retirement Study

Figure 1: Stock Market Performance, 1980-2003

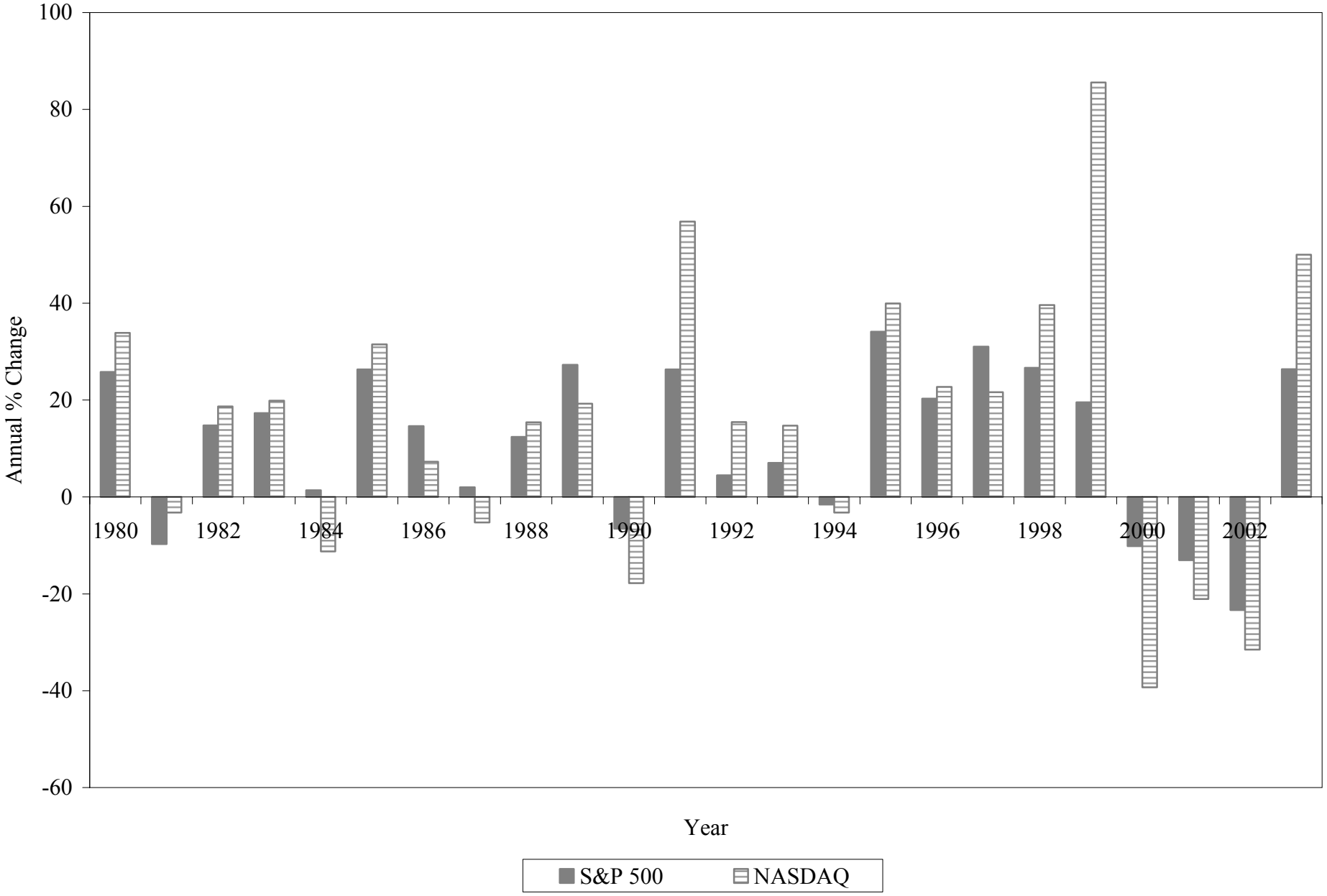
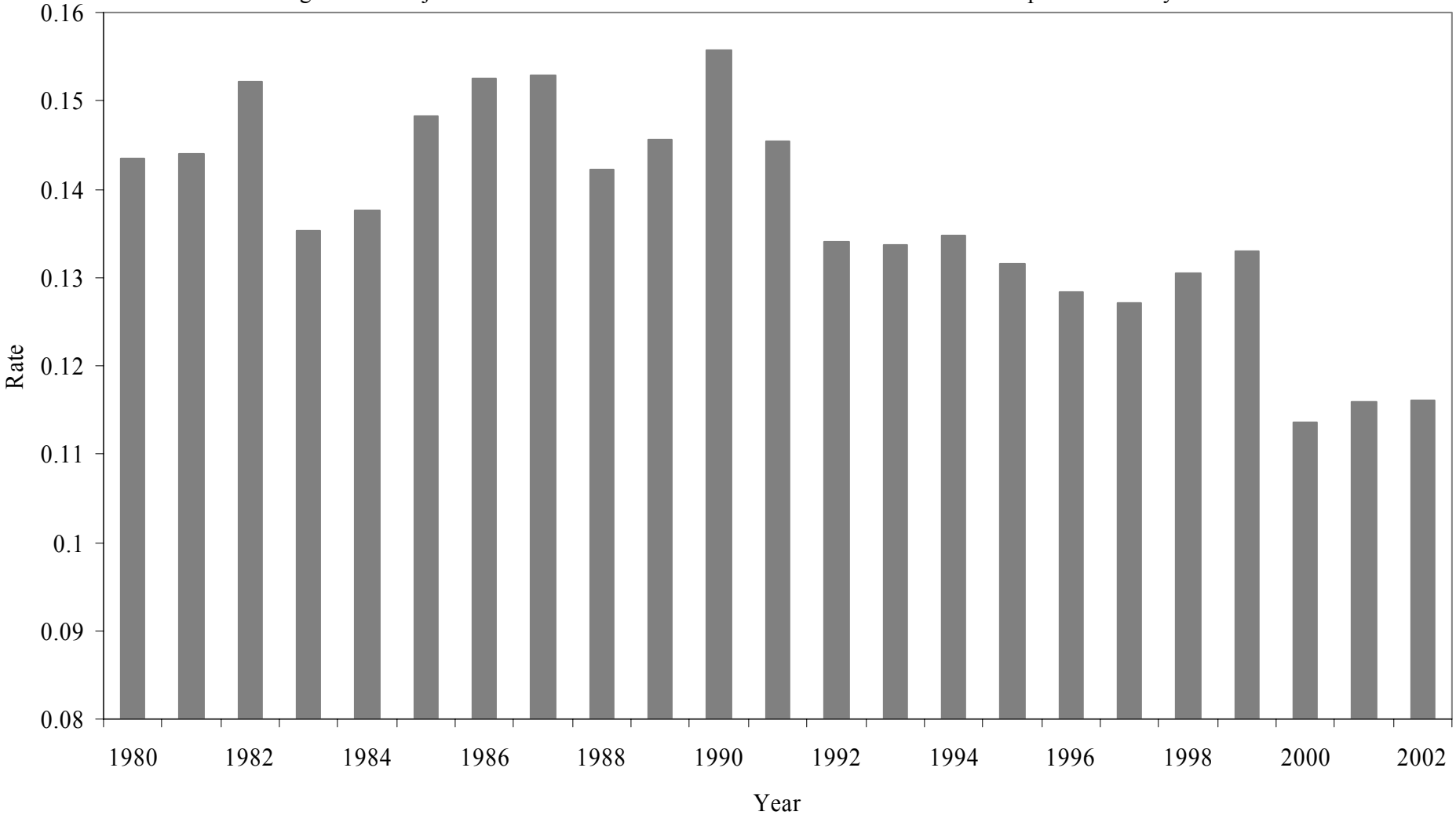
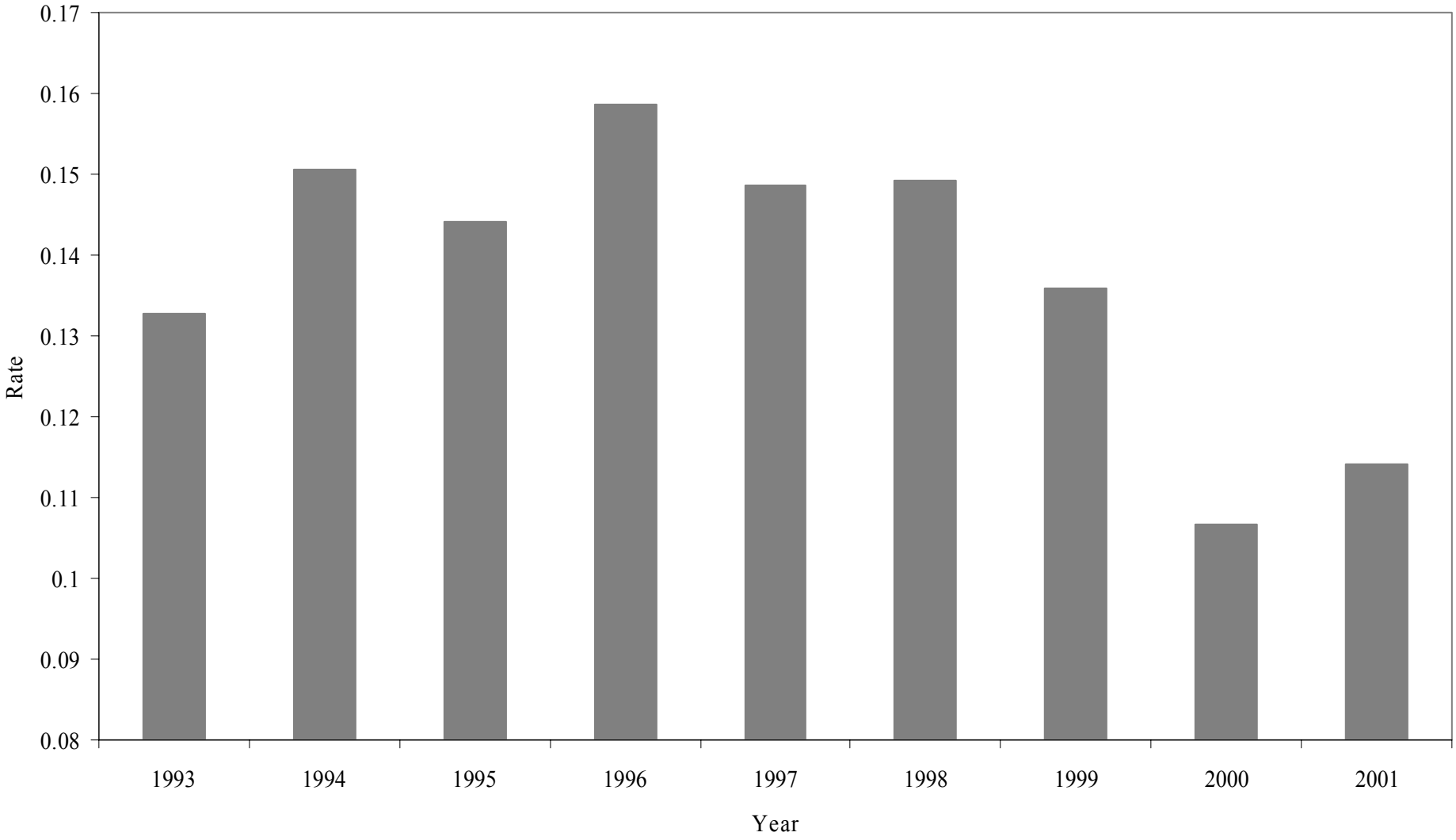


Figure 2A: Adjusted Retirement Rates for Workers 60 to 65 in the Current Population Survey



Note: Rates reflect retirement behavior adjusted for variation in the unemployment rate and the exact age composition of 60 to 65 year olds. The estimates assume an unemployment rate of 5 percent and are measured at the average retirement hazard between age 60 and 65. Year t reflects retirements that take place roughly between March of year t and March of year t+1.

Figure 2B: Adjusted Retirement Rates for Workers 60 to 65 in the Health and Retirement Survey



Note: Rates reflect retirement behavior adjusted for variation in the unemployment rate and the exact age composition of 60 to 65 year olds. The estimates assume an unemployment rate of 5 percent and are measured at the average retirement hazard between age 60 and 65.

Figure 3: Investment Allocation in IRAs and Defined Contribution Pensions

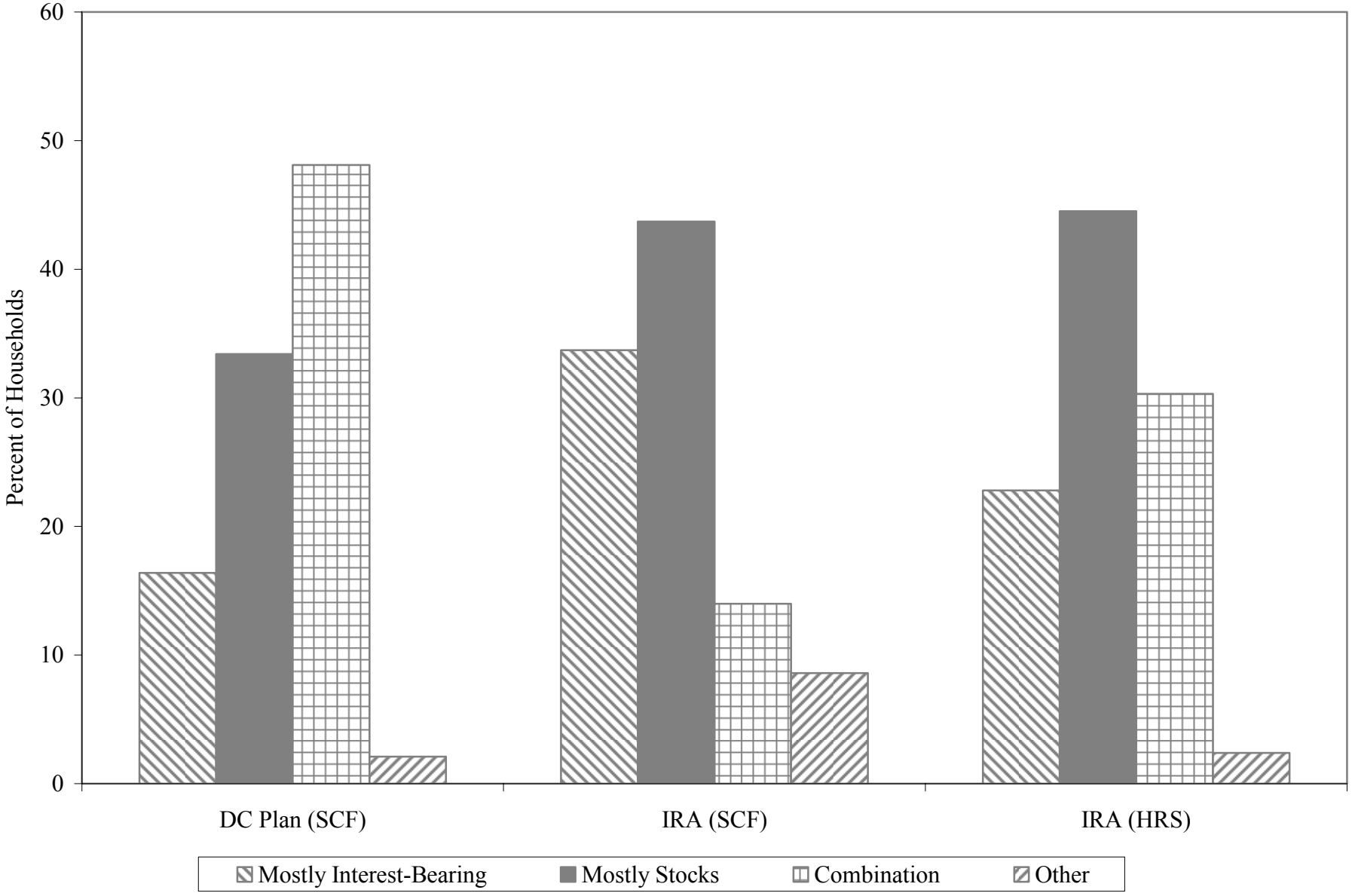
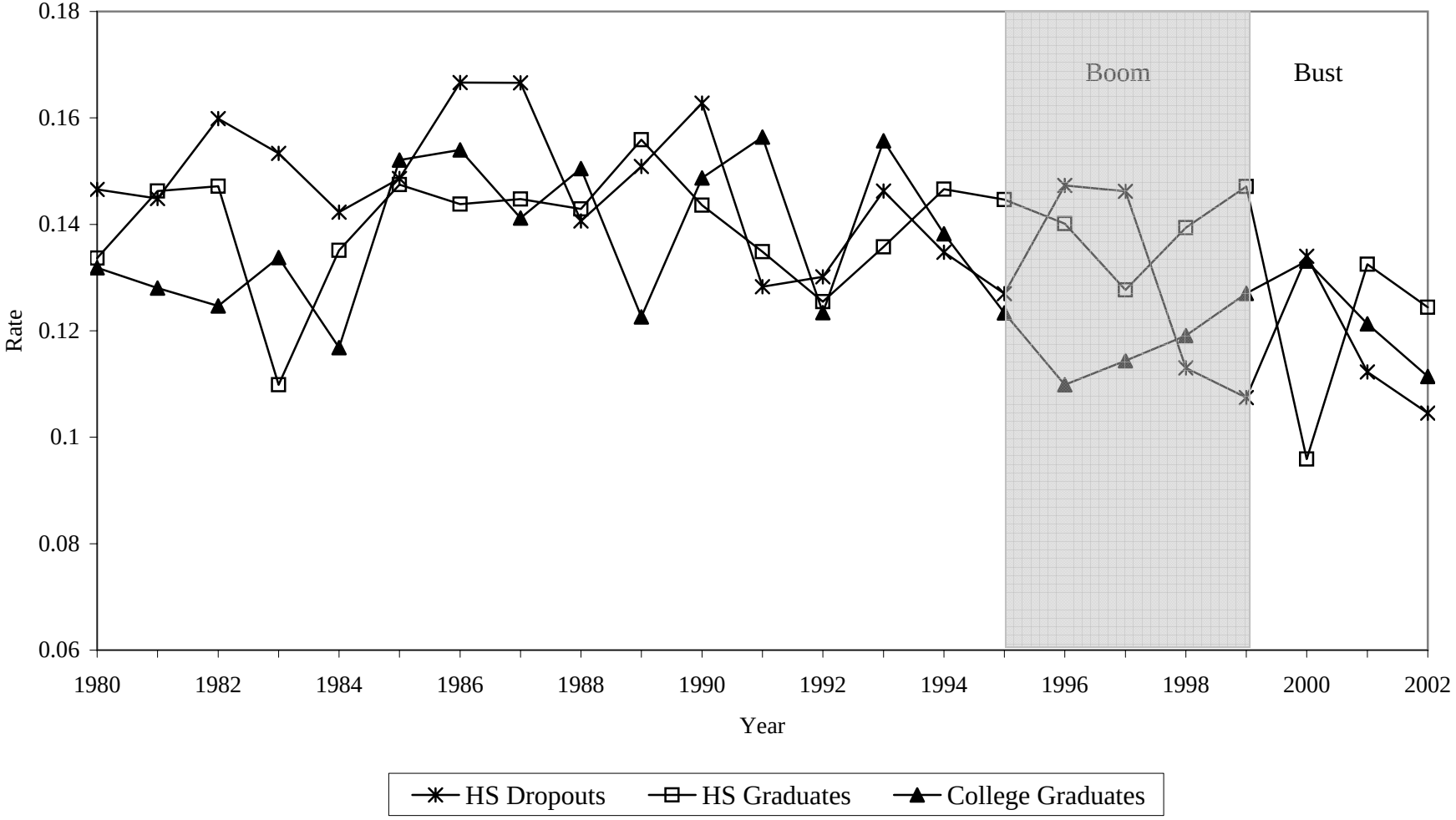
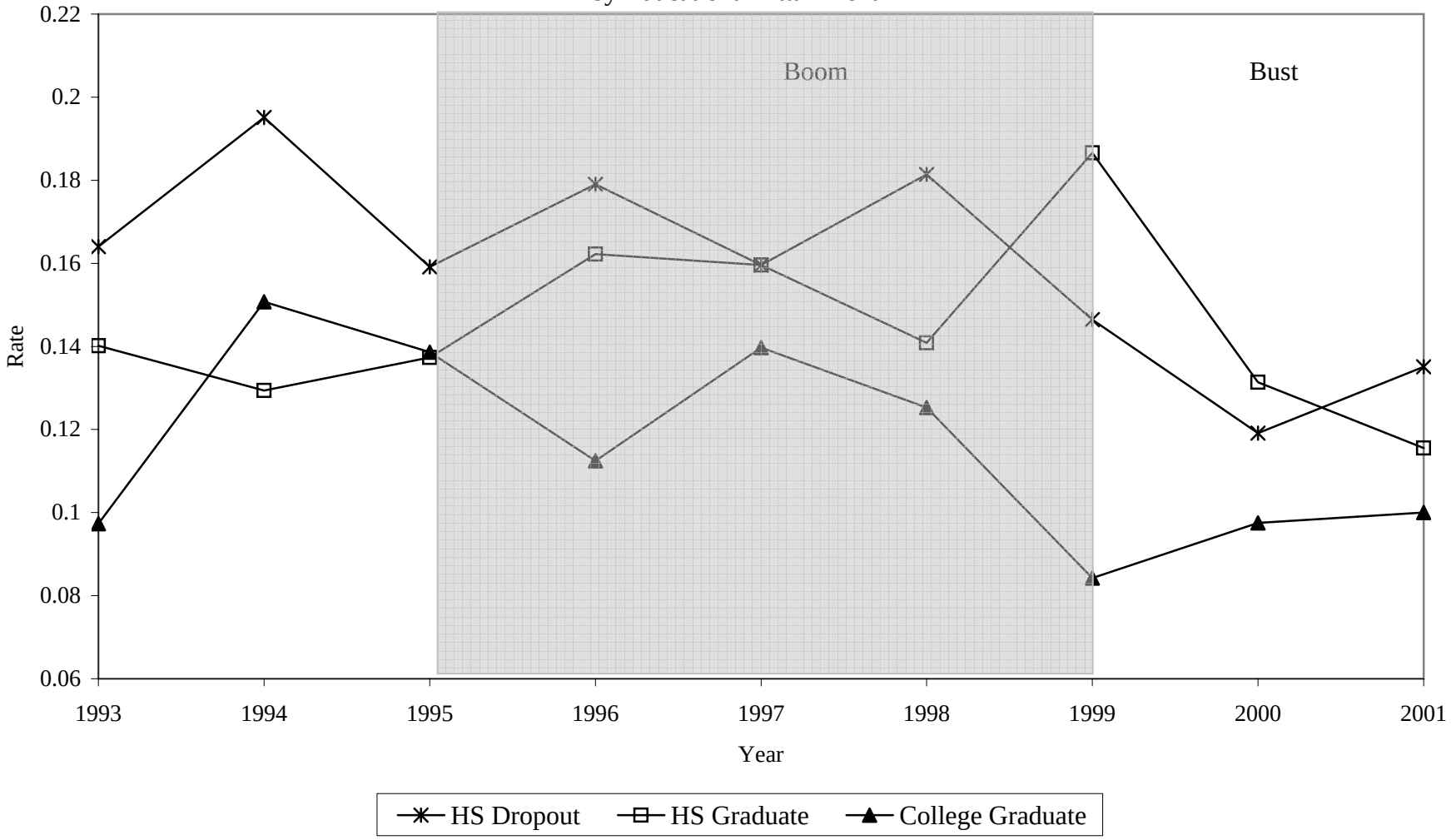


Figure 4A: Adjusted Retirement Rates for Workers 60 to 65 in the Current Population Survey, by Educational Attainment



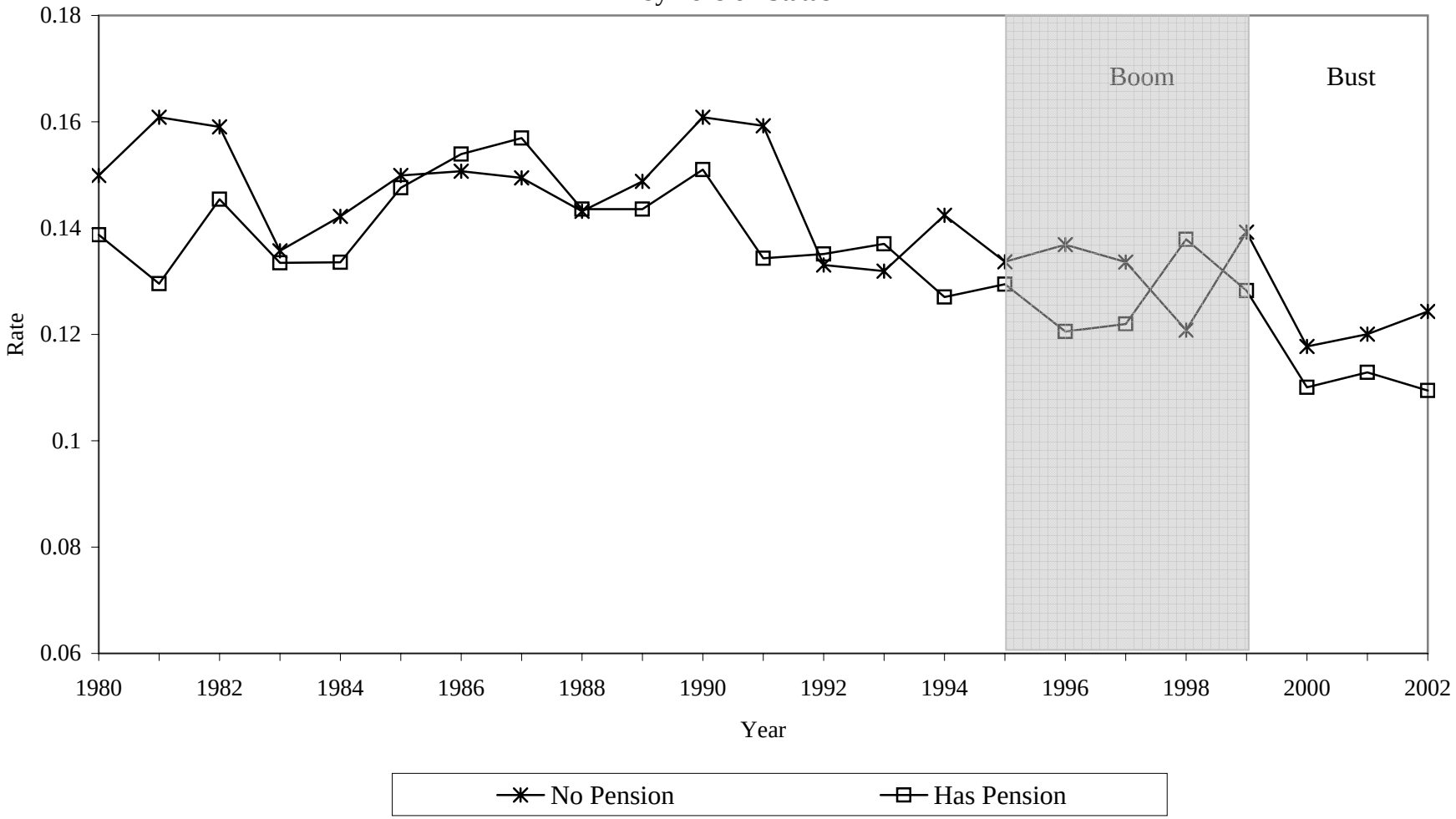
Note: Rates reflect retirement behavior adjusted for variation in the unemployment rate and the exact age composition of 60 to 65 year olds. The estimates assume an unemployment rate of 5 percent and are measured at the average retirement hazard between age 60 and 65. Year t reflects retirements that take place roughly between March of year t and March of year t+1.

Figure 4B: Adjusted Retirement Rates for Workers 60 to 65 in the Health and Retirement Survey, by Educational Attainment



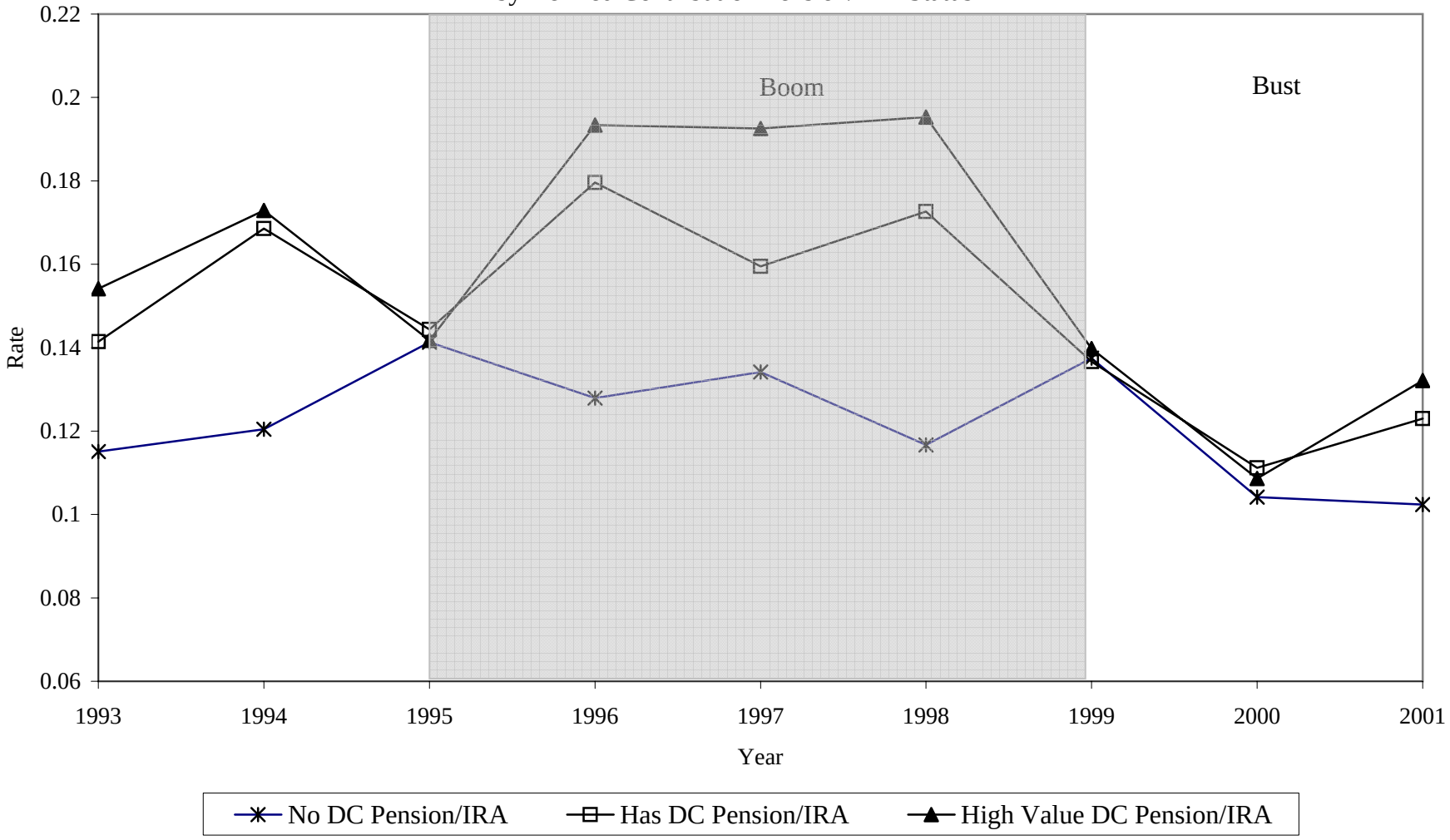
Note: Rates reflect retirement behavior adjusted for variation in the unemployment rate and the exact age composition of 60 to 65 year olds. The estimates assume an unemployment rate of 5 percent and are measured at the average retirement hazard between age 60 and 65.

Figure 5A: Adjusted Retirement Rates for Workers 60 to 65 in the Current Population Survey, by Pension Status



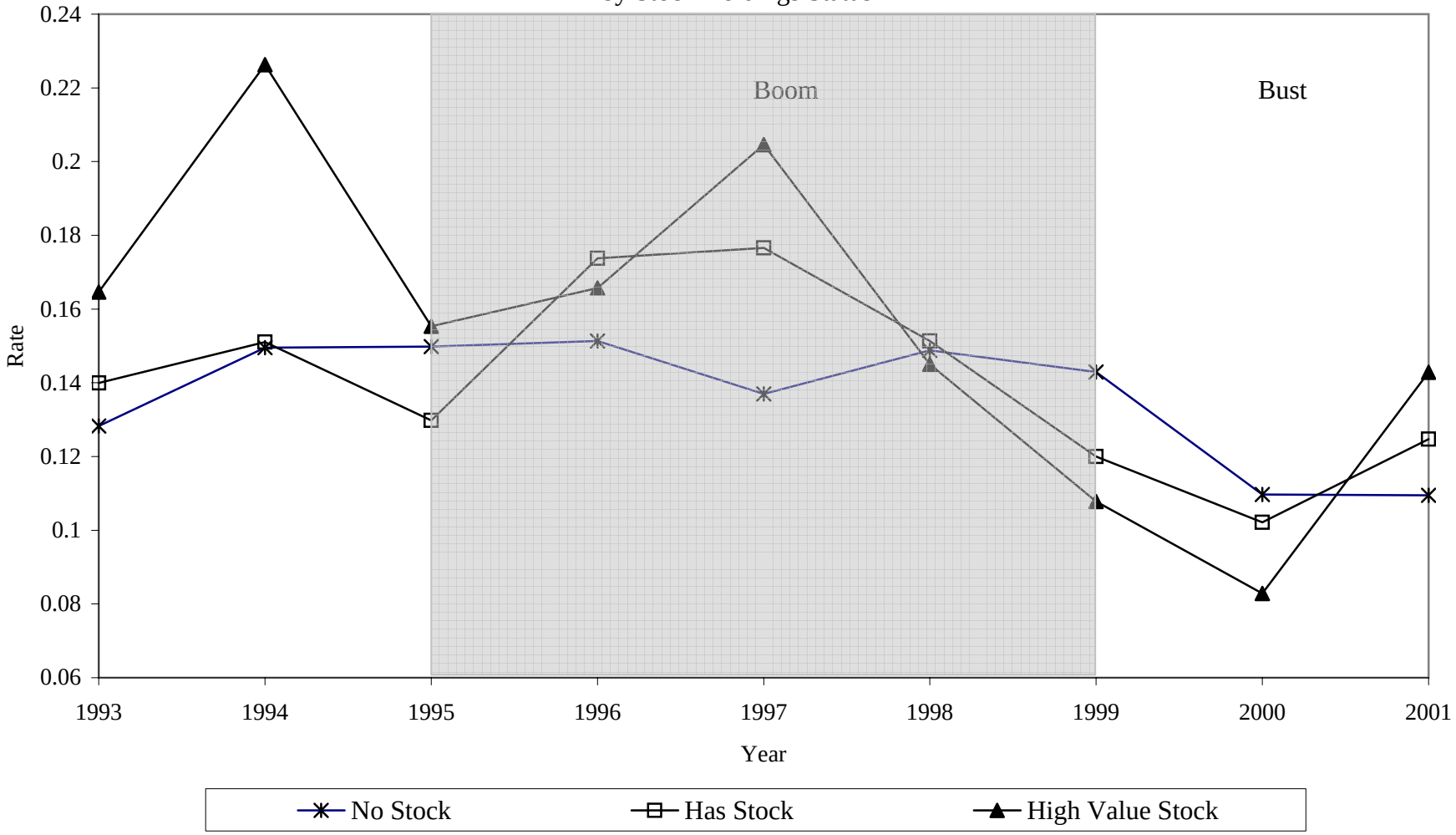
Note: Rates reflect retirement behavior adjusted for variation in the unemployment rate and the exact age composition of 60 to 65 year olds. The estimates assume an unemployment rate of 5 percent and are measured at the average retirement hazard between age 60 and 65. Year t reflects retirements that take place roughly between March of year t and March of year t+1.

Figure 5B: Adjusted Retirement Rates for Workers 60 to 65 in the Health and Retirement Survey, by Defined Contribution Pension/IRA Status



Note: Rates reflect retirement behavior adjusted for variation in the unemployment rate and the exact age composition of 60 to 65 year olds. The estimates assume an unemployment rate of 5 percent and are measured at the average retirement hazard between age 60 and 65.

Figure 6: Adjusted Retirement Rates for Workers 60 to 65 in the Health and Retirement Survey, by Stock Holdings Status



Note: Rates reflect retirement behavior adjusted for variation in the unemployment rate and the exact age composition of 60 to 65 year olds. The estimates assume an unemployment rate of 5 percent and are measured at the average retirement hazard between age 60 and 65.