

July 2006

# BABY BOOM GENERATION

Retirement of Baby  
Boomers Is Unlikely  
to Precipitate  
Dramatic Decline in  
Market Returns, but  
Broader Risks  
Threaten Retirement  
Security



G A O

Accountability \* Integrity \* Reliability



Highlights of [GAO-06-718](#), a report to congressional committees

# BABY BOOM GENERATION

## Retirement of Baby Boomers Is Unlikely to Precipitate Dramatic Decline in Market Returns, but Broader Risks Threaten Retirement Security

### Why GAO Did This Study

The first wave of baby boomers (born between 1946 and 1964) will become eligible for Social Security early retirement benefits in 2008. In addition to concerns about how the boomers' retirement will strain the nation's retirement and health systems, concerns also have been raised about the possibility for boomers to sell off large amounts of financial assets in retirement, with relatively fewer younger U.S. workers available to purchase these assets. Some have suggested that such a sell-off could precipitate a market "meltdown," a sharp and sudden decline in asset prices, or reduce long-term rates of return. In view of such concerns, we have examined (1) whether the retirement of the baby boomers is likely to precipitate a dramatic drop in financial asset prices; (2) what researchers and financial industry participants expect the effect of the boomer retirement to have on financial markets; and (3) what role rates of return will play in providing retirement income in the future. We have prepared this report under the Comptroller General's authority to conduct evaluations on his own initiative as part of the continued effort to assist Congress in addressing these issues.

### What GAO Recommends

GAO is not making any recommendations.

[www.gao.gov/cgi-bin/getrpt?GAO-06-718](http://www.gao.gov/cgi-bin/getrpt?GAO-06-718).

To view the full product, including the scope and methodology, click on the link above. For more information, contact Barbara Bovbjerg at (202) 512-7215 or [bovbjergb@gao.gov](mailto:bovbjergb@gao.gov).

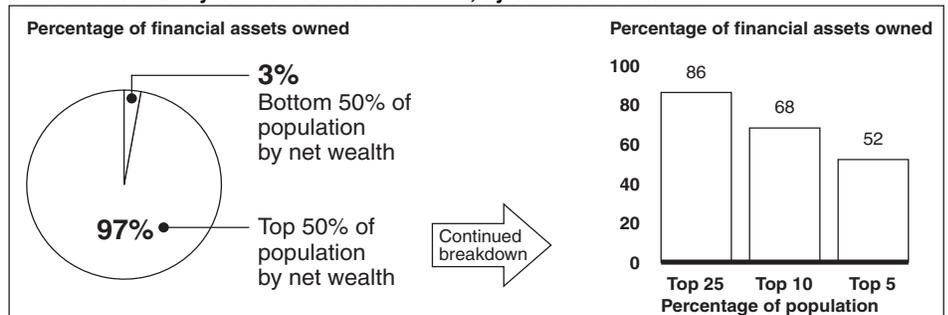
### What GAO Found

Our analysis of national survey and other data suggests that retiring boomers are not likely to sell financial assets in such a way as to cause a sharp and sudden decline in financial asset prices. A large majority of boomers have few financial assets to sell. The small minority who own most assets held by this generation will likely need to sell few assets in retirement. Also, most current retirees spend down their assets slowly, with many continuing to accumulate assets. If boomers behave the same way, a rapid and large sell off of financial assets appears unlikely. Other factors that may reduce the odds of a sharp and sudden drop in asset prices include the increase in life expectancy that will spread asset sales over a longer period and the expectation of many boomers to work past traditional retirement ages.

A wide range of academic studies have predicted that the boomers' retirement will have a small negative effect, if any, on rates of return on assets. Similarly, financial industry representatives did not expect the boomers' retirement to have a big impact on the financial markets, in part because of the globalization of the markets. Our statistical analysis shows that macroeconomic and financial factors, such as dividends and industrial production, explained much more of the variation in stock returns from 1948 to 2004 than did shifts in the U.S. population's age structure, suggesting that demographics may have a small effect on stock returns relative to the broader economy.

While the boomers' retirement is not likely to cause a sharp and sudden decline in asset prices, the retirement security of boomers and others will likely depend more on individual savings and returns on such savings. This is due, in part, to the decline in traditional pensions that provide guaranteed retirement income and the rise in account-based defined contribution plans. Also, fiscal uncertainties surrounding Social Security and rising health care costs will ultimately place more personal responsibility for retirement saving on individuals. Given the need for individuals to save and manage their savings, financial literacy will play an important role in helping boomers and future generations achieve a secure retirement.

Distribution of Baby Boomer Financial Assets, by Wealth Percentiles



Source: GAO analysis of 2004 Survey of Consumer Finances.

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## Abbreviations

DB	defined benefit
DC	defined contribution
EBRI	Employee Benefit Research Institute
HRS	Health and Retirement Study
IRA	Individual Retirement Account
S&P	Standard & Poor's
SCF	Survey of Consumer Finances

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United States Government Accountability Office  
Washington, DC 20548

July 28, 2006

### Congressional Committees

The aging of the U.S. population is expected to present great fiscal and economic challenges in the decades ahead. The first wave of the baby boom generation, the 78 million Americans born between 1946 and 1964 and alive as of 2005, will turn age 62 and become eligible for Social Security benefits beginning in 2008. The retirement of the relatively large baby boom generation, combined with other demographic trends, is expected to strain the nation's retirement and health systems.<sup>1</sup> This impending event has also raised concerns about the potential market effect should baby boomers sell off large amounts of financial assets in retirement. If proportionally fewer workers are available to buy these assets, some market observers fear that the increase in supply of stocks, bonds, and other financial assets relative to demand may place downward pressure on asset prices. At the extreme, some observers have raised the possibility of a market "meltdown," a sharp decline in stock or other asset prices, precipitated by the baby boom retirement. In contrast, others have noted that such an outcome could be mitigated by a rising demand for U.S. financial assets from developing countries and by immigration.

Returns on investment are important in helping many Americans accumulate sufficient savings throughout their working lives to meet their retirement needs. From 1946 to 2004, U.S. stocks have returned an average of 8.0 percent annually, adjusted for inflation. From 1986 to 2004, U.S. 10-year Treasury notes have yielded an annual average of 3.4 percent, adjusted for inflation. Importantly, returns on financial assets provide retirement income for many Americans, accounting for 12.6 percent of total income for Americans age 65 and over in 2004, and over half of this cohort received some income from financial assets. If the baby boom retirement were to reduce asset returns, retirees would generate less income from investments and workers would have more trouble saving adequately for retirement.

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<sup>1</sup> See GAO, *21st Century Challenges: Reexamining the Base of the Federal Government*, [GAO-05-325SP](#) (Washington, D.C.: Feb. 1, 2005); *21st Century Challenges: Transforming Government to Meet Current and Emerging Challenges*, [GAO-05-830T](#) (Washington, D.C.: July 13, 2005); and *21st Century: Addressing Long-Term Fiscal Challenges Must Include a Re-examination of Mandatory Spending*, [GAO-06-456T](#) (Washington, D.C.: Feb. 13, 2006).

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In view of such concerns, we have examined (1) whether the retirement of the baby boom generation is likely to precipitate a dramatic drop in financial asset prices; (2) what researchers and financial industry experts expect the effect of the baby boom retirement to have on the financial markets, and (3) what role rates of return will play in providing retirement income in the future. We have prepared this report under the Comptroller General's authority to conduct evaluations on his own initiative as part of a continued effort to assist Congress in addressing these issues.

To analyze whether the retirement of the baby boom generation is likely to precipitate a dramatic drop in financial asset prices, we examined financial information from the Survey of Consumer Finances (SCF) to determine what financial assets are held by baby boomers and the Health and Retirement Study (HRS) to determine how current retirees spend down their assets.<sup>2</sup> To identify the views of researchers and outside experts on the financial effects of the baby boom retirement, we reviewed simulation-based and empirical studies analyzing the baby boom generation's impact on financial markets and interviewed financial and public policy experts from mutual fund companies, pension funds, life insurance companies, broker-dealers, financial planning organizations, and financial industry trade associations. We also conducted our own econometric analysis of the historical importance of demographics on financial asset returns. To assess the role rates of return will play in providing retirement income, we reviewed past GAO reports, academic literature, and obtained insights from interviews with outside experts. We conducted our work between August 2005 and June 2006 in accordance with generally accepted government auditing standards. A more extensive discussion of our scope and methodology appears in appendix I.

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## Results in Brief

Our analysis of national survey and other data suggests that baby boomers would be unlikely to sell enough financial assets in retirement to precipitate a market meltdown, or a sudden and sharp decline in asset prices. First, a large majority of boomers have few financial assets to sell, and the small wealthy minority that holds the large majority of this generation's assets will likely need to sell little, if any, of their assets in

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<sup>2</sup> The SCF is a nationally representative survey sponsored by the Federal Reserve Board containing detailed information on assets and debt of U.S. households. We define baby boomers in our analysis of SCF as a household headed by an individual born between 1946 and 1964. HRS is a nationally representative biennial survey of older Americans produced by the University of Michigan and sponsored by the National Institute on Aging.

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retirement.<sup>3</sup> Our examination of the 2004 SCF shows that the wealthiest 10 percent of boomers own about two-thirds of the financial assets held by this generation, excluding assets held indirectly in defined benefit (DB) pensions. About one-third of all boomers do not own any assets in stocks, bonds, mutual funds, or retirement accounts. Second, if baby boomers behave like current retirees, a rapid and large sell off of financial assets also appears unlikely. Our analysis of data on current retirees' saving and investment behavior reveals that most retirees slowly spend down their assets in retirement, with many actually continuing to accumulate assets. Other factors that would mitigate against a sharp and sudden decline in asset prices include the 19-year span over which boomers will reach retirement age, the extended life expectancy of boomers, and the expected increase in boomer employment past traditional retirement ages, which would facilitate additional asset accumulation and reduce the need to sell assets to provide retirement income. Finally, to the extent that boomers may be less reluctant than prior generations to treat their homes as a source of retirement income through such strategies as reverse mortgages, they may also depend less heavily on selling their financial assets for income.

Researchers and financial industry representatives largely expect the baby boom retirement to have little or no effect on stock and bond markets. Studies that used models to simulate the market effects of a hypothetical baby boom followed by a baby bust generally predicted that the baby boom retirement will have a small, negative effect on financial asset returns. Similarly, most of the empirical studies, which statistically examined the impact of past changes in the U.S. population's age structure on stock returns and bond yields, suggested that demographic shifts have had a minimal or no effect on stock returns or bond yields. In addition, financial industry representatives whom we interviewed generally did not expect the baby boomers to have a significant impact on the financial markets when they retire. They said factors that could slow the sale of assets or increase demand and thereby mitigate any demographic effect included the possibility that the minority of boomers who own the majority of financial assets will likely bequeath rather than sell their assets, boomers will hold stock well into retirement to hedge inflation and the risk of outliving their savings, and international factors such as

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<sup>3</sup> We define financial assets as stocks, bonds (excluding U.S. savings bonds), mutual funds, Individual Retirement Accounts, Keogh accounts, account-type retirement savings plans, and assets in annuities, trusts, and managed accounts that are invested in stocks and bonds.

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immigration and an increase in asset demand from developing countries. Finally, our statistical analysis indicates that macroeconomic and financial factors, such as dividends and industrial production, have explained more of the variation in stock returns from 1948 to 2004 than shifts in the U.S. population's age structure—suggesting that such factors could outweigh any future demographic effect on stock returns.

While the baby boom retirement is not likely to cause a sharp decline in asset prices or returns, the retirement security of boomers and future generations will likely depend increasingly on individual savings and the returns these savings can earn. The decline in traditional DB pensions that provide income for life and their replacement with account-based defined contribution (DC) plans mean that fewer boomers will have a dependable income during retirement other than that from Social Security. However, fiscal uncertainties about Social Security's solvency may result in reduced future benefits for certain age groups and income levels, thereby placing more responsibility for saving on individuals. Collectively, these trends would increase the dependence of individuals on rates of return to accumulate enough financial assets at retirement and to produce sufficient income from their assets during retirement. Given the need for individuals to rely increasingly on their ability to manage their own accumulation and spending of assets and savings, financial literacy will likely play an ever important role in the retirement security of baby boomers and future generations.

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## Background

In the 21st century, older Americans are expected to comprise a larger share of the population, live longer, and spend more years in retirement than previous generations. The share of the U.S. population age 65 and older is projected to increase from 12.4 percent in 2000 to 19.6 percent in 2030 and continue to grow through 2050. At the same time, life expectancy is increasing. By 2020, men and women reaching age 65 are expected to live another 17 or 20 years, respectively. Finally, falling fertility rates are contributing to the increasing share of the elderly population. In the 1960s, the fertility rate was an average of three children per woman.<sup>4</sup> Since the 1970s, the fertility rate has hovered around two children per woman, meaning relatively fewer future workers are being born to replace retirees. The combination of these trends is expected to significantly increase the

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<sup>4</sup> The fertility rate is the average number of children born to a woman between the ages 15 to 44, among all women who survive to age 44.

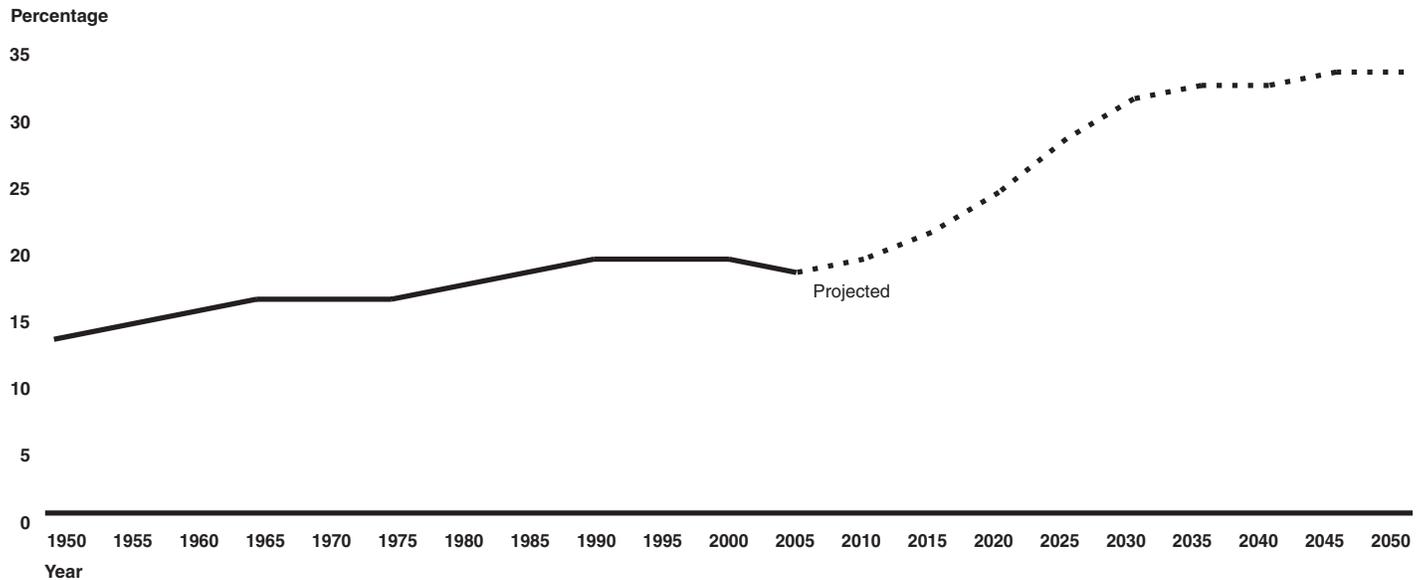
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elderly dependency ratio—the number of people age 65 and over in relation to the number of people age 15 to 64. In 1950, there was 1 person age 65 or over for every 8 people age 15 to 64. By 2000, the elderly dependency ratio had risen to 1 person age 65 for every 5 people of traditional working age, and by 2050 this ratio is projected to rise further to about 1 elderly to every 3 working age people (see fig. 1).<sup>5</sup> Consequently, relatively fewer workers will be supporting those receiving Social Security and Medicare benefits, which play an important role in helping older Americans meet their retirement needs.

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<sup>5</sup> These demographic changes are not unique to the United States. Other developed countries are undergoing demographic change similar or greater in magnitude than the United States. For example, the elderly dependency ratio for Italy and Japan is projected to rise from around 1 person age 65 or over for every 4 people age 15 to 64 to around 1 older person for every 1.5 younger people from 2000 to 2050; Spain and Germany will also face a steeply rising dependency ratio over the same period. In comparison, the ratio for the United Kingdom is expected to increase at a similar pace as the U.S. ratio.

**Figure 1: U.S. Elderly Dependency Ratio (Population Age 65 and Older Relative to Age 15 to 64), 1950-2000 and Projected 2005-2050**



Source: United Nations.

Note: Population Division of the Department of Economic and Social Affairs of the United Nations Secretariat, World Population Prospects: The 2004 Revision and World Urbanization Prospects: The 2003 Revision. Data for 2005 through 2050 are projected. The elderly dependency ratio equals the number of people age 65 and older divided the number between age 15 and 64, expressed as a percentage.

By causing a large shift in the U.S. population’s age structure, some have suggested that the baby boom generation may affect stock and other asset markets when this cohort retires. This concern stems from hypothetical spending and saving patterns over people’s lifetimes, which economists describe in the “life cycle” model. The model hypothesizes that people attempt to smooth their consumption over their lifetime. As individuals’ earnings typically grow over their working life, this suggests that younger workers, with relatively low earnings, may save relatively little or borrow to finance current consumption (or to buy a house); older workers may save significantly more in preparation for retirement; and retirees may spend down their savings. The model therefore predicts that the saving rate is hump-shaped over an individual’s lifetime.

Over the course of their lives, individuals make decisions about not only how much to save but also how to distribute their savings among a mix of assets, such as stocks, bonds, real estate, and bank accounts. For example, older workers are expected to shift their portfolios toward less volatile

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assets, such as bonds or cash accounts, because they will tend to prefer assets with a more predictable flow of income since they will have less time to weather potential price declines in riskier assets such as stocks.

In addition to their saving and consumption patterns, baby boomers also may affect stock returns in particular through broader macroeconomic channels. Stocks represent claims on the profits earned by firms, and in the long run the returns on these assets should reflect the productivity of the firms' capital. Generally, economic theory states that capital becomes more productive with more and better quality labor to use that capital. Because the baby boom retirement is expected to reduce the growth rate of the U.S. labor supply, it may reduce returns to capital, which could reduce the returns to stocks. More generally, investors may price stocks in relation to the underlying value of the firm, taking into account the value of firm's current assets and stream of future profits.

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## Financial Evidence from Baby Boomers and Current Retirees Does Not Suggest a Sharp Decline in Asset Prices

Our analysis of national survey data indicates that the baby boom generation is not likely to precipitate a sharp and sudden decline in financial asset prices as they retire. Our analysis of the 2004 SCF shows that just 10 percent of boomers own more than two-thirds of this generation's financial assets, excluding assets held indirectly in DB pensions. These wealthiest boomers may be able to support themselves on the income from these investments without spending them down significantly. About one-third of all boomers do not own any stocks, bonds, mutual funds, or retirement accounts.<sup>6</sup> As with the prior generation, baby boomers may continue to accumulate financial assets in retirement and liquidate their assets only gradually with the hope of leaving bequests. The gradual entry of the boomers over a 19-year period into retirement should further reduce the likelihood of a sudden decline in asset prices.<sup>7</sup> Further, boomers have indicated that they plan to retire later than generations that retired in the recent past, with almost half not planning to leave full-time employment until age 65 or later. Many may also continue to work throughout retirement, reducing or delaying their need to sell financial assets. Housing represents a greater share of total wealth for most baby boomers than do financial assets, and therefore the housing

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<sup>6</sup> In determining wealth for the purposes of this report, we added all assets that each household owns and subtracted all outstanding debts.

<sup>7</sup> For purposes of this report, we consider people to be retired if they self-report they are retired in the SCF or HRS. We refer to full retirement as when an individual stops working for pay altogether.

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markets present more financial risk to most boomers than the financial markets.

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### Concentration of Financial Assets among a Minority of Baby Boomers May Lessen Their Market Effect

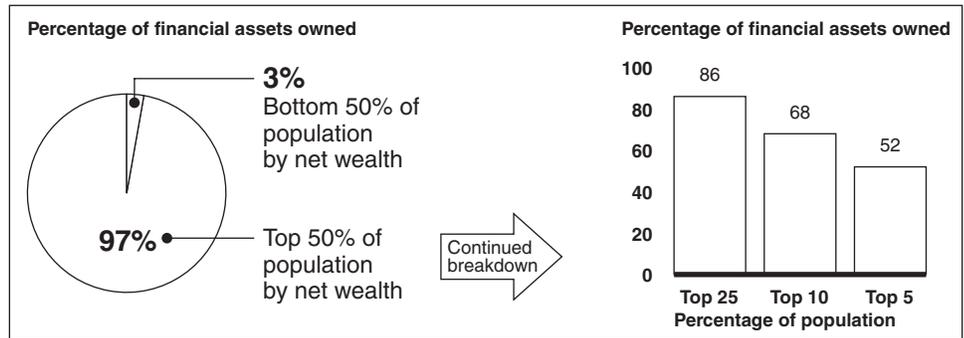
The potential for the baby boom generation to precipitate a market meltdown in retirement may be substantially reduced by the fact that a small minority of this population holds the majority of the generation's financial assets. According to our analysis of the 2004 SCF, the wealthiest 10 percent of boomers owned over two-thirds of the approximately \$7.6 trillion held by boomers in stocks, bonds, mutual funds, Individual Retirement Accounts (IRAs), and other account-type retirement savings plans in 2004. This wealthiest group held \$1.2 million, on average, in these financial assets, plus over \$2 million in other assets such as home equity and other investments.<sup>8</sup> Figure 2 shows the concentration of financial assets among boomers. This concentration of wealth is very similar to that of current retirees and could mitigate a sharp and sudden impact on financial asset prices if wealthy boomers need not spend down their financial assets in retirement. Research on current retirees indicates that the wealthiest of these individuals tend to not sell their financial assets, contrary to what the life-cycle model would predict; instead, they choose to live from the income these assets generate.<sup>9</sup> Our analysis of the 2004 SCF also found that of the wealthiest 10 percent of current retirees born before 1946, less than 16 percent spent money from their savings and investments over and above their income during the previous year. In this same group, over 65 percent responded that their income in 2003 exceeded their spending, indicating that they had accumulated more assets without having a net sale from their holdings.

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<sup>8</sup> Because DB pension plans are future income payments and not assets held in an account, they are not included in calculating financial assets or wealth with the SCF data.

<sup>9</sup> Christopher D. Carroll, "Portfolios of the Rich," National Bureau of Economic Research, *Working Paper No. 7826* (August 2000).

**Figure 2: Distribution of Baby Boomer Financial Assets, by Wealth Percentiles**



Source: GAO analysis of 2004 Survey of Consumer Finances.

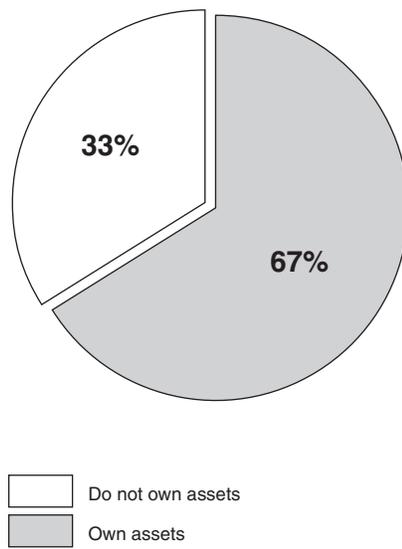
Note: Financial assets include stocks, bonds, mutual funds, IRAs, Keogh plans, and other account-type retirement savings plans. The distribution of baby boomers is based on total wealth, defined as the net of all assets that each household owns and all outstanding debts.

The possibility of an asset meltdown is further reduced by the fact that those households that would seem more likely to need to sell their financial assets in retirement do not collectively own a large portion of the total stocks and bonds in the market. Although the majority of baby boomers hold some financial assets in a variety of investment accounts, the total holdings for all boomer households, \$7.6 trillion, account for roughly one-third of the value of all stocks and 11 percent of bonds outstanding in the U.S. markets, and the wealthiest boomers own most of these assets (see figs. 3 and 4).<sup>10</sup> Those households that are most likely to spend down their assets in retirement—those not in the top 10 percent by wealth—collectively hold just 32 percent of all baby boomer financial assets. As a group, the influence of these households on the market is less substantial. One-third of this group does not own any stocks, bonds, mutual funds, or retirement accounts, and among those who do, their total holdings are relatively small, with their median holdings totaling \$45,900.

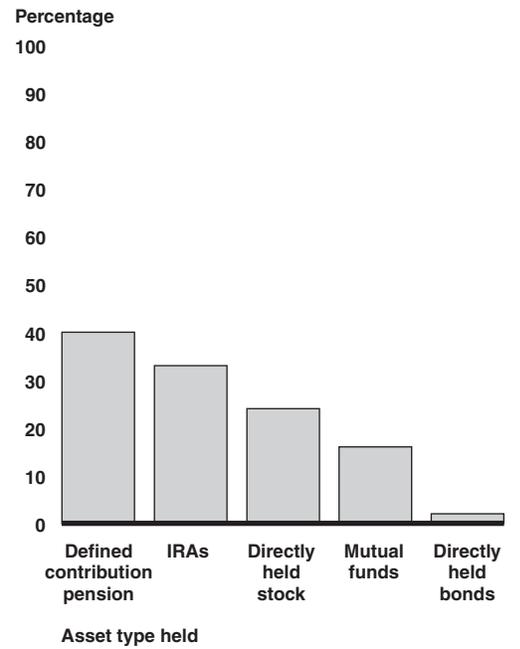
<sup>10</sup> At the close of 2004, assets invested in the New York Stock Exchange and NASDAQ totaled \$16.1 trillion, and assets in domestic bonds, both corporate and government, excluding money markets, totaled \$20.7 trillion.

**Figure 3: Percentage of Baby Boomers Who Own Financial Assets and Their Use of Different Investment Accounts**

**Total baby boomer households**

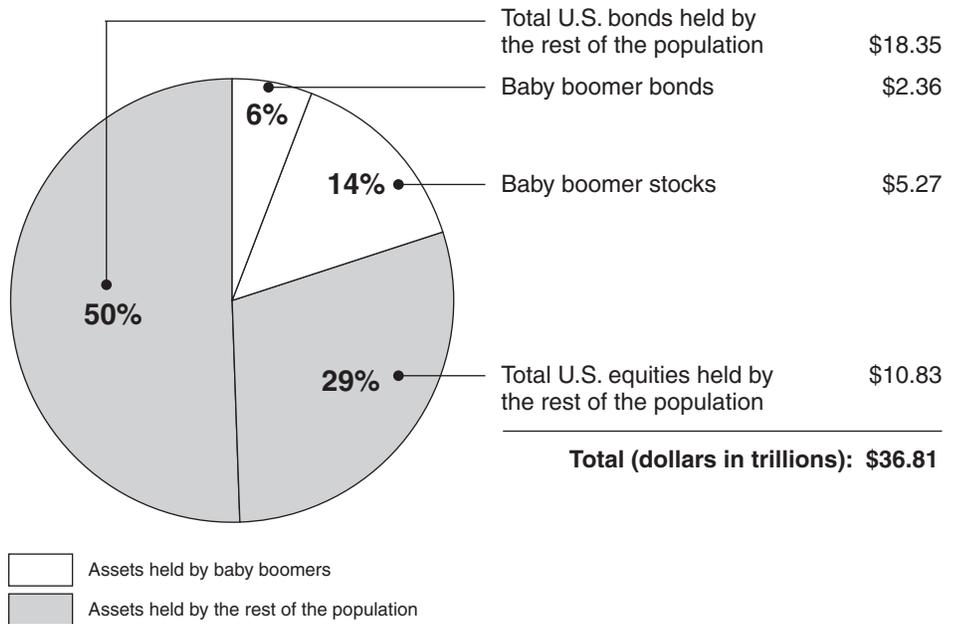


**Assets held by baby boomer households**



Source: GAO analysis of 2004 Survey of Consumer Finances.

**Figure 4: Total Financial Assets Held by Boomers and the Rest of the U.S. Population**



Source: GAO analysis of 2004 SCF.

Note: Due to rounding, total does not equal 100 percent.

## Analysis of Current Retiree Behavior Reveals a Pattern of Continued Accumulation and Slow Spending of Assets

Our analysis of national data on the investment behavior of current retirees reveals an overall slow spending down of assets in retirement, with many retirees continuing to purchase stocks. To the extent that baby boomers behave like current retirees, a rapid and mass sell off of financial assets seems unlikely.<sup>11</sup> In examining retiree holdings in stocks, using biennial data spanning 1994 to 2004 from HRS, we found that many people continue to buy stocks in retirement. More than half of retirees own stocks

<sup>11</sup> An important distinction between current retirees and baby boomers is that the latter are more likely to rely on DC pensions for retirement income, which may affect how they spend down their assets. Research has shown that there is a lower propensity to spend assets from a DC plan when compared to income from a DB plan. While approximately 16 percent of people older than baby boomers have DC pensions as part of their retirement savings plan, about 42 percent of older boomers and 45 percent of younger boomers have DC pensions. A DB pension provides a guaranteed benefit usually in the form of an annuity, whereas a DC pension is an individual account whose value depends on contributions and investment returns. Another difference is that benefits from DB plans are insured up to specified limits by the Pension Benefit Guaranty Corporation.

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outside of an IRA, Keogh, or pension account and, among this group, approximately 57 percent purchased stocks at some point over the 10-year period in retirement.<sup>12</sup> We found that from 2002 to 2004 the stock ownership for most of these retirees either increased or remained at the same level. Among those who owned stock, almost 31 percent reported buying stocks during this 2-year period, while just fewer than 26 percent reported selling.<sup>13</sup> For the retirees who both bought and sold stocks, approximately 77 percent purchased at least as much value in stock as they sold.<sup>14</sup>

Additionally, although retirees might be expected to have a low tolerance for market risk and will therefore divest themselves of equities in favor of bonds, the SCF data does not suggest such a major reallocation.<sup>15</sup> Comparing households' holdings in stocks and bonds by age, we found only a small difference in aggregate stock and bond allocation across portfolios. Specifically, data from the 2004 SCF shows that of total wealth among households headed by people over age 70, more is invested in stocks than bonds.<sup>16</sup> In 2004, households headed by those over age 70 had roughly 60 percent of their investments in stocks and 40 percent invested

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<sup>12</sup> This measure of stock purchases includes stock or money put into a mutual fund, including automatic reinvestments.

<sup>13</sup> This measure of stock sales and purchases does not include IRAs, Keoghs, or pension accounts.

<sup>14</sup> In addition, for investments in real estate (not including a primary residence) and private businesses, assets that few retirees hold, we found that the majority of retirees do not sell these assets off quickly. According to the HRS, approximately 22 percent of retirees owned real estate and about 10 percent owned shares in a private business in 2004. These assets represented a significant share of net wealth among those retirees who held them—for retirees with both real estate and private business holdings, these combined assets represent, on average, about half of total wealth. However, from 1994 to 2004 time period, only about one-quarter of these retirees sold real estate and 8 percent sold an interest in a private business.

<sup>15</sup> While investments in equities are viewed to be a hedge against inflation and have higher average returns than bonds, they are riskier investments compared to most bond investments, and therefore pose more of a risk of loss of value in the short run. A loss in portfolio value would be especially harmful to retirees, as they are less likely to be able to return to work to make up for a loss in wealth and they have a shorter time horizon to recoup their losses in the market.

<sup>16</sup> Researchers similarly have found that the percentage of net worth invested in common stocks shows very little decline after age 60, with the share of net worth held as common stocks never falling below the percentage observed for 45 to 49 year-olds. See Barry P. Bosworth, Ralph C. Bryant, and Gary Burtless, "The Impact of Aging on Financial Markets and the Economy: A Survey" (Washington, D.C.: The Brookings Institution, July 2004).

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in bonds, while those households headed by someone aged 40 to 48 held 68 percent of their portfolios in stocks and 32 percent in bonds.

Our finding that retirees slowly spend down assets is consistent with the results of several academic studies. One recent study that examined asset holdings of elderly households suggests there is a limited decline in financial assets as households age.<sup>17</sup> Prior work also finds evidence that retirees spend down at rates that would leave a considerable portion of their wealth remaining at the end of average life expectancy and a significant number of retirees continue to accumulate wealth at old ages.<sup>18</sup> For example, a 1990 study estimated that most single women would have approximately 44 percent of their initial wealth (at age 65) remaining if they died at the average age of life expectancy.<sup>19</sup> Other studies have shown that over the last several decades the elderly have drawn down their lump-sum wealth at relatively conservative rates of 1 to 5 percent per year.<sup>20</sup>

Retirees may spend down assets cautiously as a hedge against longevity risk. Private annuities, which minimize longevity risk, are not widely held by older Americans.<sup>21</sup> As life expectancy increases and people spend more years in retirement, retirees will need their assets to last a longer period of time and, thus, should spend them down more slowly. The average number of years that men who reach age 65 are expected to live has increased from 13 in 1970 to 16 in 2005, and is projected to increase to 17

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<sup>17</sup> James Poterba, "The Impact of Population Aging on Financial Markets," *Working Paper No. 10851* (Cambridge, Mass.: National Bureau of Economic Research, 2004).

<sup>18</sup> Michael D. Hurd, "Research on the Elderly: Economic Status, Retirement, and Consumption and Saving," *Journal of Economic Literature*, Vol. 28, No. 2 (June 1990, 565-637); and Laurence J. Kotlikoff, "Intergenerational Transfers and Savings," *The Journal of Economic Perspectives*, Vol. 2, No. 2 (Spring 1988, 41-58).

<sup>19</sup> Hurd, "Research on the Elderly: Economic Status, Retirement, and Consumption and Saving," p. 612.

<sup>20</sup> Alicia H. Munnell, Annika Sunden, Mauricio Soto, and Catherine Taylor, "How Will the Rise in 401(k) Plans Affect Bequests?," *Issue Brief No. 10* (Boston: Center for Retirement Research at Boston College, Nov. 2002.)

<sup>21</sup> Research has shown that inefficiencies exist in the annuity market due to a lack of competition and adverse selection among those who purchase annuities. Adverse selection in the annuities market occurs because people who buy annuities also tend to live longer, which is adverse to the insurer. See Olivia S. Mitchell, James M. Poterba, Mark J. Warshawsky, and Jeffrey R. Brown, "New Evidence on the Money's Worth of Individual Annuities," *The American Economic Review*, Vol. 89, No. 5 (Dec. 1999) and National Center for Policy Analysis, "Social Security and Market Risk: The Annuity Market: Present and Future," <http://www.ncpa.org/pub/st/st244/s244c.html> (accessed June 21, 2006).

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by 2020. Women have experienced a similar rise—from 17 years in 1970 to over 19 years in 2005. By 2020, women who reach age 65 will be expected to live another 20 years.<sup>22</sup>

Another factor that may explain the observed slow spending down of assets among retirees is the bequest motive. National survey data show that many retirees intend to leave a sizeable bequest, which may explain their reluctance to spend down their wealth. Because more than three-quarters of retirees have a bequest motive, many may never sell all of their assets. To the extent that retirees bequeath their assets instead of selling them for consumption, the result could be an intergenerational transfer rather than a mass sell-off that would negatively affect asset markets. In addition to current retirees, data from the HRS indicates that the majority of older baby boomers (those born between 1946 and 1955) expect to leave a bequest. Approximately 84 percent of these baby boomers expect to leave a bequest, while 49 percent expect the bequest to be at least \$100,000.

It is important to note that the baby boom generation's asset sale behavior in retirement might differ from that of recent generations of retirees. First, fewer baby boomers are covered by DB plans that typically pay a regular income in retirement and increasingly have DC plans that build up benefits as an account balance. To the extent that this shift means that boomers have an increased share of retirement wealth held as savings instead of as income, this may require boomers to sell more assets to produce retirement income than did previous generations.<sup>23</sup> Second, unanticipated expenses, such as long-term care and other health care costs, may make actual bequests smaller than expected. Although 2002 HRS data indicates that only 8 percent of the leading edge of baby boomers have long-term care insurance, recent projections show that 35 percent of people currently age 65 will use nursing home care.<sup>24</sup> If boomers are confronted

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<sup>22</sup> See GAO, *Older Workers: Labor Can Help Employees and Employers Better Plan for the Future*, [GAO-06-80](#) (Washington, D.C.: December 2005).

<sup>23</sup> Countering this potential effect is that the move away from DB plans would mean that plan sponsors might have less of a need to sell assets to pay current retirees.

<sup>24</sup> The majority of nursing home care and home health care costs are not paid by private insurance or Medicare. In many cases, the burden of these expenses are borne by the patient receiving care, until they have spent down nearly all of their assets and become eligible for Medicaid, which does cover these costs. Peter Kemper, Harriet L Komisar, and Lisa Alecxi, "Long-Term Care Over an Uncertain Future: What Can Current Retirees Expect?" *Inquiry*, Vol. 42, No. 4, Mar. 2006, pp. 335–350.

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with higher than expected health care costs in retirement, they would have a greater need to spend down their assets.

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## Defined Benefit Pension Plans Unlikely to Sell Off Large Amounts of Stocks Solely as a Response to Boomer Retirement

Households are not the only holders of financial assets that might shift or draw down their holdings as the baby boomers age. DB pension plans, which promise to provide a benefit that is generally based on an employee's salary and years of service, hold assets to pay current and future benefits promised to plan participants, which are either current employees or separated or retired former employees. According to Federal Reserve Flow of Funds Accounts data, private-sector plans as a whole owned \$1.8 trillion in assets in 2005. Of this amount, plans held approximately half in stocks.<sup>25</sup> According to the Employee Benefit Research Institute (EBRI), federal government DB plans contained an additional \$815 billion in assets as of 2004. However, most of these DB plans invest in special Treasury securities that are non-marketable. State and local plans held an additional \$2.6 trillion in assets; however, the data do not separate DB and DC assets for these plans. If DB plans hold approximately 85 percent of state and local plan assets, as is the case for federal government plans, and if DB plans held approximately half of their assets as equities, this would mean state and local plans held an estimated \$1.1 trillion in equities. Thus, public and private DB plans held an estimated approximate value of \$2 trillion in stocks. Because of the number of boomers, we would expect that, as they retire, DB plans would pay out an increasing amount of benefits. This demographic shift could cause plans to sell some of their holdings to provide current benefits. Indeed, a 1994 study projected that the pension system would cease to be a source of saving for the economy roughly in 2024.<sup>26</sup> We would also expect plans to convert some stocks to less volatile assets, such as cash

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<sup>25</sup> The Flow of Funds Accounts data report amounts held in mutual fund shares but do not report the proportion of these shares that represent stock holdings. We assume that all assets listed in mutual fund shares are held in stocks to show the maximum amount of assets that could be held as stock.

<sup>26</sup> The study also noted that when the pension system begins to be a net seller of financial assets, it could depress asset prices, including stocks, bonds, and real estate. See Sylvester J. Schieber and John B. Shoven, "The Consequences of Population Aging on Private Pension Fund Saving and Asset Markets," *Working Paper No. 4665* (Cambridge, MA: National Bureau of Economic Research, 1994).

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and bonds, to better ensure that plans have sufficient money to pay current benefits.<sup>27</sup>

While DB plans may shift their assets in response to demographic changes, it is unclear whether they would cause major variations in stock and bond prices. First, even though DB plans hold about \$2 trillion in stocks, this sum still represents a relatively small fraction of total U.S. stock wealth (\$16.1 trillion, as of 2004). Further, there are reasons why DB plans may not appreciably shift their investments away from stocks. While the baby boom retirement may increase the number of persons receiving benefits, the DB participant pool has been aging long before the baby boom approached retirement. The percentage of private-sector DB participants made up of retirees has climbed steadily for the past 2 decades, from 16 percent in 1980 to over 25 percent in 2002. Over this time, we have observed little evidence of a shift in investments by private DB plans away from stocks and toward fixed-income assets. In 1993, private DB plans held just below half of their assets in stocks, about the same proportion as today; in 1999, at the recent stock market's peak, plans held about 58 percent of assets in stocks.

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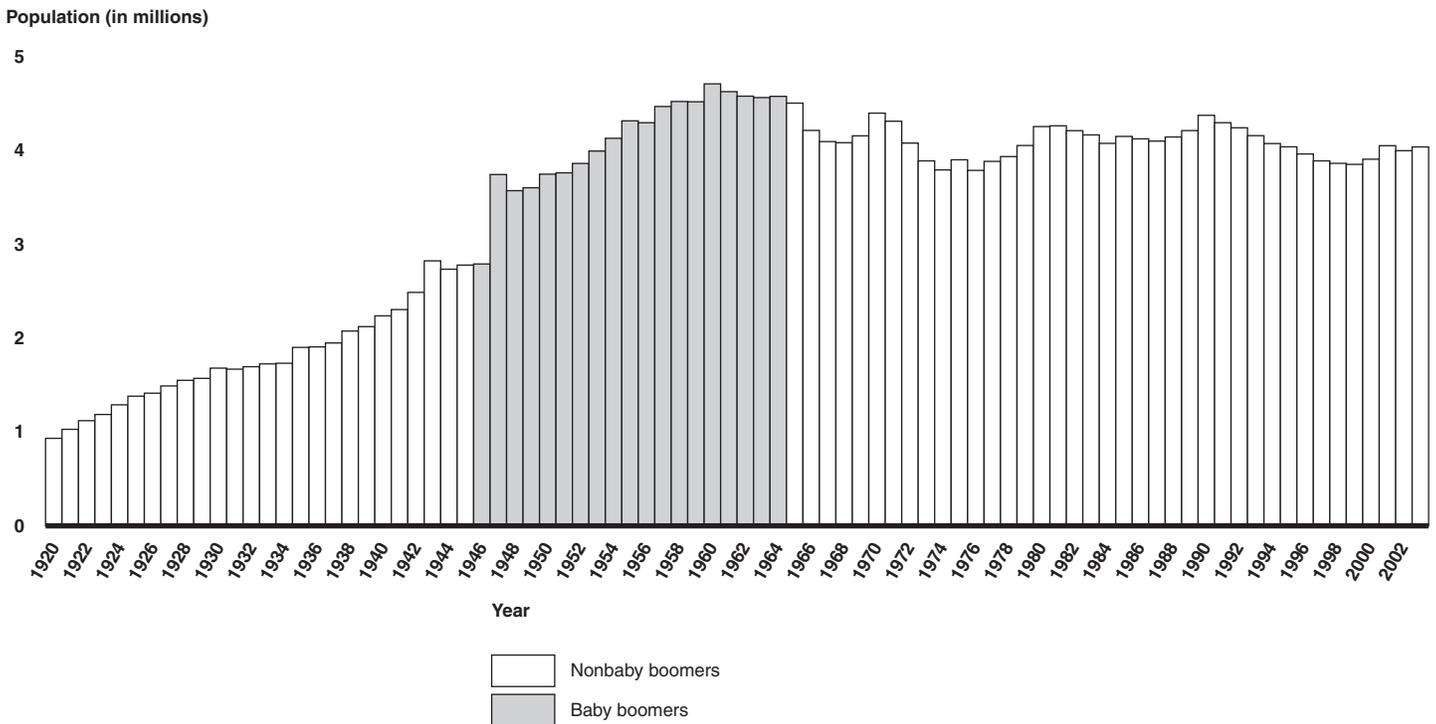
### Gradual Entry into Retirement and Subsequent Employment Plans Suggest a Cumulative Rather Than Sudden Effect on Markets

The gradual transition of the baby boomers into retirement suggests that the sale of their financial assets will be spread out over a long period of time, which mitigates the risk of a shock to financial markets. The baby boom generation spans a 19-year time period—the oldest baby boomers will turn age 62 in 2008, becoming eligible for Social Security benefits, but the youngest baby boomers will not reach age 62 until 2026. Among boomers in the U.S. population in 2004, the peak birth year was 1960, as seen in figure 5, and these boomers will turn age 62 in 2022.

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<sup>27</sup> Other factors might also cause DB plans to sell stocks in the near future. The number of plans, which has been in decline since the mid-1980s, continues to shrink, and as plans terminate, they use their assets to pay lump sum benefits or turn their assets over to insurance companies or the Pension Benefit Guaranty Corporation, entities that tend to hold more bonds than stocks. As DB plans continue to terminate, this trend would likely cause a decline in the level of stocks in the DB system. Also, pending pension reform legislation in Congress may create incentives for plan sponsors to shift their asset allocation from stocks toward bonds and other less volatile assets.

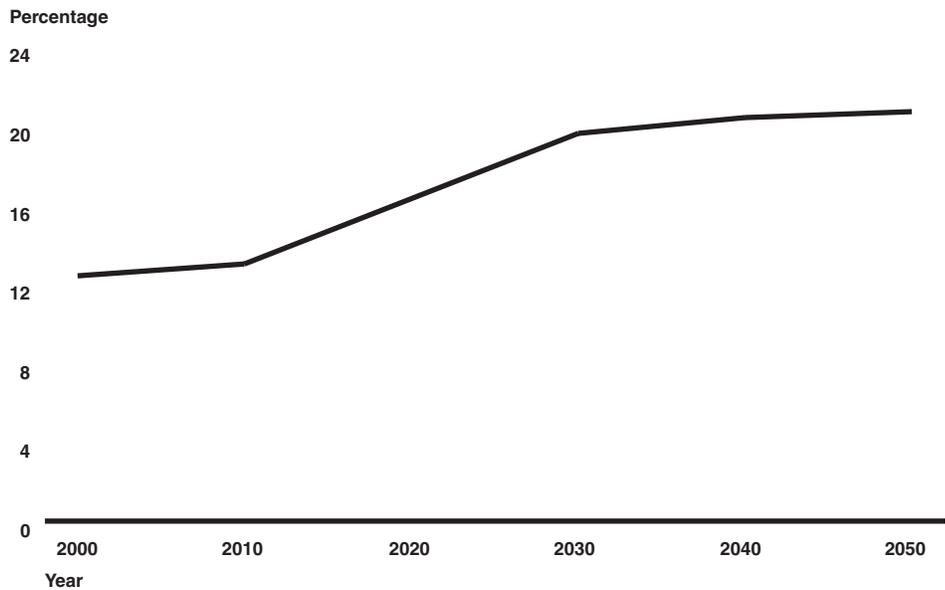
**Figure 5: 2004 U.S. Resident Population, by Birth Year**



Source: 2006 Statistical Abstract of the United States.

As boomers gradually enter retirement, the share of the population age 65 and older is projected to continue increasing until about 2040, at which point it is expected to plateau, as seen in figure 6. Thus, the aging of the baby boom generation, in conjunction with the aging of the overall U.S. population, is a cumulative development rather than a sudden change.

**Figure 6: Share of the U.S. Population Age 65 and Older, Projected to 2050**



Source: U.S. Census Bureau.

In addition, the expected increase in the number of baby boomers working past age 62 may also reduce the likelihood of a dramatic decline in financial asset prices. An increase in employment at older ages could facilitate the accumulation of financial assets over a longer period of time than was typical for earlier generations (albeit also needing to cover consumption over a longer life expectancy).<sup>28</sup> Furthermore, continuing to work for pay in retirement, often called partial or phased retirement, would reduce the need to sell assets to provide income.<sup>29</sup> In fact, some degree of extended employment has already been evident since the late 1990s, as seen in figure 7. From 1998 to 2005, the labor force participation rate of men and women age 65 and older increased by 20 percent and 34 percent, respectively. Survey data show that such a trend is expected to continue: Data from the 2004 SCF indicate that the majority of boomers intend to work past age 62, with boomers most commonly reporting they

<sup>28</sup> From the perspective of the overall economy, increased employment at older ages would also support continued growth of the labor supply, which may improve the productivity of and financial returns to capital.

<sup>29</sup> In general, partial retirement refers to someone who classifies himself or herself as partially or fully retired but is still working for pay on a part-time basis.

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expect to work full time until age 65. Almost 32 percent of boomers said they never intend to stop working for pay. Another study by the AARP in 2004 found that many baby boomers expect to go back to work after they formally retire—approximately 79 percent of boomers said they intend to work for pay in retirement.<sup>30</sup> Other research has shown that about one-third of those who return to work from retirement do so out of financial necessity.<sup>31</sup> These developments suggest that baby boomers may be less inclined to take retirement at age 62. However, some boomers may not be able to work as long as they expect because of health problems or limited employment opportunities.<sup>32</sup> To the extent that these boomers follow through on their expressed plans to continue paid work, their income from earnings would offset some of their need to spend down assets.

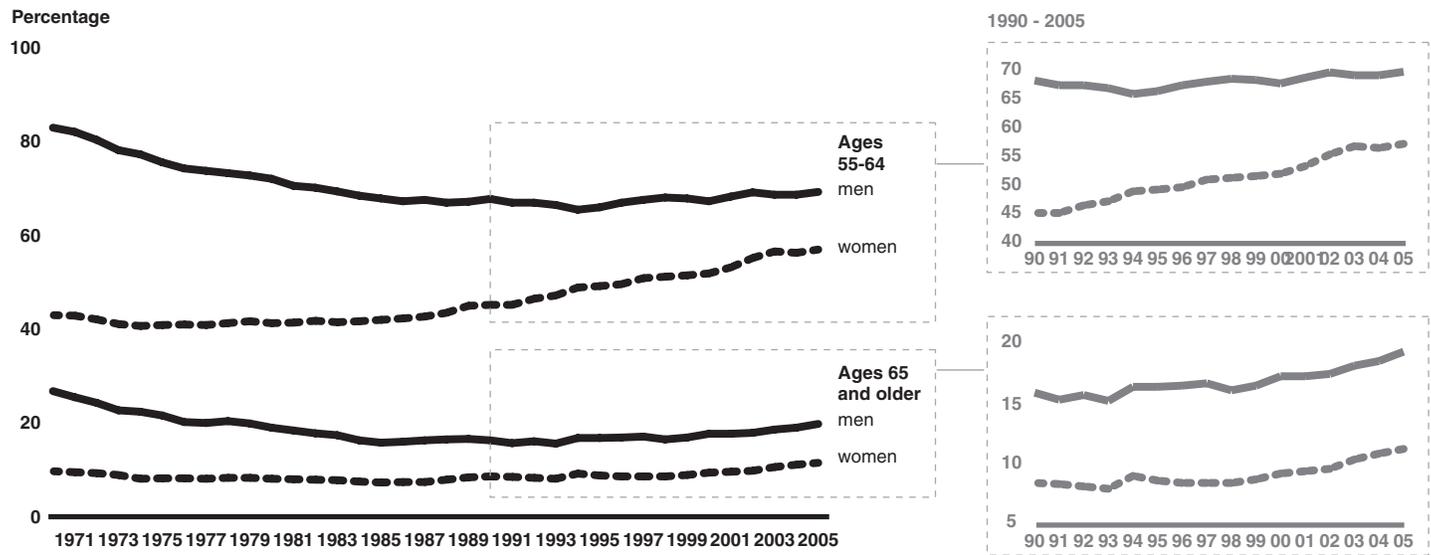
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<sup>30</sup> AARP, *Baby Boomers Envision Retirement II: Survey of Baby Boomers' Expectations for Retirement*, Prepared for AARP Environmental Analysis by Roper ASW, 2004.

<sup>31</sup> Putnam Investments, *Retirement Only a Breather: 7 Million Go Back to Work*. (Research conducted by Brightwork Partners, 2005).

<sup>32</sup> In prior work, we found that, although the majority of full-time workers age 55 or older indicate they would like to gradually reduce their work hours in transition to full retirement, many are constrained by health problems or perceive limited employment opportunities. See: GAO, *Older Workers: Labor Can Help Employers and Employees Plan Better for the Future*, [GAO-06-80](#) (Washington, D.C.: Dec. 5, 2005).

**Figure 7: Labor Force Participation Rates for Americans, Ages 55 and Older**



Source: U.S. Bureau of Labor Statistics.

### The Role of Housing, a Key Asset for Baby Boomers in Retirement Security, Continues to Evolve

Housing represents a large portion of most baby boomers' wealth and their management and use of this asset may have some effect on their decisions to sell assets in the financial markets. For a majority of boomers, the primary residence accounts for their largest source of wealth—outstripping DC pensions, personal savings, vehicles, and other nonfinancial assets. Home ownership rates among boomers exceed 75 percent, and recent years of appreciation in many housing markets have increased the net wealth of many boomers. This suggests that a price decline in housing, a prospect that many analysts appear to be concerned about, could have a much greater impact on the overall wealth of boomers than a financial market meltdown. While research has suggested that baby boomers have influenced housing demand and, in turn, prices, assessing the potential impact of the baby boom retirement on the housing market is beyond the scope of our work.

Interestingly, according to experts we interviewed, equity in the primary residence has not historically been viewed by retirees as a source of consumable wealth, except in the case of financial emergencies. Reverse mortgages, which do not require repayment until the owner moves from the residence or dies, could grow more attractive for financing portions of

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retirement spending, particularly for those baby boomers who are “house rich but cash poor” and have few other assets or sources of income.<sup>33</sup> For boomers who do own financial assets, an expansion of the reverse mortgage market might reduce their need to sell financial assets rapidly. However, boomers also appear to be carrying more debt than did previous generations. Our analysis of the SCF data shows that the mean debt-to-asset ratio for people aged 52 to 58 rose from 24.5 percent in 1992 to 70.9 percent in 2004.<sup>34</sup> To the extent that baby boomers continue to be willing to carry debt into retirement, they may require more income in retirement to make payments on this debt.

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## Researchers and Financial Industry Representatives Largely Foresee Little to No Impact on Financial Markets as the Baby Boomers Retire

Researchers and financial industry representatives largely expect the U.S. baby boom’s retirement to have little or no impact on the stock and bond markets. A wide range of studies, both simulation-based and empirical, either predicted a small, negative impact or found little to no association between the population’s age structure and the performance of financial markets. Financial industry representatives whom we interviewed also generally expect the baby boom retirement not to have a significant impact on financial asset returns because of the concentration of assets among a minority of boomers, the possibility of increased global demand for U.S. assets, and other reasons. Broadly consistent with the literature and views of financial industry representatives, our statistical analysis indicates that past changes in macroeconomic and financial factors have explained more of the variation in historical stock returns than demographic changes. Variables such as industrial production and dividends explained close to half of the variation in stock returns, but changes in the population’s age structure explained on average less than 6 percent. If the pattern holds, our findings indicate that such factors could outweigh any future demographic effect on stock returns.

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<sup>33</sup> Reverse mortgages allow those aged 62 and older to access equity in their homes through lump-sum payments, structured monthly payments, or lines of credit to the homeowner based on the value of the home. Once the borrower moves from the residence or dies, the principal, interest, and all fees immediately come due.

<sup>34</sup> The debt-to-value ratio measures total debt in relation to total assets. The percentage of debt to assets increases as a person takes on more debt relative to the underlying asset, such as a home or an automobile.

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## Academic Studies Largely Foresee Little to No Baby Boom Retirement Effect on the Financial Markets

With few exceptions, the academic studies we reviewed indicated that the retirement of U.S. baby boomers will have little to no effect on the financial markets. Studies that used models to simulate the market effects of a baby boom followed by a decline in the birth rate generally showed a small, negative effect on financial asset returns. Similarly, most of the empirical studies, which statistically examined the impact of past changes in the U.S. population's age structure on rates of return, suggested that the baby boom retirement will have a minimal, if any, effect on financial asset returns.<sup>35</sup>

## Simulation-Based Studies

Thirteen studies that we reviewed used models of the economy to simulate how a hypothetical baby boom followed by a baby bust would affect financial asset returns.<sup>36</sup> The simulation models generally found that such demographic shifts can affect returns through changes in the saving, investment, and workforce decisions made by the different generations over their lifetime. For example, baby boomers cause changes in the labor supply and aggregate saving as they progress through life, influencing the demand for assets and productivity of capital and, thus, the rates of return. Specifically, the models predicted that baby boomers cause financial asset returns to increase as they enter the labor force and save for retirement and then cause returns to decline as they enter retirement and spend their savings. According to a recent study surveying the literature, such simulation models suggest, on the whole, that U.S. baby boomers can expect to earn on their financial assets around half a percentage point less each year over their lifetime than the generation would have earned absent a baby boom.<sup>37</sup> In effect, for two investors—one of whom earns 7 percent and the other earns 6.5 percent annually over a 30-year period—the former

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<sup>35</sup> In the studies that we reviewed some researchers measured changes in the stock market based on annual price changes, while others used annual rates of return. The two measures are highly correlated, with rates of return taking into account dividends paid to shareholders as well as price changes. For bonds, some researchers measured changes in the market by annual prices changes, while others used yields or returns. Bond prices and yields are inversely related, with an increase in the price of a bond reducing its yield. When discussing the results of the individual studies, we used the market-performance measure used by the researchers.

<sup>36</sup> See appendix II for a list of the studies we reviewed.

<sup>37</sup> James M. Poterba, "Impact of Population Aging on Financial Markets in Developed Countries," *Economic Review* (Kansas City: Federal Reserve Bank of Kansas City, 2004).

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investor would earn \$6.61 for every dollar saved at the beginning of the period and latter investor would earn \$5.61 for every dollar saved.<sup>38</sup>

None of the simulation-based studies concluded that the U.S. baby boom retirement will precipitate a sudden and sharp decline in asset prices, and some studies presented their results in quantitative terms. One of the studies, for example, predicted that the baby boom's retirement would at worst lower stock prices below what they would otherwise be by roughly 16 percent over a 20-year period starting around 2012.<sup>39</sup> This decline, however, is equivalent to around 0.87 percent each year—somewhat small in comparison to real annual U.S. stock returns, which have averaged about 8.7 percent annually since 1948. The study therefore concluded that the size of the decline is much too small to justify the term “meltdown.” Moreover, another study predicted that baby boomers can expect the returns on their retirement savings to be about 1 percentage point below their current annual returns.<sup>40</sup> The study's lower returns reflect the decline in the productivity of capital that results from fewer workers being available (due to the baby boom retirement) to put the capital to productive use. A third study's results suggest that fluctuations in the size of the different generations induce substantial changes in equity prices, but the study does not conclude that the baby boom's retirement will lead to a sharp and sudden decline in asset prices.<sup>41</sup>

The simulation models we reviewed, by design, excluded or simplified some factors that were difficult to quantify or involved uncertainty that may cause the models to overstate the baby boom's impact on the

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<sup>38</sup> The proportional effect of a 0.5 percent decline in annual return would be smaller if the baseline level of the return was higher, but the absolute effect in terms of dollars would be larger.

<sup>39</sup> K. M. Lim and D. N. Weil, “The Baby Boom and the Stock Market Boom,” *Scandinavian Journal of Economics*, vol. 105, no. 3 (2003).

<sup>40</sup> The study concludes that baby boomers will be better off than their parents and children in terms of their lifetime consumption, because asset returns rise during their working years and because they have relatively fewer children, boosting their ability to save early on. Robin Brooks, “Asset-Market Effects of the Baby Boom and Social-Security Reform,” *American Economic Review*, vol. 92, no. 2 (2002).

<sup>41</sup> The study's simulation model predicted that demographic changes accounted for around half of the variation between the highest and lowest stock prices. John Geanakoplos, Michael Magill, and Martine Quinzii, “Demography and the Long-Run Predictability of the Stock Market,” *Cowles Foundation Paper No. 1099* (New Haven, Conn.: Cowles Foundation for Research in Economics, Yale University, 2004).

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### The Baby Boom Retirement and the Equity Premium

While some researchers and others suggest that the baby boom retirement will cause rates of return on financial assets to fall, some also suggest that the event will affect the equity premium, or difference in returns between risky and safe assets (such as between stocks and U.S. Treasury bonds). This effect is based on the belief that aging boomers will shift their portfolios from stocks to bonds, because they will tend to prefer safe assets since they will have less time weather potential price declines in risky assets. Several simulation models largely predicted that boomers will shift from stocks to bonds as they near and enter retirement, temporarily causing bond returns to decline relatively more than stock returns and resulting in a higher equity premium. In contrast, several empirical studies examining how demographic shifts have affected the equity premium generally did not find statistical evidence supporting the simulation models' predictions. Such findings are consistent with a gradual, as opposed to a sudden, shift from stocks to bonds, as exemplified by the asset allocation strategies provided by some "lifecycle" mutual funds and advised by some financial planners. Indeed, investment advisers and other financial service representatives that we interviewed emphasized that retired boomers should continue to hold some of their savings in stocks to hedge inflation and the risk of outliving their savings. Likewise, our analysis of national survey data also shows that current retirees remain significantly invested in stocks.

Source: GAO.

markets. For example, some models assumed that baby boomers will sell their assets solely to a relatively smaller generation of U.S. investors when they retire. Some researchers have noted that if China and India were to continue their rapid economic growth, they may spur demand for the assets that baby boomers will sell in retirement.<sup>42</sup> Supporting this view, other research suggests that global factors may be more important than domestic factors in explaining stock returns in developed countries.<sup>43</sup> Some models assumed that individuals in the same generation enter the labor force at the same time, work a fixed amount, and retire at the same time. In reality, some may work full or part-time after reaching retirement age.<sup>44</sup> Likewise, the baby boomers' children, rather than working a fixed amount, may delay their entry into the labor force and take advantage of job opportunities created by retiring baby boomers. These factors could dampen the effect of the baby boomer retirement on the markets.<sup>45</sup> A few of the models neglect that some investors may be forward-looking and anticipate the potential effect of the aging baby boomers on the markets. To the extent that such investors do so, current financial asset prices would reflect, at least partially, the future effect of the baby boom's retirement and thus dampen the event's effect on asset prices when it actually occurs.<sup>46</sup> Finally, the models typically do not include a significant

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<sup>42</sup> A study exploring the implications of the assumption found that financial asset returns in Germany would fall by about 1.4 percentage points if baby boomers were only allowed to buy and sell assets domestically, but would fall by about 1 percentage point if the country's economy were open to international financial flows. See Axel Börsch-Supan, "Global Aging: Issues, Answers, More Questions," *Working Paper WP 2004-084*, University of Michigan Retirement Research Center (2004).

<sup>43</sup> Swee Sum Lam and William Wee-Lian Ang "Globalization and Stock Market Returns," *Global Economy Journal*, vol. 6, no. 1 (2006).

<sup>44</sup> For example, a recent study estimated based on a survey that about 7 million previously retired U.S. individuals have returned to work for pay, representing almost one-third of the retirees. See Brightwork Partners, LLC, *The Working Retired*, a study prepared for Putnam Investments (Boston: 2005).

<sup>45</sup> See, for example, Monika Büttler and Philipp Harms, "Old Folks and Spoiled Brats: Why the Baby-Boomers' Savings Crisis Need Not Be That Bad," *Discussion Paper No. 2001-42*, CentER (2001). The researchers found that the effect of a baby boom on asset prices could be dampened, in part by the early retirement of baby-boom parents and the late entry of the baby-boom children into the labor force.

<sup>46</sup> Although the extent to which investors are forward-looking is an important factor in determining the current and future impact of demographic change on financial asset prices, the degree of foresight is open to question. See, for example, Stefano DellaVigna and Joshua M. Pollet, *Attention, Demographics, and the Stock Market* (Department of Economics, University of California, Berkeley: 2003 mimeographed).

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increase in immigration, but such an outcome would increase the labor force and be expected to raise the productivity of capital and, thus, the return on financial assets.<sup>47</sup>

## Empirical Studies

Seven empirical studies of the U.S. financial markets we reviewed suggested, on average, that the retirement of U.S. baby boomers will have a minimal, if any, impact on financial asset returns.<sup>48</sup> These studies specifically tested whether changes in the U.S. population's age structure have affected stock returns or bond yields or both over different periods, ranging from 1910 to 2003. These studies focused primarily on changes in the size of the U.S. middle age population (roughly age 40 to 64) or its proportion to other age segments of the population. People in this age group are presumably in their peak earning and saving years and, thus, expected to have the most significant impact on financial asset returns.

These empirical studies are inherently retrospective. Therefore, care must be taken in drawing conclusions about a future relationship between demographics and asset performance, especially given that the historical data do not feature an increase in the retired population of the magnitude that will occur when the U.S. baby boomers retire. However, the significant shift in the structure of the population that occurred as the boomers entered the labor force and later their peak earning years should provide an indication of how demographic change influences financial asset returns.

For stocks, four of the seven studies found statistical evidence implying that the past increases in the relative size of the U.S. middle age population have increased stock returns.<sup>49</sup> This finding supports the

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<sup>47</sup> The overall impact of immigration becomes more ambiguous when considering the federal government's budget. Immigration will boost tax revenues but also can increase outlays for transfer programs related to health, education, and welfare if the immigrating cohort is less-skilled. See, for example, Ronald Lee and Timothy Miller, "Immigration, Social Security, and Broader Fiscal Impacts," *The American Economic Review*, vol. 90, no. 2 (2000).

<sup>48</sup> See appendix II for a list of the studies that we reviewed.

<sup>49</sup> See, Steven M. Bergantino, "Life Cycle Investment Behavior, Demographics, and Asset Prices," (Ph.D diss., Massachusetts Institute of Technology, 1998); Robin J. Brooks, "Asset Market and Savings Effects of Demographic Transitions" (Ph.D diss., Yale University, 1998); E. Phillip Davis and Christine Li, "Demographics and Financial Asset Prices in the Major Industrial Economies," *Working Paper* (Brunel University, West London: 2003); and Geanakoplos, Magill, and Quinzii (2004).

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simulation-model predictions that a relative decrease in the middle age population—as is expected to occur when baby boomers begin to retire—will lower stock returns. In contrast, two of the studies found little evidence that past changes in the U.S. middle age population have had any measurable effect on stock returns.<sup>50</sup> Finally, the remaining study found evidence implying that a relative decrease in the U.S. middle age population in the future would increase, rather than decrease, stock returns.<sup>51</sup>

For the four studies whose statistical results implied that the baby boom retirement will cause stock returns to decline, we determined that the magnitude of their demographic effect, on balance, was relatively small. Using U.S. Census Bureau data, we extrapolated from three of the four studies' results to estimate the average annual change in returns of the Standard and Poor's (S&P) 500 Index that the studies would have attributed to demographic changes from 1986 to 2004. During this period, baby boomers first began to turn age 40 and the proportion of individuals age 40 to 64 went from about 24.5 percent of the population to about 32 percent.<sup>52</sup> We found two of the studies' results show that the increase in the middle age population from 1986 to 2004 led stock returns, on average, to increase by 0.19 and 0.10 percentage points each year, respectively. We found that the third study's results showed a much larger average annual increase of about 6.7 percentage points from 1986 to 2004. To put these three estimates into context, the average annual real return of the S&P 500 Index during this period was around 10 percent. The last estimate,

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<sup>50</sup> Peter S. Yoo, "Age Distributions and Returns of Financial Assets," *Working Paper 1994-002A* (St. Louis: Federal Reserve Bank of St. Louis, 1994), and James M. Poterba, "The Impact of Population Aging on Financial Markets," *Working Paper No. 10851* (Cambridge, Mass.: National Bureau of Economic Research, 2004).

<sup>51</sup> Diane Macunovich, "Discussion of Social Security: How Social and Secure Should It Be?," *Social Security Reform: Links to Saving, Investment, and Growth*, Steven Sass and Robert Triest, eds. (Boston: Federal Reserve Bank of Boston, 1997). While the study found evidence that a decrease in the 45-year olds increased stock returns, it also found evidence that an increase in the 66-year old population reduced stock returns, leaving the aggregate effect of the baby boom retirement on stock returns unclear.

<sup>52</sup> We arrived at our estimates in several stages. First, we used U.S. Census Bureau data to calculate the demographic variables in each study from 1948 to 2004. Second, we multiplied the demographic regression coefficients in each study by their appropriate demographic variables for the period from 1948 to 2004. Third, to estimate the relative impact of the baby boomers on stock returns from 1986 to 2004, we subtracted the average annual impact on stock returns from 1948 to 1985 (a period of relative stability in the middle age population) from the average annual impact on stock returns from 1986 to 2004 (a period of rapid growth in the middle age population).

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however, may exaggerate the probable impact of the baby boom retirement on stock returns.<sup>53</sup> The fourth study's methodology did not allow us to use U.S. census data to estimate the effect of its results on stock returns from 1986 to 2004. Nonetheless, the study estimated that demographically driven changes in the demand for stocks can account for about 77 percent of the annual increase in real stock prices between 1986 and 1997 and predicted that stock prices will begin to fall around 2015 as a result of falling demographic demand.

Besides testing for the effect of demographic shifts on stock returns, five of the seven studies included bonds in their analyses and largely found that the baby boom retirement will have a small effect or no effect on bond yields. Three studies found statistical evidence indicating that the past increase in the relative size of the U.S. middle age population reduced long-term bond yields. In turn, the finding suggests that the projected decrease in the middle age population in the future would raise yields. Extrapolating the results of one study, we find its estimates imply that the increase in the U.S. middle age population from 1986 to 2004 reduced long-term bond yields by about 0.42 percentage points each year, compared to actual real yields that averaged 3.41 percent over the same time period. The other two studies tested how the demographic shift affected long-term bond prices rather than yields, but an increase in prices would, in effect, reduce yields.<sup>54</sup> We found that the results of one of the studies showed that the demographic shift from 1986 to 2004 raised bond prices by only about 0.05 percentage points each year. The other study's methodology did not allow us to estimate the effect, but the study estimated that demographically driven changes in the demand for bonds can account for at least 81 percent of the annual increase in real bond prices between 1986

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<sup>53</sup> In their simulation-based model, the researchers used as their demographic variable the ratio of the U.S. population age 40 to 59 to the U.S. population age 20 to 39. In their empirical analyses, they modified their demographic variable, in our view, without an economic rationale to capture more of the variation in stock returns, switching to the ratio of the population age 40 to 49 to the population age 20 to 29. By choosing the demographic variable purely on the basis of statistical association, the change likely biased their estimated effect upward. Also, the study's demographic variable is projected to fluctuate much less in the future, suggesting that upcoming demographic changes will have less of an impact on stock returns. A researcher estimated that the projected changes in the study's demographic variable from 2000 to 2050 would result in a 0.60 percentage point decline in annual real returns.

<sup>54</sup> The interest payment a borrower makes on a bond is typically fixed, so an increase in the bond's price reduces the fixed payment as a proportion of the bond's price and, thus, reduces the bond's yield.

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and 1997 and predicted that bond prices will begin to fall around 2015 as a result of falling demographic demand. In contrast to these studies, two studies found little statistical evidence to indicate that past changes in the middle age population have had any measurable effect on long-term bond returns.<sup>55</sup>

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### Financial Industry Representatives Do Not Expect Baby Boom Retirement to Have a Significant Financial Market Impact

The financial industry representatives with whom we met generally told us that they do not expect U.S. baby boomers to have a significant impact on the financial markets when they retire. They cited a number of factors that could mitigate a baby boom induced market decline, many of which we discussed earlier.<sup>56</sup> For example, some mentioned the concentration of assets among a minority of households, the long time span over which boomers will be retiring, and the possibility for many boomers to continue working past traditional retirement ages. Some also noted that baby boomers will continue to need to hold stocks well into retirement to hedge inflation and to earn a higher rate of return to hedge the risk of outliving their savings, reducing the likelihood of a sharp sell-off of stock. A number of representatives cited developments that could increase the demand for U.S. assets in the future, such as the continued economic growth of developing countries and an increase in immigration. Finally, several commented that interest rates, business cycles, and other factors that have played the primary role in influencing financial asset returns are likely to overwhelm any future demographic effect from changes in the labor force or life cycle savings behavior.

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<sup>55</sup> These studies, however, found statistical evidence suggesting that the past increase in the middle age population has decreased returns on “Treasury bills,” or short-term bonds. This finding suggests that the projected decrease in the middle age population will increase Treasury bill returns.

<sup>56</sup> While it may not be in the interest of the financial industry to make alarming projections about the baby boom retirement, mutual fund companies and broker-dealers we interviewed offer stock funds, bond funds, annuities, and international stock funds. As a result, they have a broad range of products to offer workers and retirees in the event that they become concerned about the risks of a particular asset class or country.

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## Broad Economic Factors Will Likely Have a Greater Impact on Financial Markets Than Will Demographics

Our statistical analysis indicates that macroeconomic and financial factors explain more of the variation in historical stock returns than population shifts and suggests that such factors could outweigh any future demographic effect on stock returns. In addition, factors not captured by our model were also larger sources of stock return variation than the demographic variables we selected. We undertook our own statistical analysis, because many of the empirical studies we reviewed either did not include relevant variables that influence stock returns in their models or included them but did not discuss the importance of these variables relative to the demographic variables.<sup>57</sup> To broaden the analysis, we developed a statistical model of stock returns based on the S&P 500 Index to compare the effects of changes in demographic, macroeconomic, and financial variables on returns from 1948 to 2004.<sup>58</sup> As shown in figure 8, fluctuations in the macroeconomic and financial variables that we selected collectively explain about 47 percent of the variation in stock returns over the period. These variables are the growth rate of industrial production,<sup>59</sup> the dividend yield, the difference between interest rates on long- and short-term bonds, and the difference between interest rates on risky and safe corporate bonds—all found in previous studies to be significant determinants of stock returns. These variables are likely to contain information about current or future corporate profits. In contrast, our four demographic variables explained only between 1 percent and 8 percent of the variation in the annual stock returns over the period. These variables were based on population measures found to be statistically significant in the empirical studies we reviewed: the proportion of the U.S. population age 40 to 64, the ratio of the population age 40 to 49 to the population age 20 to 29, and annual changes in the two. Note, however, that almost half of the variation in stock returns was explained by neither the macroeconomic and financial variables nor the demographic factors we tested, a finding that is comparable to similar studies. Hence, some determinants of stock returns remain unknown or difficult to quantify.

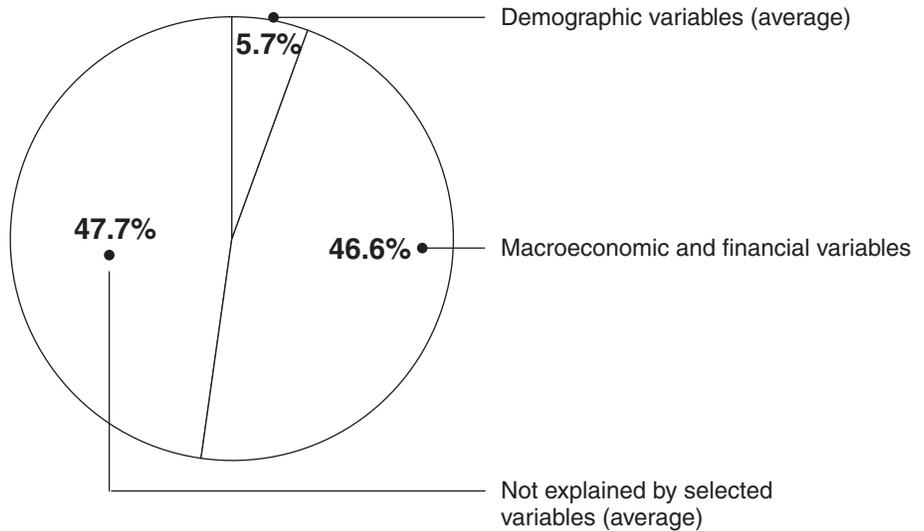
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<sup>57</sup> These studies include, for example, Geanakoplos, Magill, and Quinzii (2004), Poterba (2004), and Davis and Li (2003).

<sup>58</sup> See appendix IV for a complete description of our statistical model and results.

<sup>59</sup> Industrial production is the output of U.S. manufactured goods, mines, and utilities. Its growth rate is highly correlated with gross domestic product, a broader measure of the economy's output. While labor force growth should influence growth of the overall economy, including industrial production, we believe that the significance of industrial production in our model is driven primarily by changes in industrial production related to business cycle fluctuations.

**Figure 8: Sources of Stock Market Return Variation**



Source: GAO analysis of S&P 500 returns, 1948-2004.

The statistical model shows that financial markets are subject to a considerable amount of uncertainty and are affected by a multitude of known and unknown factors. However, of those known factors, the majority of the explanatory power stems from developments other than domestic demographic change. Simply put, demographic variables do not vary enough from year to year to explain the stock market ups and downs seen in the data. This makes it unlikely that demographic changes, alone, could induce a sudden and sharp change in stock prices, but leaves open the possibility for such changes to lead to a sustained reduction in returns. At the same time, fluctuations in dividends and industrial production, which are much more variable than demographic changes, may obscure any demographic effect in future stock market performance. For example, a large recession or a significant reduction in dividends would have a negative effect on annual returns that would likely overwhelm any reduction in returns resulting from the baby boom retirement. Conversely, an unanticipated increase in productivity or economic growth would be expected to increase returns substantially and likely dwarf the effect of year-over-year changes in the relative size of the retired population.

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## Baby Boomers and Future Generations Likely to Increasingly Rely on Their Own Savings, Placing Greater Importance on Rates of Return and Financial Management Skills

While the baby boom retirement is not likely to cause a sharp decline in asset prices or returns, the retirement security of boomers and future generations will likely depend increasingly on individual saving and rates of return as guaranteed sources of income become less available. This reflects the decline of coverage by traditional DB pension plans, which typically pay a regular income throughout retirement, and the rise of account-based DC plans. Uncertainties about the future level of Social Security benefits, including the possible replacement of some defined benefits by private accounts, and the projected increases in medical and long-term care costs add to the trend toward individuals taking on more responsibility and risk for their retirement. All of these developments magnify the importance of achieving rates of return on savings high enough to produce sufficient income for a secure retirement. In this environment, individuals will need to become more educated about financial issues, both in accumulating sufficient assets as well as learning to draw them down effectively during a potentially long retirement.

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## As Baby Boomers Retire, Fewer May Receive Income from Traditional Pensions

Changes in pension design will require many baby boomers and others to take greater responsibility in providing for their retirement income, increasing the importance of rates of return for them. The past few decades have witnessed a dramatic shift from DB plans to DC plans. From 1985 to 2004, the number of private sector DB plans has shrunk from about 114,000 to 31,000. From 1985 to 2002 (the latest year for which complete data are available), the number of DC plans almost doubled, increasing from 346,000 to 686,000. Furthermore, the percentage of full-time employees participating in a DB plan (at medium and large firms) declined from 80 to 33 percent from 1985 to 2003, while DC coverage increased from 41 to 51 percent over the period.<sup>60</sup> The shift in pension design has affected many boomers. According to the 2004 SCF, about 50 percent of people older than the baby boomers reported receiving benefits from a DB plan, but fewer than 44 percent of baby boomers have such coverage. However, within the baby boom generation, there is a noticeable difference: 46 percent of older boomers (born between 1946 and 1955) reported having a DB plan, while only 39 percent of young boomers (born

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<sup>60</sup> Participation in DB plans is typically much higher in the public sector. For 1998, the latest year for which data are available, 90 percent of state and local government workers participated in a DB plan.

between 1956 and 1964) had a DB plan (see table 1).<sup>61</sup> According to the SCF, the percentage of households age 35 to 44 with a DC plan increased from 18 percent in 1992 to 42 percent in 2001.

**Table 1: Pension Coverage by Plan Design, 2004, as Percentage of Birth Cohort**

Birth years	DB plan only	DC plan only	Both DB and DC
1956-1964	16.8	21.6	22.1
1946-1955	23.5	18.6	22.2
1936-1945	34.1	10.7	16.5

Source: GAO Analysis of 2004 SCF.

The shift from DB to DC plans places greater financial management responsibility on a growing number of baby boomers and makes their retirement savings more dependent on financial market performance. Unlike DB plans, DC plans do not promise a specified benefit for life. Rather, DC plan benefits depend on the amount of contributions, if any, made to the DC plan by the employee and the employer, and the returns earned on assets held in the plan. Because there is no guaranteed benefit, the responsibility to manage these assets and the risk of having insufficient pension benefits at retirement falls on the individual. Similar to DB plans, some DC plans offer their participants the option of converting their balance into an annuity upon retirement, but DC plan participants typically take or keep their benefits in lump-sum format.<sup>62</sup>

Small changes in average rates of return can affect the amount accumulated by retirement and income generated during retirement. For example, if a boomer saved \$500 each year from 1964 until retirement in 2008 and earned 8 percent each year, he or she would accumulate almost \$209,000 at retirement. The same worker earning 7 percent each year over the same period would accumulate only \$153,000 at retirement, a

<sup>61</sup> While this trend may partially reflect that older workers are more likely to have pension coverage than younger workers, the shrinking of DB plans and the aging of its participant pool are well-established and likely to continue.

<sup>62</sup> One study by the Investment Company Institute found that 32 percent of DC participants chose an annuity upon taking benefits. See Investment Company Institute, *Defined Contribution Plan Distribution Choices at Retirement: A Survey of Employees Retiring Between 1995 and 2000* (Washington, D.C.: Fall 2000). A 2003 GAO study found a much lower incidence, with fewer than 10 percent of DC participants choosing to annuitize upon retirement (see [GAO-03-810](#)). As of 2000, about 38 percent of DC plans offered the option of receiving benefits as an annuity.

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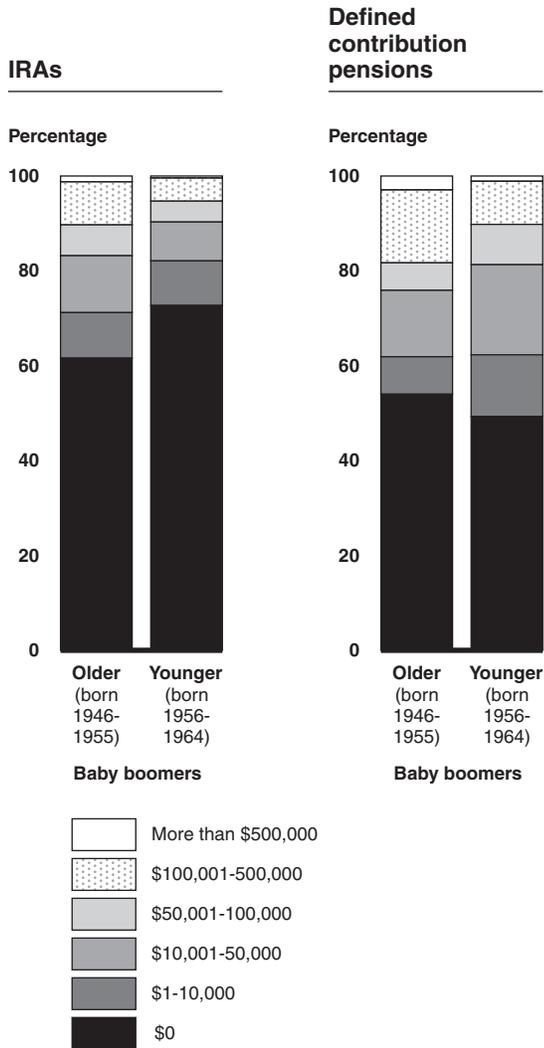
difference in total saving of 27 percent. Moreover, rates of return can have a similar affect on retirement income. With \$209,000 at retirement, the retiree could spend \$19,683 each year for 20 years if he or she continued to earn 8 percent each year in retirement. If the annual rate of return dropped one percentage point to 7 percent, the same amount of retirement savings would generate only about \$18,412 each year for 20 years, a difference of 6.5 percent in annual retirement income. Retirees depending on converting savings to income are particularly dependent on rates of return, since they may have limited employment options. Similarly, workers nearing retirement may be more affected by fluctuations in rates of return than younger workers, who would have more working years to make up any declines or losses.

Although DC plans place greater responsibility on individuals for their retirement security, statistics indicate that so far at least some have yet to fully accept it. First, many workers who are covered by a DC plan do not participate in the plan. Recent data indicate that only about 78 percent of workers covered by a DC plan actually participate in the plan. Second, even among baby boom participants, many have not saved much in these accounts. Figure 9 shows the percentage of boomers with account balances in their DC pensions and IRAs, which are personal accounts where individuals can accumulate retirement savings. Over one-half of households headed by someone born from 1946 to 1955 did not have a DC pension; for those that did have a DC pension, their median balance was \$58,490, an amount that would generate just a \$438 monthly annuity starting at age 65. Similarly, only 38 percent reported having an IRA, and the median IRA balance among those participating was only \$37,000, an amount that would generate a monthly annuity of only \$277.<sup>63</sup>

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<sup>63</sup> We calculated annuity equivalents using the annuity calculator from the Thrift Savings Plan ([www.tsp.gov](http://www.tsp.gov)), assuming an interest rate of 5.5 percent, single life benefits beginning at age 65, no joint survivor benefits, and level payments.

**Figure 9: Individual Retirement Account and Defined Contribution Pension Balances for Older and Younger Baby Boomers, 2003**



Source: GAO analysis of 2004 Survey of Consumer Finances.

These statistics may not provide a complete picture for some individuals and households, since those with a small DC plan account balance also may have a DB plan and thus may not have the same need to contribute to their account. However, EBRI found that, as of 2004, median savings in 401(k) accounts, a type of DC plan, were higher for every age group up to age 64 for those with a DB plan than those with only a 401(k). Also, the median balances for those with only 401(k) plans may not be enough to

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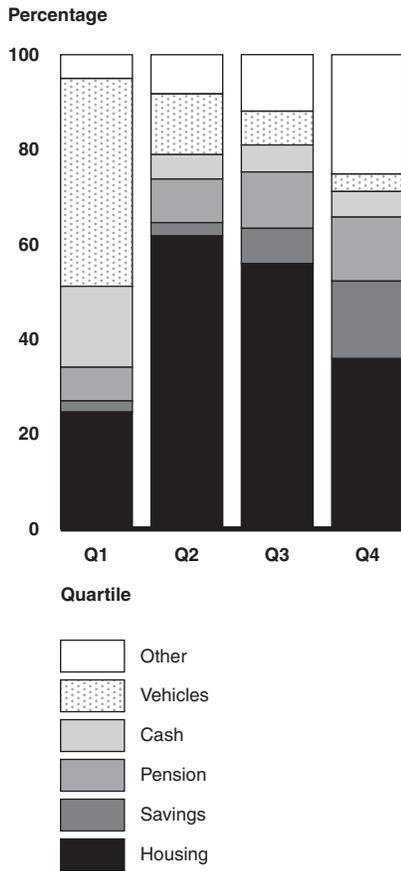
support them in retirement. For families with the head of family age 55 to 64 in 2004 with only a 401(k), EBRI estimated that their median balance was \$50,000; for those age 45 to 54, the median was \$40,000. While many in these age groups could continue to work for several years before reaching retirement age, without substantially higher savings, these households may be primarily dependent on income from Social Security during retirement.

Extending our analysis of the allocation of baby boomer assets generally reveals that financial assets are, in general, a small portion of boomers' asset portfolios. Among all boomers, housing is the largest asset for the majority of households, with vehicles making up the second largest portion of wealth. Figure 10 shows the allocation of baby boomer assets among housing, cash, savings, pensions, vehicles, and other assets.<sup>64</sup> Not including the top quartile by wealth, savings and pensions, the portions of wealth that are invested in stocks and bonds are a small portion of overall wealth, constituting no more than 20 percent of total gross assets per household. Among the bottom two quartiles by wealth, on average boomers have more of their wealth invested in their personal vehicle (automobile or truck), which depreciates over time, than in either savings or pensions, assets that generally appreciate over time. Overall, the finding that most boomers do not hold a significant amount of financial assets, measured both by account balance and by percentage of total assets, mitigates this generation's potential effect on the asset markets as boomers retire and highlights the fact that many boomers may enter retirement without adequate personal savings.

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<sup>64</sup> Cash consists of assets in checking, savings, and money market accounts, certificates of deposit, and U.S. Savings Bonds. Savings consists of assets held outside of an employer-sponsored retirement plan and invested in IRAs, Keogh plans, mutual funds, annuities, trusts, managed accounts, and publicly traded stocks and bonds. Pensions consist of assets held in an employer sponsored account type pension plan, such as a 401(k) or 403(b) plan; defined benefit pensions are not included. Other assets not falling within the categories defined above include business and investment real estate interests, collectibles of value, and jewelry.

**Figure 10: Allocation of Assets of Baby Boomers, by Wealth Quartiles**



Source: GAO analysis of 2004 Survey of Consumer Finances.

Note: Q1 refers to the bottom 25 percent of the population by wealth, while Q4 refers to the top 25 percent of the population by wealth.

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## Financial Stress on Social Security, Medicare, and Health Expenditures May Create Uncertainties for Some Baby Boomers and Future Generations

The uncertainties surrounding the future financial status of Social Security, the program which provides the foundation of retirement income for most retirees, also presents risks to baby boomers' retirement security.<sup>65</sup> These benefits are particularly valuable because they provide a regular monthly income, adjusted each year for inflation, to the recipient and his survivors until death. Thus, Social Security benefits provide some insurance against outliving one's savings and against inflation eroding the purchasing power of a retiree's income and savings. Such benefits provide a unique retirement income source for many American households.

Social Security, however, faces long-term structural financing challenges that, if unaddressed, could lead to the exhaustion of its trust funds. According to the intermediate assumption projections of Social Security's 2006 Board of Trustees' Report, annual Social Security payouts will begin to exceed payroll taxes by 2017, and the Social Security trust fund is projected to be exhausted in 2040. Under these projections, without counterbalancing changes to benefits or taxes, tax income would be enough to pay only 74 percent of currently scheduled benefits as of 2040, with additional, smaller benefit reductions in subsequent years.

These uncertainties are paralleled, if not more pronounced, with Medicare, the primary social insurance program that provides health insurance to Americans over age 65. Medicare also faces very large long-term financial deficits. According to the 2006 Trustees report, the Hospital Insurance Trust Fund is projected to exhaust itself by 2018. The challenges stem from concurrent demographic trends—people are living longer, spending more years in retirement, and have had fewer children—and from costs for health care rising faster than growth in the gross domestic product. These changes increase benefits paid to retirees and reduce the number of people, relative to previous generations, available to pay to support these benefits.

These financial imbalances have important implications for future retirees' retirement security. While future changes to either program are uncertain, addressing the financial challenges facing Social Security and Medicare may require retirees to receive reduced benefits, relative to scheduled future benefits, while workers might face higher taxes to finance current

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<sup>65</sup> According to the 2004 SCF, about half of retirees receive at least half of their income from Social Security. For those in the lowest 60 percent of the income distribution, these benefits make up over three-quarters of their total income. For all retirees, Social Security accounts for about 40 percent of their total retirement income. See [GAO-05-193SP](#).

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benefits. In addition, some proposals to reform Social Security incorporate a system of individual accounts into the current program that would reduce scheduled benefits under the current system, perhaps with protections for retirees, older workers, and low-wage workers, and make up for those reductions to some degree with income from the individual accounts.<sup>66</sup> Like DC plans generally, these accounts would give the individual not only the prospect for higher rates of return but also the risk of loss, placing additional responsibility and risk on individuals to provide for their own retirement security. Similarly, tax-preferred health savings accounts are a type of personal account to allow enrollees to pay for certain health-related expenditures.

The worsening budget deficits that are expected to result if fiscal imbalances in Social Security and Medicare are not addressed could have important effects on the macroeconomy. By increasing the demand for credit, federal deficits tend to raise interest rates, which are mitigated to the extent that foreign savings flow into the United States to supplement scarce domestic savings. If foreigners do not fully finance growing budget deficits, upward pressure on interest rates can reduce domestic investment in productive capacity. All else equal, these higher borrowing costs could discourage new investment and reduce the value of capital already owned by firms, which should be reflected in reduced stock prices as well.

The fiscal challenges facing Medicare underscore the issue of rising retiree health costs generally. Rising health care costs have made health insurance and anticipated medical expenses increasingly important issues for older Americans. Although the long-term decline in the percentage of employers offering retiree health coverage has appeared to have leveled off in recent years, retirees continue to face an increasing share of costs, eligibility restrictions, and benefit changes that contribute to an overall erosion in the value and availability of coverage. A recent study estimated

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<sup>66</sup> Individual accounts would also try to increase revenues, in effect, by providing the potential for higher rates of return on account investments than the trust funds would earn under the current system, but this exposes workers to a greater degree of risk. Some proposals would create individual accounts without reducing promised benefits or increasing payroll taxes, relying instead on compensating decreased government spending, increased revenues, or increased borrowing from the public. Note that individual accounts would generally not by themselves achieve solvency for the Social Security system. Achieving solvency requires more revenue, lower benefits, or both. See GAO, Social Security Reform: Considerations for Individual Account Design, [GAO-05-847T](#) (Washington, D.C.: June 23, 2005).

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that the percentage of after-tax income spent on health care will almost double for older individuals by 2030 and that after taxes and health care spending incomes may be no higher in 2030 than in 2000 for a typical older married couple. People with lower incomes will be the most adversely affected. The study projected that by 2030, those in the bottom 20 percent of the income distribution would spend more than 50 percent of their after-tax income on insurance premiums and out-of-pocket health care expenses, an increase of 30 percentage points from 2000.<sup>67</sup> The costs of healthcare in retirement, especially long-term and end-of-life care, are a large source of uncertainty for baby boomers in planning their retirement financing, as typical private and public insurance generally does not cover these services. Nursing home and long-term care are generally not covered under Medicare but by Medicaid, which is the program that provides health insurance for low-income Americans. Medicaid eligibility varies from state to state, but generally requires that a patient expend most of their financial assets before they can be deemed eligible for benefits. Most private long-term care insurance policies pay for nursing home and at-home care services, but these benefits may be limited, and few elderly actually purchase this type of coverage, with a little over 9 million policies purchased in the United States by 2002. Thus, health care costs may cause some baby boomers without long-term care insurance to rapidly spend retirement savings.

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### Baby Boomers and Future Generations May Increasingly Rely on Their Own Investment Decisions, Highlighting Importance of Financial Literacy

With more individuals being asked to take responsibility for saving for their own retirement in a DC pension plan or IRA, financial literacy and skills are becoming increasingly important in helping to ensure that retirees can enjoy a comfortable standard of living. However, studies have found that many individuals have low financial literacy.<sup>68</sup> A recent study of HRS respondents over age 50 found that only half could answer two simple questions regarding compound interest and inflation correctly, and one-third could answer these two questions and another on risk diversification correctly. Other research by AARP of consumers age 45 and

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<sup>67</sup> See Richard W. Johnson and Rudolph G. Penner, "Will Health Care Costs Erode Retirement Security?" *Issue in Brief* (Boston: Center for Retirement Research at Boston College, 2004, No. 23.)

<sup>68</sup> GAO, *Highlights of a GAO Forum: The Federal Government's Role in Improving Financial Literacy*, [GAO-05-93SP](#) (Washington, D.C.: Nov. 15, 2004). At this forum, experts suggested that the federal government should not make financial literacy a national priority but should play a supportive role, given that a wide array of state, local, nonprofit, and private organizations provide financial education.

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older found that they often lacked knowledge of basic financial and investment terms. Similarly, a survey of high school students found that they answered questions on basic personal finance correctly only about half of the time.

Baby boomers approaching retirement and fortunate enough to have savings may still face risks from failing to diversify their stock holdings. In one recent survey, participants perceived a lower level of risk for their company stock than for domestic, diversified stock funds.<sup>69</sup> However, investors are more likely to lose their principal when investing in a single stock as opposed to a diversified portfolio of stocks, because below average performance by one firm may be offset by above average performance by the others in the portfolio. In addition, holding stock issued by one's employer in a pension account is even more risky because if the company has poor financial performance, it could result in both the stock losing value and the person losing his job. One consequence of this poor financial literacy may be investors holding a substantial part of their retirement portfolio in employer stock. EBRI reported that the average 401(k) investor age 40 to 49 had 15.4 percent of her portfolio in company stock in 2004; the average investor in his 60's still had 12.6 percent of her assets in company stock.<sup>70</sup> Perhaps of greater concern, the Vanguard Group found that, among plans actively offering company stock, 15 percent of participants had more than 80 percent of their account balance in company stock in 2004.<sup>71</sup>

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## Concluding Observations

Our findings largely suggest that baby boomers' retirement is unlikely to have a dramatic impact on financial asset prices. However, there appear to be other significant retirement risks facing the baby boom and future generations. The long-term financial weaknesses of Social Security and Medicare, coupled with the uncertain future policy changes to these programs' benefits, and the continued decline of the traditional DB pension system indicate a shift toward individual responsibility for

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<sup>69</sup> See John Hancock Financial Services, *Defined Contribution Plan Survey: Insight into Participant Investment Knowledge and Behavior*, 2002.

<sup>70</sup> Sarah Holden and Jack VanDerhei, "401(k) Plan Asset Allocation, Account Balances, and Loan Activity in 2004," *EBRI Issue Brief #285* (September 2005).

<sup>71</sup> This figure includes only those plans in which Vanguard serves as the manager. Vanguard Corporation, *How America Saves 2005: A Report on Vanguard 2004 Defined Contribution Plan Data* (Valley Forge, Penn.: October 2005).

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retirement. These trends mean that rates of return will play an increasingly important role in individuals' retirement security. For those with sufficient income streams, this new responsibility for retirement will entail a lifetime of financial management decisions—from saving enough to managing such savings to generate an adequate stream of income during retirement, the success of which will directly or indirectly be dependent on rates of return. Given the potential impact of even a modest decline in returns over the long run on savings and income, market volatility, and uncertainties about pensions, Social Security, and Medicare, the onset of the baby boom retirement poses many questions for future retirement security.

The performance of financial and other asset markets provides just one source of risk that will affect the retirement income security of baby boomers and ensuing generations. For those with financial assets, choices they make about investments play a critical role not just in having adequate savings at retirement but also in making sure their wealth lasts throughout retirement. That Americans are being asked to assume more responsibility for their retirement security highlights the importance of financial literacy, including basic financial concepts, investment knowledge, retirement age determination, and asset management in retirement. Government policy can help, policies that encourage individuals to save more and work longer (for those who are able) and that promote greater education about investing and retirement planning that can help ensure higher and more stable retirement incomes in the future.

Although individual choices about saving and working will continue to play a primary role in determining retirement security, the high percentage of boomers who have virtually no savings, assets, or pensions will face greater difficulties in responding to the new retirement challenges. For this group, the federal government will play an especially key role in retirement security through its retirement and fiscal policies. The challenges facing Social Security and Medicare are large and will only grow as our population ages. Legislative reforms to place Social Security and Medicare on a path towards sustainable long-term solvency would not only reduce uncertainty about retiree benefits, particularly for those Americans who own few or no assets, but also help address the federal government's long-term budget imbalances that could affect the economy and asset markets. Ultimately, retirement security depends on how much society and workers are willing to set aside for savings and retirement benefits and on the distribution of retirement risks and responsibilities among government, employers, and individuals. One of Congress's greatest challenges will be to balance this distribution in a manner that

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achieves a national consensus and helps Americans keep the promise of adequate retirement security alive in the 21st century.

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## Agency Comments

We provided a draft of this report to the Department of Labor, the Department of the Treasury, the Department of Housing and Urban Development, and the Social Security Administration, as well as several outside reviewers, including one from the Board of Governors of the Federal Reserve System. Labor, Treasury, and SSA and the outside reviewers provided technical comments, which we incorporated as appropriate. We are sending copies of this report to the Secretary of Labor, the Secretary of the Treasury, the Secretary of the Housing and Urban Development Department, and the Commissioner of the Social Security Administration, appropriate congressional committees, and other interested parties. We will also make copies available to others on request. In addition, the report will be available at no charge on GAO's Web site at <http://www.gao.gov>.

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If you have any questions concerning this report, please contact Barbara Bovbjerg at (202) 512-7215 or George Scott at (202) 512-5932. Contact points for our Office of Congressional Relations and Public Affairs may be found on the last page of this report. GAO staff who made contributions are listed in appendix VI.



Barbara D. Bovbjerg, Director  
Education, Workforce, and Income Security Issues



George A. Scott, Acting Director  
Financial Markets and Community Investment Issues

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*List of Congressional Committees*

The Honorable Richard C. Shelby  
Chairman  
The Honorable Paul S. Sarbanes  
Ranking Minority Member  
Committee on Banking, Housing, and Urban Affairs  
United States Senate

The Honorable Charles E. Grassley  
Chairman  
The Honorable Max Baucus  
Ranking Minority Member  
Committee on Finance  
United States Senate

The Honorable Susan M. Collins  
Chairman  
The Honorable Joseph I. Lieberman  
Ranking Minority Member  
Committee on Homeland Security and Governmental Affairs  
United States Senate

The Honorable Gordon H. Smith  
Chairman  
The Honorable Herb Kohl  
Ranking Minority Member  
Special Committee on Aging  
United States Senate

The Honorable George Miller  
Ranking Minority Member  
Committee on Education and the Workforce  
House of Representatives

The Honorable Michael G. Oxley  
Chairman  
The Honorable Barney Frank  
Ranking Minority Member  
Committee on Financial Services  
House of Representatives

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The Honorable Tom Davis  
Chairman  
The Honorable Henry A. Waxman  
Ranking Minority Member  
Committee on Government Reform  
House of Representatives

The Honorable William M. Thomas  
Chairman  
The Honorable Charles B. Rangel  
Ranking Minority Member  
Committee on Ways and Means  
House of Representatives

The Honorable Jim McCrery  
Chairman  
The Honorable Sander M. Levin  
Ranking Member  
Subcommittee on Social Security  
House Committee on Ways and Means

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# Appendix I: Scope and Methodology

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To analyze whether the retirement of the baby boom generation is likely to precipitate a dramatic drop in financial asset prices, we relied primarily on information from two large survey data sets. We calculated the distribution of assets and wealth among baby boomers and existing retirees and bequest and work expectations of baby boomers from data from various waves of the Federal Reserve's Survey of Consumer Finances (SCF). This triennial survey asks extensive questions about household income and wealth components; we used the latest available survey from 2004 and previous surveys back to 1992. The SCF is widely used by the research community, is continually vetted by the Federal Reserve, and is considered to be a reliable data source. The SCF is believed by many to be the best source of publicly available information on U.S. household finances.

Some caveats about the data should be kept in mind. Because some assets are held very disproportionately by relatively wealthy families, the SCF uses a two part sample design, one of which is used to select a sample with disproportionate representation of families more likely to be relatively wealthy. The two parts of the sample are adjusted for sample nonresponse and combined using weights to provide a representation of families overall. In addition, the SCF excludes one small set of families by design. People who are listed in the October issue of *Forbes* as being among the 400 wealthiest in the United States are excluded. To enable the calculation of statistical hypothesis tests, the SCF uses a replication scheme.<sup>1</sup> A set of replicate samples is selected by applying the key dimensions of the original sample stratification to the actual set of completed SCF cases and then applying the full weighting algorithm to each of the replicate samples. To estimate the variability of an estimate from the SCF, independent estimates are made with each replicate and with each of the multiple imputations; a simple rule is used to combine the two sources of variability into a single estimate of the standard error.

We also analyzed recent asset sales by retirees and work and bequest expectations of baby boomers, as well as gathered further financial information on baby boomers and older generations, from data from the Health and Retirement Study (HRS) from 1994 to 2004. The University of Michigan administers the HRS every 2 years as a panel data set, surveying respondents every two years starting in 1992 about health, finances, family

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<sup>1</sup> See Arthur B. Kennickell, "Currents and Undercurrents: Changes in the Distribution of Wealth, 1989-2004," *SCF Working Papers*, June 22, 2006.

situation, and many other topics. Like the SCF, the HRS is widely used by academics and continually updated and improved by administrators. We also received expert opinions on the likely impact of the baby boom retirement on asset and housing markets from interviews with various financial management companies, public policy organizations, and government agencies, particularly those agencies dealing with housing.

To assess the conclusions of academics researchers and outside experts on the financial impacts of the baby boom retirement, we read, analyzed, and summarized theoretical and empirical academic studies on the subject. Based on our selection criteria, we determined that these studies were sufficient for our purposes but not that their results were necessarily conclusive. We also interviewed financial industry representatives from mutual fund companies, pension funds, life insurance companies, broker-dealers, and financial industry trade associations. We also did our own analysis of the historical importance of demographics and other variables on stock returns by collecting demographic, financial, and macroeconomic data and running a regression analysis. We performed data reliability assessments on all data used in this analysis.

To assess the role rates of return will play in providing retirement income in the future, we synthesized findings from the analysis of financial asset holdings to draw conclusions about the risk implications for different subpopulations of the baby boom and younger generations. We also used facts and findings on pensions and Social Security (from past GAO reports and the academic literature) and insights from interviews with outside experts to extend and support our conclusions.

We conducted our work between August 2005 and June 2006 in accordance with generally accepted government auditing standards.

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# Appendix II: Bibliography of Simulation-Based and Empirical Studies

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**Appendix II: Bibliography of Simulation-Based and Empirical Studies**

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# Appendix III: Summary of the Simulation-Based and Empirical Studies Assessing the Impact of a Baby Boom on Financial Markets

**Table 2: Simulation-Based Studies Assessing the Impact of a Baby Boom on Financial Markets**

Study	Objective	Model	Key assumptions	Asset(s)	Channel through which baby boom affects asset returns	Implications
<b>Abel (2001 and 2003)</b>	Assess the impact of a baby boom on the price of capital, with and without a bequest motive	Overlapping-generations model, with agents living for two periods: working when young but not when old	Model assumes a closed economy, agents supply labor inelastically, and a convex adjustment cost technology for converting consumption goods into capital goods. In one scenario, the model assumes agents have no bequest motive. In the other, it assumes agents have a bequest motive, so they do not consume all of their wealth during retirement.	Capital	Baby boomers affect the price of capital through their aggregate savings and, in turn, demand for assets. Assuming a bequest motive does not attenuate the reduction in the price of capital when baby boomers retire. Although retirees do not sell all of their capital, there is more capital in the economy, because retirees save more when working in anticipation of leaving bequests.	Model suggests that baby boomers will increase stock returns while in the labor force and will reduce stock returns in retirement.
<b>Brooks (1998, 2000, 2002, and 2003)</b>	Assess the impact of the baby boom on stock and bond returns, including the equity premium	Overlapping-generations model, with agents living for four periods: childhood, young working age, old working age, and retirement	Model assumes a closed economy, agents supply labor inelastically, and agents make a portfolio decision over risky capital or safe bonds. In one scenario, model assumes agents do not receive social security benefits; in another scenario, it assumes they do.	Risky capital and safe bonds	Demographic shifts lead to changes in aggregate savings over time, causing the real interest rate to vary and, in turn, push stock and bond returns in the same direction. Changes in stock returns mirror wage income, which moves inversely with the size of the labor force and reflects changes in the capital-labor ratio.	Model suggests that baby boomers will increase stock and bond returns while in the labor force and reduce stock and bond returns but increase the equity premium in retirement.

**Appendix III: Summary of the Simulation-Based and Empirical Studies Assessing the Impact of a Baby Boom on Financial Markets**

<b>Study</b>	<b>Objective</b>	<b>Model</b>	<b>Key assumptions</b>	<b>Asset(s)</b>	<b>Channel through which baby boom affects asset returns</b>	<b>Implications</b>
<b>Börsch-Supan, Ludwig, and Winter (2004)</b>	Assess the effects of population aging and pension reform on international capital markets	Multi-country overlapping generations model	Model assumes countries and regions are modeled symmetrically as open economies; demographic changes capture survival rates, immigration, and fertility rates; variable labor supply in some scenarios; and bequests are accidental.	Capital	Changes in aggregate savings and labor supply affect the ratio of capital to labor and capital to output and hence the rate of return, where the rate of return to capital moves negatively with the capital-to-output ratio.	Model suggests that baby boomers will increase stock returns while in the labor force and reduce stock returns in retirement.
<b>Bütler and Harms (2001)</b>	Assess the impact of a baby boom on the price of capital	Overlapping-generations model, with three living generations	Model assumes a closed economy, agents have perfect foresight and leave no bequests, economy produces a consumption good and physical capital, agents can transfer income across periods by buying bonds or physical capital that is safe, labor supply is endogenous in some scenarios, and no social security exists.	Bonds and physical capital that provides rent	Due to their large size and impact on the capital-to-labor ratio, baby boomers depress the wage rate but prop up the return to capital when working. In retirement, they contribute to a rise in the wage rate and depress the return to capital. Endogenous labor supply dampens factor price fluctuations by allowing baby-boom parents and children to shift their labor supply to take advantage of the baby boomers' impact on the returns to capital and labor.	Model suggests that baby boomers will increase stock returns while in the labor force and reduce stock returns in retirement. The swing in returns can be attenuated by the working and saving behavior of the generations preceding and following the baby boomers.

**Appendix III: Summary of the Simulation-Based and Empirical Studies Assessing the Impact of a Baby Boom on Financial Markets**

<b>Study</b>	<b>Objective</b>	<b>Model</b>	<b>Key assumptions</b>	<b>Asset(s)</b>	<b>Channel through which baby boom affects asset returns</b>	<b>Implications</b>
<b>Geanakoplos, Magill, and Quinzii (2004)</b>	Assess the impact of the combination of life-cycle behavior and changing demographic structure on stock prices and the equity premium	Overlapping-generations model, with agents living for three periods: young adult, middle age, and retirement	Model assumes a closed economy, agents supply labor inelastically, and a large cohort is deterministically followed by a smaller cohort. It then adds other assumptions, including children, social security, bequests, uncertainty with wages and dividends, and capital stock with adjustment costs.	Safe bonds and, in later versions of the model, equity contract representing claims on capital	In the basic model, demographic shifts lead to excess demand for consumption or saving, requiring interest rates to change and, in turn, bond and equity prices to move inversely with such change. Model also shows that large cohorts drive the terms of trade against themselves by being so numerous, favoring the small cohorts on the other side of the market that follow or precede them.	Model suggests that baby boomers will increase stock and bond returns while in the labor force and reduce stock and bond returns but increase the equity premium in retirement.
<b>Helmenstein, Prskawetz, and Yegorov (2002)</b>	Assess the effect of population aging on the financial markets when wealth is unevenly distributed	Theoretical model, with economic behaviors assumed rather than derived from optimizing agents	Model assumes wealth accrues from bequests and savings, which are accumulated as a fraction of wage income; and the population is divided into different generations, each of which has equal amount of wealth but is composed of low and high-wealth individuals. High-wealth individuals receive a bequest at age 20, hold their wealth in stocks, consume only labor income, and work their entire lives; low-wealth individuals follow the life-cycle hypothesis.	Safe bonds and stock that is also safe	In the model where wealth is uniformly distributed among high-wealth individuals, the increase in demand for stocks and bonds by baby boomers when in the work force causes prices to rise. Likewise, the spending of savings by baby boomers in retirement causes prices to decline.	Model suggests that baby boomers will increase stock and bond returns while in the labor force and reduce stock and bond returns in retirement. The decline in returns, however, could be attenuated if wealth is not evenly distributed.

**Appendix III: Summary of the Simulation-Based and Empirical Studies Assessing the Impact of a Baby Boom on Financial Markets**

<b>Study</b>	<b>Objective</b>	<b>Model</b>	<b>Key assumptions</b>	<b>Asset(s)</b>	<b>Channel through which baby boom affects asset returns</b>	<b>Implications</b>
<b>Lim and Weil (2003)</b>	Assess the impact of the baby boom on stock prices	Macro-demographic model of linked dynasties	Model assumes production and investment are carried out by identically competitive firms that maximize the present discounted values of their cash flows; firms making investments face installation costs that are a positive function of the ratio of investment to capital; closed economy; and labor supply is exogenous.	Capital	Demographics affect stock prices through the installation cost of capital. As capital is the only savings vehicle, greater savings drives up the price of capital. The larger the adjustment costs, the larger are the movements in stock prices.	Model suggests that baby boomers will increase stock returns while in the labor force and reduce stock returns in retirement.
<b>Yoo (1997)</b>	Assess the impact of a baby boom on asset prices	Overlapping-generations model, with agents living for 55 periods and receiving an age-dependent endowment during the first 45 periods	Model assumes a closed economy, an agent's demand for an asset does not respond to expectations of future prices, supply of capital is fixed, and agents supply labor inelastically. The model later relaxes assumptions about expectations of future prices and the fixed supply of capital.	Capital	Variation in a population's age distribution affects the aggregate demand for an asset by changing the distribution of asset holders. This variation in aggregate demand for an asset produces the relationship between a population's age distribution and asset prices.	Model suggests that baby boomers will increase stock returns while in the labor force and reduce stock returns in retirement. The effect is attenuated if the supply of capital varies.

**Appendix III: Summary of the Simulation-Based and Empirical Studies Assessing the Impact of a Baby Boom on Financial Markets**

<b>Study</b>	<b>Objective</b>	<b>Model</b>	<b>Key assumptions</b>	<b>Asset(s)</b>	<b>Channel through which baby boom affects asset returns</b>	<b>Implications</b>
<b>Young (2002)</b>	Assess the impact of a baby boom and other demographics shocks on asset prices	Overlapping-generations model	Model assumes agents will save for old age, but some will die before old age, with their savings being bequeathed to the next generation; agents supply labor exogenously in varying amounts and degrees of effectiveness over their lifetime; agents can hold assets that pay a rate of return, and receive bequests; agents live up to five periods and consume a decreasing amount of their wage income in each period.	Capital	The baby boom increases labor supply and lowers the capital-to-labor ratio, raising the marginal product of capital and interest rate and reducing the marginal product of labor and wage rate. When baby boomers are in the work force, aggregate savings is raised; thus, when boomers retire, the raised capital drives down the interest rate on retirement.	Model suggests that baby boomers will increase stock returns while in the labor force and reduce stock returns in retirement.

Source: GAO summary of studies.

**Table 3: Empirical Studies Assessing the Impact of a Baby Boom on Financial Markets**

<b>Study</b>	<b>Objective</b>	<b>Demographic variable(s)</b>	<b>Asset variable(s)</b>	<b>Time frame of analysis</b>	<b>Key results</b>
<b>Ang and Maddaloni (2003)</b>	Tests for associations between demographic variables and equity premium in the United States and other countries	Average age of population above 20 years old Percentage of the population age 65 and over Percentage of the population in the working ages of 20 to 64	Difference between the compounded total return of the stock market index and compounded return on a risk-free asset	1900-2001 for the United States, France, Germany, and United Kingdom; 1920-2001 for Japan	Demographic changes predicted future changes in the equity premium in the international data but only weakly in the U.S. data.
<b>Bakshi and Chen (1994)</b>	Tests for associations between demographic variable and equity premium	Average age of population over age 20	Excess return on S&P 500 stock index	1946 to 1990	In the United States, increases in the average age of persons older than age 20 predicted a higher risk premium.

**Appendix III: Summary of the Simulation-Based and Empirical Studies Assessing the Impact of a Baby Boom on Financial Markets**

<b>Study</b>	<b>Objective</b>	<b>Demographic variable(s)</b>	<b>Asset variable(s)</b>	<b>Time frame of analysis</b>	<b>Key results</b>
<b>Bergantino (1998)</b>	Tests for associations between demographic variables and (1) stock and bond prices and (2) equity premium in the United States	Growth in the demographic demand for financial assets constructed from time series of cross-sectional profiles of stock and bond holdings  Ratio of demographic demand for stocks to demographic demand for bonds	Average annual rate of real price appreciation of (1) the S&P 500 stock index and (2) long-term government bonds	1946 to 1997	In the United States, the increase in the demand for stocks and bonds based on demographic changes increased stock and bond prices but had no effect on the equity premium.
<b>Brooks (1998)</b>	Tests for associations between demographic variables and (1) stock and bond prices and (2) stock prices relative to bond prices in the United States and other countries	Population age 40 to 64 divided by rest of the population  Population age 40 to 64 divided by population age 65 and older	Logged annual (1) stock price indices for a cross-section of countries and (2) price indices for bonds based on yields to maturity of long-term government bonds	1950 to 1995	The increase in people age 40 to 64 relative to the rest of the population increased stock and bond prices, particularly in the United States. Also, the increase in people 40 to 64 relative to people over 65 increased the equity premium.
<b>Davis and Li (2003)</b>	Tests for associations between demographic variables and stock and bond prices in the United States and other countries	Percentage of the population (1) age 20 to 39 and (2) age 40 to 64	Change in annual average level of (1) real stock price index (excluding dividends) and (2) real long-term bond yield	1950 to 1999 for stocks; 1960 to 1999 for bonds	The relative increase in people age 40 to 64 increased stock prices and decreased long-term bond yields in the United States and other countries.
<b>Geanakoplos, Magill, and Quinzii (2004)</b>	Tests for associations between demographic variable and financial asset prices and returns in the United States and other countries	Ratio of population age 40 to 49 to population age 20 to 29	Price-to-earnings ratio, real return on S&P 500 stock index, real short-term interest rate, and real stock price index of foreign countries	1910 to 2002 for the United States; 1950 to 2001 for the foreign countries	In the United States, the relative increase in the population age 40 to 49 increased stock returns. The results for the other countries included in the study were mixed.
<b>Goyal (2004)</b>	Tests for, among other things, associations between demographic variables and the equity premium	Percentage change and level of population age 25 to 44, age 45 to 64, and age 65 and over.  Average age of person over age 25	Difference between logged S&P 500 stock returns and logged Treasury bill rate	1926 to 1998	In the United States, the relative increase in persons age 45 to 64 increased the equity premium.

**Appendix III: Summary of the Simulation-Based and Empirical Studies Assessing the Impact of a Baby Boom on Financial Markets**

<b>Study</b>	<b>Objective</b>	<b>Demographic variable(s)</b>	<b>Asset variable(s)</b>	<b>Time frame of analysis</b>	<b>Key results</b>
<b>Macunovich (1997)</b>	Tests for associations between demographic variables and stock prices	Logged annual change in U.S. population age 6, 9, 18, 27, 45, 66, and total U.S. population	3-year moving average of the annual change in the Dow Jones Industrial Average	1934 to 1994	In the United States, the increase in people age 45 and 66 decreased stock returns.
<b>Poterba (2004)</b>	Tests for associations between demographic variables and stock and bond returns in the United States	Percentage of population age 40 to 64; percentage of population over age 65; population age 40 to 64 divided by population age 20 and older; and population over age 65 divided by population age 20 and older	Annual real returns for Treasury bills, long-term government bonds, and large corporate stocks based on S&P 500	1926 to 2003 for United States	In the United States, the relative increase in people age 40 to 64 decreased short-term government bond returns but had no effect on long-term government bond or stock returns.
<b>Yoo (1994)</b>	Tests for associations between demographic variables and stock and bond returns	Percentage of population age 25 to 34, age 35 to 44, age 45 to 54, and age 65 and over	Annual real returns of common stock, small company stock, long-term corporate bonds, long-term government bonds, intermediate-term government bonds, and Treasury bills	1926 to 1988	In the United States, the relative increase in people age 45 to 54 decreased annual returns of short and intermediate-term government bonds but had no effect on the annual returns of stock and long-term government or corporate bonds.

Source: GAO summary of studies.

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# Appendix IV: Econometric Analysis of the Impact of Demographics on Stock Market Returns

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This appendix discusses our analysis of the impact of demographics and macroeconomic and financial factors on U.S. stock market returns from 1948 to 2004. In particular, we discuss (1) the development of our model used to estimate the relative importance of demographics and other factors in determining stock market returns, (2) the data sources, and (3) the specifications of our econometric model, potential limitations, and results.

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## GAO's Econometric Model of the Effects of Demographic, Macroeconomic, and Financial Factors on Stock Market Returns

We developed an econometric model to determine the effects of changes in demographic, macroeconomic, and financial variables on stock market returns from 1948 to 2004. Our independent empirical analysis is meant to address two separate but related questions:

- Are the demographic effects on stock returns found in some of the empirical literature<sup>1</sup> still apparent when additional control variables—macroeconomic and financial indicators known to be associated with stock returns—are present in the regression analysis?
- How much of the variation in stock returns is explained by those macroeconomic and financial indicators as compared to demographic variables?

Answering the first question serves to address the possibility of omitted variable bias in simpler regression specifications. For example, studies by Poterba;<sup>2</sup> Geanakoplos, Magill, and Quinzii (hereafter, GMQ); and Yoo<sup>3</sup> use only demographic variables as their independent variables. The omission of relevant variables in regressions of this kind will result in biased

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<sup>1</sup> From our literature review, studies that found evidence of a relationship between demography and stock returns include Robin J. Brooks, "Asset Market and Savings Effects of Demographic Transitions," Ph.D. diss., Yale University (1998); E. Phillip Davis and Christine Li, "Demographics and Financial Asset Prices in the Major Industrial Economies," *Working Paper* (Brunel University, West London: 2003); and John Geanakoplos, Michael Magill, and Martine Quinzii, "Demography and the Long-Run Predictability of the Stock Market," *Cowles Foundation Paper No. 1099* (New Haven, Conn.: Cowles Foundation for Research in Economics, Yale University, 2004). While Davis and Li include a set of control variables, Brooks' international approach captures only a global business-cycle component. Geanakoplos, Magill, and Quinzii do not include control variables.

<sup>2</sup> James M. Poterba, "The Impact of Population Aging on Financial Markets," *Working Paper No. 10851* (Cambridge, Mass.: National Bureau of Economic Research, 2004).

<sup>3</sup> Peter S. Yoo, "Age Distributions and Returns of Financial Assets," *Working Paper 1994-002A* (St. Louis: Federal Reserve Bank of St. Louis, 1994).

estimates of the size and significance of the effects under investigation. Answering the second question serves to put the influence of demographics on stock returns in perspective: How much of stock market movements are explained by demographics as opposed to other variables? To answer the questions we include a series of demographic variables from the literature we reviewed in a multivariable regression model. We relied primarily on information in a seminal study done by Eugene Fama to develop our model.<sup>4</sup>

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## Data and Sample Selection

We analyzed the determinants of real (adjusted for inflation) total (including both price changes and dividends) returns of the Standard and Poor's (S&P) 500 Index from 1948 to 2004. We chose the S&P 500 Index as our dependent variable not only because it is widely regarded as the best single gauge of U.S. equities market and covers over 80 percent of the value of U.S. equities but also because S&P 500 Index mutual funds are by far the largest and most popular type of index fund. Due to changes in the structure of financial markets over time, we chose a shorter time horizon to minimize the likelihood of a structural break in the data.<sup>5</sup> For our independent variables, we selected macroeconomic and financial variables that economic studies have found to be important in explaining stock returns and were used in Fama's analysis to determine how much of stock market variation they explained.<sup>6</sup> We selected two demographic variables, the proportion of the population age 40-64 and the ratio of the population age 40-49 to the population age 20-29 (the middle-young or "MY" ratio), that had statistically significant coefficients in several of the empirical studies that we reviewed.<sup>7</sup> Table 1 presents the independent and dependent variables in our model and their data sources. For consistency, we estimate the equation four times using both levels and changes in the two demographic variables.

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<sup>4</sup> Eugene Fama, "Stock Returns, Expected Returns, and Real Activity," *Journal of Finance*, vol. 45, no. 4 (1990).

<sup>5</sup> A Chow test confirms that there are no structural breaks around the midpoint (1976) in any of the regressions, but there is probably a structural break after 1980 in the baseline (Fama) regression

<sup>6</sup> See Fama (1990).

<sup>7</sup> See Brooks (1998), Davis and Li (2003), and Geanakoplos, Magill, and Quinzii (2004).

**Table 4: Names, Definitions and Data Sources of Variables Used in Our Regression Models**

<b>Dependent variable</b>	
Stock Returns	Real annual returns to the S&P 500 Index from Robert Shiller’s calculations
<b>Independent variables</b>	
<b>Control Variables</b>	
Dividend yield	Dividends paid to shares of stocks in the S&P 500 Index, divided by the share price, from Moody’s Economy.com (lagging)
Term spread	The difference between yields on Moody’s AAA corporate bonds and the 3-month T-bill, from the Federal Reserve Bank of St. Louis (lagging)
Default spread shock	Unexpected changes to the difference between Moody’s BAA and AAA corporate bonds, calculated as residuals from an AR(1) regression, from the Federal Reserve Bank of St. Louis
Industrial production	Industrial Production Index of U.S. manufacturing, mining, and electric and gas utilities, from the Board of Governors of the Federal Reserve (leading) <sup>a</sup>
<b>Demographic variables</b>	
Middle age-to-young (MY) ratio	Ratio of individuals in the United States ages 40 to 49 over 20 to 29, from the U.S. Census Bureau
Proportion 40-64	Proportion of individuals in the U.S. ages 40-64, from the Census Bureau

Source: GAO analysis of S&P 500 returns, 1948-2004.

<sup>a</sup>For industrial production, because it is leading, we assume that the causality is wholly from growth in industrial production to stock returns, and not vice versa. This is consistent with the literature, as expressed in Nai-Fu Chen, Richard Roll, and Stephen A. Ross, “Economic Forces and the Stock Market,” *Journal of Business*, vol. 59, no. 3 (1986), “stock prices are usually considered as responding to external forces.” Further, in Paul Beaudry and Franck Portier, “Stock Prices, News and Economic Fluctuations,” *Working Paper 10548* (Cambridge, Mass.: National Bureau of Economic Research, 2004), the authors find that stock prices respond today to news about productivity shocks that will effect the economy with a substantial delay. This implies that higher industrial production in the future should cause higher stock returns today.

**Model Specification, Limitations, and Estimation**

We estimated the following regression equation:

$$r_t = \beta_0 + \beta_1 x_{1,t-1} + \beta_2 x_{2,t-1} + \beta_3 x_{3,t} + \beta_4 x_{4,t+1} + \theta y_t + \varepsilon_t$$

where  $r_t$  is real stock market returns during calendar year  $t$ ,  $x_i$  are four control variables (the dividend yield, the term spread, shocks to the

default spread, and growth of industrial production, respectively) adapted from Fama's study,<sup>8</sup>  $y_t$  is the demographic variable, and  $\varepsilon_t$  is the error at time  $t$ . The error structure is modeled assuming White's heteroskedasticity-consistent covariance matrix. We first estimate the equation without a demographic variable to measure the proportion of variation explained by macroeconomic and financial indicators, followed by estimating the regression equation four separate times to include each of the demographic measures.<sup>9</sup> For the benchmark model, we find no evidence of serial autocorrelation or deviations from normality.<sup>10</sup>

Despite standard diagnostics and careful regression specification, some limitations of our analysis remain. We cannot be certain that we have chosen the best variables to represent the aspects of the economy that move the stock market or the demographic variables that may influence stock returns as well. We have attempted to choose appropriate variables based on the existing empirical and theoretical literature on the economic and demographic determinants of stock returns. Nevertheless, even these variables may be measured with error. Generally, measurement errors would cause us to underestimate the importance of those variables that have been measured with error. This would be most problematic in the case of our demographic variables, though measurement error in our economic and financial control variables actually makes our estimates conservative. Nevertheless, we assessed the reliability of all data used in this analysis, and found all data series to be sufficiently reliable for our purposes. As a result, we believe that the limitations mentioned here (and related to the direction of causality in industrial production mentioned above) do not have serious consequences for the interpretation of our results.

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<sup>8</sup> See Fama (1990).

<sup>9</sup> By including the variables in this order, we are measuring the contribution of demographics to the R-squared after controlling for macroeconomic and financial variables. We replicated the results instead including the demographic variables first, and found that they accounted for even less of the variation in stock returns, around 1.8 percent on average, compared to an average of roughly 5.7 percent when macroeconomic and financial variables were included first.

<sup>10</sup> The presence of serial autocorrelation or deviations from normality would imply that the methods we used to measure statistical significance (e.g., p-values) were inappropriate, and could thus lead to incorrect conclusions about the strength of relationships between variables.

The regression results are presented in tables 2 through 6 below. Our results are consistent with the literature on the determinants of stock market returns, especially Fama’s study, in that several of our macroeconomic and financial variables are statistically significant, and they account for a substantial proportion (roughly 47 percent) of the variation in stock returns. The coefficient of determination in Fama’s study could be higher due to the inclusion of more industrial production leads.

The finding in Davis and Li’s study that the 40-64 population had a statistically significant impact on stock returns is not robust to alternative specifications, as demonstrated in Table 6. The proportion of the population 40-64 is no longer a statistically significant determinant of stock returns, and the inclusion of the variable improves the R-squared by less than 1.5 percent. However, changes in the 40-64 population are significant, and account for an additional 8 percent of the variation in stock returns.

The MY ratio and changes in the MY ratio are statistically significant, as seen in Tables 5 and 6, and the model with changes in the MY ratio accounts for a higher proportion of the variation in stock returns than the model estimated with the level of the ratio.<sup>11</sup>

**Table 5: Stock Market Returns Regression Results—Baseline Model**

<b>Parameter</b>	<b>Estimate</b>	<b>p-value</b>
Intercept	-0.104809	0.0636
Dividend yield	0.024963	0.0462
Term spread	0.012387	0.4650
Shocks to the default spread	-0.105986	0.1698
Industrial production	2.097360	<0.0001
R-squared	0.465597	NA

Source: GAO analysis of S&P 500 returns, 1948-2004.

<sup>11</sup> Changes in the “MY” ratio were used by Geanakoplos, Magill, and Quinzii (2004).

**Appendix IV: Econometric Analysis of the Impact of Demographics on Stock Market Returns**

**Table 6: Stock Market Returns Regression Results—Middle Age Model**

Parameter	Estimate	p-value
Intercept	-0.549744	0.2546
Dividend yield	0.036523	0.0095
Term spread	0.013526	0.4516
Shocks to the default spread	-0.109996	0.2196
Industrial production	2.031814	<0.0001
Proportion middle aged (40-64)	1.513299	0.3610
Change in R-squared	0.014389	NA

Source: GAO analysis of S&P 500 returns, 1948-2004.

**Table 7: Stock Market Returns Regression Results—Change in Middle Age Model**

Parameter	Estimate	p-value
Intercept	-0.201542	0.0008
Dividend yield	0.053588	0.0004
Term spread	-0.002828	0.8802
Shocks to the default spread	-0.095472	0.2514
Industrial production	2.056497	<0.0001
Change in proportion middle aged (40-64)	27.52932	0.0044
Change in R-squared	0.080823	NA

Source: GAO analysis of S&P 500 returns, 1948-2004.

**Table 8: Stock Market Returns Regression Results—Middle-Young Ratio Model**

Parameter	Estimate	p-value
Intercept	-0.467783	0.0094
Dividend yield	0.052177	0.0003
Term spread	0.026824	0.2163
Shocks to the default spread	-0.167018	0.1369
Industrial production	1.877306	<0.0001
MY ratio (age 40-49/ age 20-29)	0.286547	0.0409
Change in R-squared	0.055683	NA

Source: GAO analysis of S&P 500 returns, 1948-2004.

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**Appendix IV: Econometric Analysis of the  
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**Table 9: Stock Market Returns Regression Results—Change in Middle-Young Ratio Model**

<b>Parameter</b>	<b>Estimate</b>	<b>p-value</b>
Intercept	-0.055320	0.3315
Dividend yield	0.017724	0.1314
Term spread	-0.006925	0.7323
Shocks to the default spread	-0.102432	0.1668
Industrial production	2.227720	<0.0001
Change in MY ratio (age 40-49/ age 20-29)	1.903652	0.0064
Change in R-squared	0.079029	NA

Source: GAO analysis of S&P 500 returns, 1948-2004.

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# Appendix V: GAO Contact and Staff Acknowledgments

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## Contacts

Barbara D. Bovbjerg (202) 512-7215

George A. Scott (202) 512-5932

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## Staff Acknowledgments

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