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Role of home equity in retirement saving: building your nest (egg)

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Abstract

This study examines the role of home equity in retirement saving. Using data from the 2001 and 2003 Panel Study of Income Dynamics, this study first updates the existing literature by regressing active saving on real housing capital gains using median regression techniques. Consistent with the literature, an increase in housing capital gains results in a decrease in active saving. While the active saving literature provides an initial analytical framework regarding saving behavior and home equity, the demographic shift in the U.S. due to the imminent retirement of the baby boomers indicates that the impact of changes in home equity on retirement saving is the more imperative question confronting policy makers. To determine this basic relationship, a level of retirement saving is regressed on home equity, yielding a positive relationship. Alternatively, when retirement saving is regressed on home equity as a share of the total retirement portfolio, the resulting relationship is negative, demonstrating that when households place more emphasis on the home in their retirement portfolio, they reduce the level of other retirement saving.

For Francis J. Goodwin,
my grandfather

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I. Introduction

According to the February 2006 release of the 2004 Survey of Consumer Finances (SCF) from the Federal Reserve, the value of the home is taking an increasingly prominent position in a household's total retirement portfolio.[1] Much of this shift in portfolio allocation can likely be attributed to the strong returns in the housing market. Overall, since the beginning of the 21st century, the home has appreciated considerably in value while other assets, like stocks, have provided comparatively weak returns. With low returns from the stock market, many households shifted their wealth in order to benefit from the higher returns in the housing market. This increase in demand for real estate has only brought about further appreciation in the housing market. From 2000 to 2005, real household real estate wealth increased at an average annualized rate of growth of 7.71%.[2] During the period prior to the decline of the stock market from 1990-1999, real estate wealth increased at an average annualized rate of only 2.24%. Not only have house values appreciated, but between 2001 and 2004 the rate of homeownership also increased while the ownership of stocks and other typical assets declined.[3] According to data from the 2003 Panel Study of Income Dynamics (PSID), home equity accounted for approximately 63% of the total wealth of home owners, or 40% of the total wealth of all households, regardless of home ownership.

Porter and Rich (2006) of the New York Times report that this appreciation in the housing market is causing Americans to view the home as an important part of their retirement portfolios, as it may provide the largest source of additional income for retirement. This allocative shift in households' retirement portfolios leads to questions about household behavior regarding other retirement saving. According to Venti and Wise (1996), traditional economic

[1] Bucks et al., 2006, A1.
[2] Data are from the Federal Reserve and the Bureau of Economic Analysis.
[3] Bucks et al., 2006, A1.

assumptions suggest that increases in home equity due to unanticipated gains in housing prices cause individuals to reduce saving in other forms. This suggests that a portfolio shift toward home equity could in fact have an adverse impact on the amount of retirement saving.

This should alert concern in policy makers on a variety of fronts. First, the housing boom is bound to end at some point. If house prices do decline eventually, this will have a profound impact on the many households relying on these returns for their retirement. Second, retirement saving has never been more important in the U.S. than it is today. Concurrent to the appreciation in the housing market, the U.S. is also experiencing another phenomenon: the aging of its workforce. As the baby boom generation nears retirement, the accumulated assets in a household's retirement portfolio are of prime necessity due to the sheer magnitude of this generation. Further, the baby boomers, unlike previous generations, may not be able to rely on government programs such as Social Security as a main feature of their retirement portfolios. Throughout 2005, there was considerable debate surrounding the future of Social Security and the financial sustainability of this program. Many American households depend heavily upon Social Security income to finance retirement. If, in fact, Social Security payments are reduced or eliminated, households will find themselves with a greater dependency upon other retirement saving. Poterba, Venti, and Wise (1994) found that Social Security wealth is the number one wealth asset for elderly households, followed by home equity. Because of this reliance on Social Security and home equity, the saving behavior of Americans has come under increased scrutiny. A reduction in other retirement saving, as is anticipated by conventional economic suppositions, is dangerous, particularly if the housing market cools.

Despite the precarious position of retirement saving, in 2004 the Federal Reserve found that retirement was the main reason to save.[4] Yet, in general, saving rates in the U.S. are at record lows. Beginning in April 2005 and continuing through the present month, April 2006, personal saving rates have been negative every month. Historically, the U.S. economy has never experienced saving rates at or below zero. In their recent release of the SCF, the Federal Reserve found that in 2004, the proportion of families that save fell 3.1 percentage points to 56.1%.[5] This glut in saving could be partially induced by the shift toward home equity as a prominent asset in the portfolio. From 2001 to 2004, the saving of the typical American household dropped by 23%, whereas the average house value rose by 22%.[6] Such fluctuation in behavior is bound to have implications for the average American household.

Even with all the potential policy concerns surrounding these current macroeconomic conditions, previous work on home equity and saving has been confined to data from primarily the late 1980s. This period saw similar economic phenomena to those observed currently in the US: saving rates declined from the robust levels of the early 80s and housing prices rose. From 1984 to 1989, real estate wealth grew at an average annualized rate of growth of 5.98%. Bosworth et al. (1991) provide one of the first studies examining the decline in saving in the US during the late 1980s. They break their sample into groups of homeowners and non-homeowners and examine the differences in saving rates for the two groups. They find that saving rates are lower for the homeowners. While the paper does not use econometric techniques to model this result, Poterba (1991), in his comments on Bosworth et al., describes this result as essentially obtaining a negative coefficient on a homeownership dummy variable in a regression on the household saving rate. Updating this result using data from the 2003 PSID indicates that the

[4] Bucks et al., 2006, A8.
[5] Bucks et al., 2006, A2.
[6] *Ibid.*

same is true for 2003: the mean value of saving for non-homeowners is significantly greater than the mean value of saving for homeowners.

Skinner (1996) and Engelhardt (1996) empirically research the correlation between home equity and saving. Using micro data from the 1984 and 1989 PSID, both studies regress active saving on housing capital gains and a vector of demographic variables. Active saving is the change in a household's wealth position net of capital gains. Both studies find a negative coefficient on housing capital gains, indicating that the decline in saving observed throughout the 1980s could in fact be due to the rapid appreciation of houses. With such a parallel situation currently in the United States, it seems probable that a similar phenomenon could be occurring as households change the allocation of wealth resources in their portfolios. While Skinner and Engelhardt both provide empirical evidence relating increases in home equity to decreases in active saving, the truly interesting question in the present context of the upcoming demographic shift in the U.S. concerns home equity's is role in retirement.

Thus, the goal of this study is to trace the theoretical and empirical link between home equity and retirement saving in light of the recent macro events in the U.S. It begins with a review of the literature motivating the role of home equity within the retirement portfolio, as well as some relevant retirement literature. It then presents the literature relating home equity and overall saving in an effort to understand the relationship between these two aspects of the portfolio. In the next section, the data used in this study are presented, and the active saving models used by Skinner (1996) are updated for more recent data. This model enables an initial investigation of saving behavior, and the results indicate that increases in home equity do cause active saving to decline. These results are consistent with those found by Skinner for data from the 1980s. A new model is then presented to provide an initial look at the relationship between

home equity and retirement saving. In this model, a level of retirement saving is regressed on a level of home equity. The relationship is found to be positive, indicating that increases in home equity cause increases in retirement saving. This could potentially be due to market appreciation effects. The model is then modified to incorporate home equity as a portion of the total retirement portfolio in order to study the implications of the changes in the home's position within the retirement portfolio. The results indicate that an increase in the proportion of home equity to total retirement saving leads to a decrease in other retirement saving. Finally, the paper summarizes the conclusions and provides potential extensions for the future work of this study.

II. Literature Review

Carroll et al. (2003) provide additional motivation for the importance of the home in a household's portfolio of assets. In their paper evaluating the impact of unemployment risk on precautionary saving, they find that when housing wealth is excluded from net worth, there is not a precautionary response to unemployment risk.[7] However, when housing wealth is included in net worth, there is a precautionary response to increased unemployment risk, thus indicating the relative importance of home equity in a household's retirement portfolio. They write, "These results point to home equity as the driving force behind the relationship between total net worth and employment risk."[8] According to their work, while it may seem counterintuitive to hold such an illiquid asset as part of one's precautionary wealth, in the face of an adverse event

[7] Their study examines uncertainty surrounding unemployment. By predicting probabilities of employment in a first stage probit model, they create a proxy for employment uncertainty. Placing these predicted values in a second stage equation for saving, they measure the precautionary response to adverse events.
[8] p. 601.

housing wealth is actually a sound investment. Many states, accordingly, allow households to maintain the ownership of their home in the face of bankruptcy.

Further indicating the importance of home equity, Poterba, Venti, and Wise (1994) examine targeted retirement saving and the net worth of older Americans. Targeted retirement saving is considered to be accounts such as 401(k)s, IRAs, and Keoghs. They find through extensive analysis of data from the Survey of Income and Program Participation (SIPP) that, while home equity is a major component of personal wealth for many households, it is not typically converted for consumption of non-housing items following retirement.

Despite the increasingly important role of home equity in many households' retirement portfolios, there have not been any studies dealing explicitly with the impacts of this portfolio reallocation on retirement saving. Venti and Wise (1996) provide a somewhat parallel analysis concerning the introduction of personal retirement accounts such as IRAs and Keogh accounts and the reallocation of resources due to this new form of saving. Traditionally, economists have argued that if, for example, individuals save more through personal retirement accounts, they will subsequently reduce saving of other forms. Using data from the 1984, 1987, and 1991 SIPP, they find that the introduction of personal retirement accounts has actually added to the financial wealth of Americans not decreased it. Thus, households that reach retirement age in 2019 are expected to have twice as many retirement assets as those households entering retirement in 1990. While Venti and Wise do not provide a detailed look at home equity in this paper, they mention preliminarily that households older than 58 tend to reduce personal retirement accounts as a result of a windfall in home equity, while younger households, who generally have lower levels of home equity, do not reduce these accounts. Their results on the implications of

personal retirement accounts provide some theoretical underpinnings for this study's look at home equity's role in the retirement portfolio.

Poterba, Venti, and Wise (1996) continue their previous research on the effects of 401(k)s and IRAs on net retirement saving. They provide a detailed discussion of saver heterogeneity, which they believe to be the key in determining the effects of retirement plans. They find that, in general, saving in retirement accounts appears to be new saving and out of consumption rather than from other portions of the retirement portfolio. In terms of home equity, they propose that increased participation in personal retirement accounts could lead to reductions in home equity due to substitution effects. However, there do not appear to be any offsetting behaviors such as 401(k) contributions leading to decreased housing equity. The authors admit that there could be issues of timing due to the introduction of the Tax Reform Act of 1986. Home equity includes a household's mortgage position, and the Tax Reform Act has led many home owners to reduce debt overall, but increase mortgage debt. Since most of their work was done with data from the late 1980s and early 1990s, they believe that the home equity data may be subject to time effects caused by tax reform. Nonetheless, their work provides some initial insights into the behavior of home equity. While Poterba, Venti, and Wise (1996) provide analysis regarding the impacts of increased personal retirement accounts on home equity, they do not look at the effect of changes in home equity on personal retirement accounts or other retirement saving, as is the main interest of this study.

Despite the lack of literature on home equity and retirement saving, research solely concerning retirement saving provides some relevant insights for this analysis. Berheim et al. (1997) find that there is not a significant relationship between accumulated wealth and rates of change in consumption as a household approaches retirement. They do, however, find a

correlation between accumulated wealth and declines in consumption at the point of retirement. They model consumption in a two stage fashion, first estimating the probability of retirement on a vector of demographic variables using a probit model. These predicted values are then used in a second stage consumption equation. Using this method, they find a decline in consumption as households near retirement. Reductions in consumption closer to, or at the point of, retirement suggest implications for retirement saving for older households. Thus, demographics seem to play an important role in saving behavior, particularly when households are confronted with changes in home equity, the stock market, or other macroeconomic indicators.

Lusardi (1999) hypothesizes that saving rates are low because people are nearsighted and do not think about retirement. Her study is driven by the fact that saving in the U.S. fell just as baby boomers should have reached their peak saving years. She believes this anomaly suggests some myopia. She notes the importance of one's house in a portfolio of assets, with 74% of households interviewed by the Health and Retirement Study (HRS) holding housing assets. [9] Of particular relevance, Lusardi notes the controversy surrounding the inclusion of home equity in measures of wealth, particularly retirement wealth. Merril (1984) and Venti and Wise (1996) find that home equity is not used to finance consumption, while Sheiner and Weil (1992) indicate that households reduce home equity as they get older. Lusardi considers three different measures of retirement wealth: financial net worth, total net worth, and the expected accumulation of wealth at retirement. Because of the mentioned ambiguity surrounding the inclusion of home equity in retirement wealth, Lusardi uses both financial net worth and total net worth as measures of retirement resources. Using these dependent variables, she regresses wealth on a vector of explanatory variables, including demographics, income, the probability of changes in home

[9] The HRS is a longitudinal data set collected by the University of Michigan's Institute for Social Research. Lusardi has restricted this data set to only include those household heads between the ages of 51 and 61.

equity, and the probability of changes in social security. She finds that there exists a significant, positive relationship between those households that actively think about retirement and retirement wealth, thus substantiating her hypothesis. With regards to housing, she finds that the probability of increased housing prices has a significantly negative impact on financial net worth. There is not a significant relationship between actual housing prices and total net worth.

Gustman and Steinmeier (2003) study retirement and saving choices in an uncertain world using the 1992-2002 HRS. They focus on saving behavior before and after the bursting of the stock market bubble. They find that when the stock market bubble burst in 2000, households began to save increasingly with resources other than stocks. Like Lusardi, Gustman and Steinmeier define retirement resources as wealth intended to finance retirement. They exclude pensions and Social Security payments, leaving them with a measure of wealth that comprises of financial, real estate, and business assets.

The literature on saving and housing capital gains, though limited, also provides some useful insights for this study. While the analysis is confined primarily to data from the 1980s, it outlines a framework for the initial modeling efforts of this study. Skinner (1989) analyzes the correlation of housing wealth and saving rates. Based on a traditional life cycle model, this study investigates the theory that increases in house prices could have been the fundamental cause of a slowdown in saving rates. Using the Panel Study of Income Dynamics (PSID) for 1976-1981, Skinner assesses the impact of house values on consumption. He expects that rising house values will cause an increase in consumption. Holding income constant, this leads to a decline in saving. While the theoretical underpinnings linking home equity and saving seem in line with the traditional Keynesian notion of wealth effects, Skinner's results were either small or insignificant for regressions testing this hypothesis.

Studying consumption rather than saving, Lehnert (2003) tests whether the consumption impact of house prices is greater among credit constrained households. Using waves of PSID data from 1968-1999, he estimated changes in housing demand as one gets older and finds that home ownership rates decline around the age of 70. He also estimates consumption elasticities and the marginal propensity to consume out of housing wealth. These elasticities and MPC's differ among age groups, with higher values for younger households.

Hoynes and McFadden (1997) approach saving rates and home equity from a demographic angle. They stress the importance of home equity as part of a household's total wealth, noting that housing for many households is the most significant portion of wealth; it accounts, on average, for over half of all wealth. While the main focus of Hoynes and McFadden is on the link between demographics and behavior in the housing market, they also examine the correlation between housing capital gains and saving rates. Using the 1984 and 1989 PSID data, they regress non-housing saving rates on housing capital gains and on a vector of demographic variables such as age, marital status of the household head, and race. Like Skinner (1989), they find that changes in housing capital have small or insignificant effects on non-housing saving.

Despite the previously insignificant results relating housing wealth and saving, both Skinner (1996) and Engelhardt (1996) further research the theory of correlation between home equity and saving. Skinner looks at the effects of housing gains on precautionary saving.[10] While younger homeowners tend to draw down on home equity gains, middle aged homeowners treat home equity as a type of insurance that can be drawn down on in the event of a negative shock, such as the early death of one's spouse. The chance that an adverse event of this nature

[10] Precautionary saving occurs in response to a potentially adverse event such as widowhood or ill health.

occurs is minimal, so very few middle aged and elderly people have a need to draw down on their housing wealth. However, this theory implies that there is unevenness in different demographic groups' responses to changes in home equity.

Skinner (1996) approaches the issue of home equity and saving from both an aggregate and disaggregate perspective. Of primary interest for this study is his look at micro data. Using data from 1984 and 1989, Skinner uses a variable created in the PSID called active saving. Active saving nets out capital gains from overall changes in wealth that occur between 1984 and 1989. Regressing active saving on housing capital gains, Skinner observes a negative coefficient, as anticipated. As a result of the research of Bosworth et al. (1991), which suggests that older households have had a more significant impact on the saving decline, Skinner also breaks the sample into households with heads younger than 45 and older than 45. Further, Skinner considers potential asymmetries in capital gains and losses. He finds that capital gains have an insignificant effect on saving, while capital losses cause households to increase saving. He concludes that these asymmetries exist because gains are often anticipated and thus have no observable impact on consumption, whereas losses are unanticipated and significantly affect saving behavior.

Similar to Skinner's study, Engelhardt (1996) also examines the impact of home equity on saving behavior using the 1984 and 1989 PSID. Engelhardt uses dependent variables of both active saving and the change in real non-housing wealth. When active saving is regressed on changes in housing capital, the coefficient for this change is negative and significant, yet when the dependent variable is the change in non-housing wealth, there is no significant effect. Engelhardt also finds asymmetric effects, again suggesting that capital losses in housing are the main causes of variation in the saving behavior of homeowners.

Juster et al. (2004) study the effects of capital gains on saving differentiated by asset type using the 1984-1994 PSID. They find that changes in the value of corporate equities have a larger impact on active saving than other types of assets. Yet, like Skinner and Engelhardt, they also find a negative and significant relationship between gains in home equity and active saving, providing further evidence for this relationship.

The results of these studies clearly point to a relationship between home equity and saving during the 1980s. Since the present macroeconomic conditions are somewhat parallel to those of the 1980s, this relationship between home equity and saving may be relevant for the current real estate boom. There has not been an attempt to model the impact of changes in home equity on active saving with data more recent than 1989 and 1994. Thus, to attain a preliminary look at the behavior of home equity and saving, Section V of this paper updates the literature using more recent data.

III. Data Source

The data used for this study come from the Panel Study of Income Dynamics (PSID) from the University of Michigan. The PSID contains a rich cross sectional following of a cohort of families from 1968 to 2003 collected on a biennial basis. Due to the lengthy following of the families involved, the data also exhibit longitudinal features and can be used as either cross sectional or panel data. When children mature and form family units of their own, these family units are also surveyed. In 1997, the survey was reevaluated, and additional families were added to represent the changes in immigration in the U.S. since 1968. Since 1968, the survey has grown from 4,800 families to over 8,600 in 2003. The data are primarily economic and demographic, with a particular emphasis on data for employment, health, and assets. Due to this,

many studies addressing saving from a micro data perspective have used the PSID for their analysis, including the work of both Skinner (1996) and Engelhardt (1996) on active saving.

For this study, the relevant data are taken from the 2001 and 2003 Family and Wealth Surveys. The Family Survey provides an extensive amount of demographic data, including variables for age, the working status of the household head, and income. The Wealth Survey contains many data on a household's portfolio of assets. The survey contains two measures of total wealth, one excluding home equity and one including it. The data are also collected in a disaggregated fashion. For example, the monetary values of assets such as stocks, personal retirement accounts, and real estate are included net of debts. Due to the identification numbers assigned in the PSID, households are easily linked between the Family and Wealth Surveys. Thus, one of the most beneficial aspects of the PSID for this study is the ability to join demographic data with data specifically related to wealth and saving behavior.

While the PSID has many valuable features, survey data can be inherently problematic. Despite efforts by the PSID to repeat or rephrase questions in an attempt to eliminate errors, researchers are at risk of including misreported values that could subsequently cause bias in the sample. However, in the case of this study, the benefits of using individually reported values outweigh these concerns. Engelhardt (1996) addresses the issue of using self-reported home values, writing, "What a household believes its home to be worth and how great it perceives its real capital gains to be should be the driving force in consumption and saving decisions."[11] Extending this theory, it seems sensible that households will make decisions about saving based on what they perceive their net worth to be, regardless of the actual accuracy of these values, thus making the PSID a particularly relevant data set for this study.

[11] p. 318-9.

IV. Active Saving

As outlined in the literature review, the majority of relevant studies pertaining to capital gains and losses in housing wealth address active saving. Thus, to gain an understanding of both the data available in the PSID and the specifications used in earlier studies, this study begins by modeling changes in real housing capital from an active saving approach. This enables a preliminary look at the relationship between home equity and saving. Active saving is the change in wealth net of all capital gains. In 1989 and 1994, the PSID defined active saving and constructed a measure of this variable. Since 1994, this variable has not been reported in the PSID. However, by extracting the components from the 2001 and 2003 Wealth and Family Surveys that were previously used to define active saving, the variable can be created for 2003.[12]

This study looks at changes in real housing capital and active saving from 2001 to 2003 following the modeling framework of Skinner (1996). The period from 2001 to 2003 captures both the decline in saving and the rise in real estate wealth in the U.S. To test the impact of these capital gains in housing on household saving, Skinner's equation has been updated to accommodate the more recent data set. In Skinner's analysis, the data ranged over a six year period, and income terms are included from 1984 to 1989. Because in this study the data only utilized from three years and because the income data for 2003 has not yet been released, income variables have not been included for each year of the sample, but rather only for 2002. The model is specified as follows:

$$ACTIVE = \beta_0 + \beta_1 \Delta HC + \beta_2 AGE + \beta_3 AGE^2 + \beta_4 MALE + \beta_5 FSIZE + \beta_6 dFSIZE + \beta_7 INCOME + \varepsilon \qquad (1)$$

[12] See Appendix 1.

where ACTIVE is saving that occurs between 2001 and 2003 net of capital gains; ΔHC is the change in housing capital from 2001 to 2003 and is defined in a manner consistent with Engelhardt (1996) such that it is the difference in the 2003 and 2001 house values less the cost of additions and repairs; AGE is the age of the household head in 2003; MALE is a binary variable equaling 1 if the household head is male in 2003; FSIZE is the size of the family in 2003; dFSIZE is a binary variable equaling 1 if there exists a change in family size from 2001 to 2003; and INCOME is the household income in 2002.

Skinner does not include an analysis of the expected coefficients for any variables other than ΔHC which he anticipates to be negative. However, it seems likely that AGE will have a positive sign as households will increase their saving as they approach retirement. AGE^2 is expected to be negative because the rate of saving will probably begin to decrease as a household gets older due to greater expectations of capital gains. MALE should be positive for two reasons: One, males tend to earn higher income so they are subsequently able to save more; and two, male-headed households typically imply a married couple and two potential earners who can save for retirement. FSIZE should have a negative sign because as families get larger, a greater strain is placed upon their resources causing them to save less. There is not an a priori assumption about dFSIZE, since it only represents a change and does not specifically denote a gain or loss in family size. A positive coefficient could be an indication that when a family gains a member, they may increase saving to accommodate for this additional individual's needs or that when a household loses a member, they can now save more since there is one less person to provide for. A negative coefficient would suggest that dFSIZE serves as a shock term. When households experience a shock, they decrease saving as a result. INCOME should have a

positive coefficient as increased income enables households to save more.

Sample

The PSID includes data on 8,620 families in the 2001 and 2003 wealth and family files. Because this study is concerned with changes in housing capital, the sample is restricted to families that own their homes, or 61% of this sample. It is further restricted to families that do not move from 2001 to 2003. In order to begin to address the question of retirement savings, all household heads are under the age of 65, resulting in a sample size of 2,611 observations. [13] Table 1 shows summary statistics for both active saving and the explanatory variables.

TABLE 1. Summary Statistics.

	ACTIVE	ΔHC	AGE	MALE	FSIZE	dFSIZE	INCOME
Mean	4,234	20,916	45.83	0.85	2.74	0.25	79,512
Median	500	9,000	46.0	1.0	2.0	0.0	65,000
Maximum	3,669,799	475,000	64.0	1.0	9.0	1.0	36,606,500
Minimum	-2,440,000	-400,000	21.0	0.0	1.0	0.0	1,488
Std. Dev.	177,812	50,234	9.36	0.357	1.28	0.44	102,800

The mean values for the restricted sample all seem reasonable. Skinner (1996) reported a mean value of active saving from 1984-1989 of $10,918 and a standard deviation of $324,980.[14] These summary statistics indicate that the mean of active saving has fallen considerably for the period from 2001 to 2003 when compared to Skinner's results. The standard deviation for active saving has also substantially decreased. Active saving, however, need not stay at consistent levels throughout time, but can change with macroeconomic conditions. The average change in

[13] Skinner restricted his sample to households under age 65 in order to exclude retired households. The 2003 PSID provides a variable specifically on retirement status. However, when the data are modeled using this variable to determine workforce participation, the results are not statistically different from the results attained using Skinner's restriction on age. Thus, for the sake of comparability, the results presented here use the restriction employed by Skinner. Further, like Skinner's study, only households with income greater than $1,000 and house values greater than $2,000 are included in the sample in an attempt to eliminate extreme outliers.

[14] p. 257.

housing capital indicates that most households are experiencing substantial increases in the worth of their home. With the current bubble-like conditions in the US housing market, as well as falling mortgage rates, these increases seem realistic.

Bosworth et al. (1991) find that younger households experienced a smaller saving rate decline than older households in the 1970s and 1980s. Thus, Skinner (1996) divides his sample into two subsets: those households with a head younger than 45 and those households with a head of 45 years or older. This divide seems even more sensible for this study, as such subsetting divides households into those born during the baby boom generation and those that were not. The sample of families with a household head older than or at age 45 is 1,482, and the sample size of household heads younger than 45 is 1,129. Summary statistics for these two age brackets can be found in Tables 2 and 3.

TABLE 2. Summary Statistics for Households with a Head Younger than 45 Years of Age.

Age<45	ACTIVE	ΔHC	AGE	MALE	FSIZE	dFSIZE	INCOME
Mean	1,680	19,758	36.96	0.86	3.26	0.30	72,576
Median	500	8,000	38.0	1.0	3.0	0.0	61,000
Maximum	1,660,000	470,000	44.0	1.0	8.0	1.0	1,095,650
Minimum	-2,440,000	-400,000	21.0	0.0	1.0	0.0	2,444
Std. Dev.	144,350	47,674	5.33	0.34	1.34	0.46	61,795

TABLE 3. Summary Statistics for Households with a Head of Age 45 or Older.

Age≥45	ACTIVE	ΔHC	AGE	MALE	FSIZE	dFSIZE	INCOME
Mean	6,180	21,798	52.6	0.84	2.34	0.22	84,796
Median	400	10,000	52.0	1.0	2.0	0.0	67,075
Maximum	3,669,799	475,000	64.0	1.0	9.0	1.0	3,660,650
Minimum	-1,847,000	-275,000	45.0	0.0	1.0	0.0	1,488
Std. Dev.	199,600	52,099	5.21	0.37	1.08	0.42	125,103

Active saving and the change in housing capital are both considerably greater for households of at least 45 years of age, yet due to the large standard deviations, this difference in means is not statistically significant for active saving and is only significant at the 10% level for

ΔHC.[15] These large standard deviations are due to the presence of outliers which are common in survey data and evident in the summary statistics in Tables 1-3. As noted earlier, Skinner (1996) also found large standard deviations for active saving. The difference in ΔHC suggests that older households tend to live in houses of higher value or tend to invest more in additions and repairs. Younger households have on average approximately 1 more person within the family unit. For older households, it is more likely that children have presently gone away to college or to form their own family units. Income for older households is statistically different than income for younger households at the 1% level of significance.[16] This intuitively makes sense because as one gets older, he or she should generally advances in his or her career, achieves an increase in salary.

Quantile Regression

Due to the presence of outliers in the PSID data, Engelhardt (1996) employs the use of both ordinary least squares (OLS) and quantile regression (QR) and finds, as expected, that OLS is extremely sensitive to outliers.[17] Skinner (1996) also uses QR for the empirical analysis in his study, placing weights on the quantiles. Engelhardt, on the other hand, utilizes the most common form of QR, the median regression. While OLS estimates parameters using the variation in the explanatory variables based on the mean of the dependent variable, a median regression utilizes the median of the dependent variable in calculating the variation of the explanatory variables. The median regression minimizes the absolute residuals rather than the sum of squares of the

[15] For active saving, t=0.86. For ΔHC, t=1.51.
[16] For income, t=3.76.
[17] See Angrist et al. (2005), Wooldridge (2002), STATA (2003) for detailed explanations of quantile regression analysis.

residuals as occurs in OLS. Thus, rather than the regression line passing through the mean, as in OLS, in a median regression it passes through the median.

Both OLS regressions and median regressions describe the central tendency of the data. Because OLS results can be drastically skewed in the presence of large outliers, as often occurs in survey data like the PSID, a median regression more effectively represents the central tendency of the data. Further, as the sample size increases, the parameter estimates in a median regression converge to the true values. While in the case of a small sample the results are not necessarily unbiased, median regressions are consistent estimators and asymptotically efficient. In this study, the minimum sample size is 1,129 so bias due to a small sample should not be an issue. Subsequently, to control for outliers, all active saving regressions are estimated using quantile regression techniques.

Empirical Results

Table 4 shows the empirical estimates for equation 1 using the restricted sample of 2001 and 2003 data in column 1. For purposes of comparison, the results of Skinner's study are shown in column 2.

TABLE 4. Quantile Regressions for Active Saving.

Active saving	2001-2003	Skinner: 1984-1989
ΔHC	-0.069*** (-5.75)	-0.025** (-2.28)
AGE	317.03 (0.58)	467 (1.47)
AGE^2	-3.45 (-0.57)	-3.14 (-1.12)
MALE	-1138.12 (-0.65)	-3883** (-2.11)
FSIZE	-291.39 (-0.55)	-2216*** (-3.86)
dFSIZE	-5964.4*** (-4.29)	-940 (-1.16)
INCOME	0.057*** (9.62)	0.106*** (3.52)
Constant	-5005.43 (-0.41)	-13563 (-1.52)
Sample Size	2611	1970
Pseudo R squared[18]	0.0028	Not reported

T-statistics are in parentheses. ***indicates significance at the 1% level. ** indicates significance at the 5% level. All levels of significance are based on two-tailed tests.

The key variable of interest is ΔHC, the change in housing capital. It is highly significant and of the expected negative sign. Although the coefficients on ΔHC in the more recent sample and in Skinner's study are statistically different from one another, the magnitudes are similar. The results support the hypothesis that increases in housing capital reduce saving. Both studies also find INCOME to have a significant impact on active saving. For the 2001-2003 data, a 1 dollar increase in INCOME leads to a 5.7 cent increase in active saving. This follows the a priori assumption that higher income should lead to increased saving. The 1984-1989 data also results in a positive coefficient estimate, but the magnitude is greater in a statistically significant

[18] The R^2 is extremely low for several reasons: 1. This study uses cross sectional data. 2. The dependent variable is a change not a level. 3. This is a quantile regression and thus produces a pseudo R^2 not an actual or adjusted R^2.

fashion. For these households, a 1 dollar increase in INCOME leads to a 10.6 cent increase in active saving. The empirical differences in the two models seem logical. The late 1980s saw declining saving rates. Yet, since the saving rates between 2001 and 2003 were substantially lower than those observed in the 1980s, it is likely that the estimates of the two models would differ. Thus, increases in housing capital cause more of a decline in active saving for the 2001-2003 data. Households are saving less, so when they experience a windfall, they are more likely to reduce other forms of saving. In terms of income, increases in income do lead to more active saving, but due to the lower saving rates at present, gains in income have less of an impact than in the 1980s.

Skinner finds MALE and FSIZE to be significant whereas the updated data find only dFSIZE to be significant. The coefficient on MALE is somewhat surprising, yet Skinner does not provide an interpretation of the result. One might expect male-headed households to potentially be more stable, and thus save more. The negative coefficient indicates that perhaps these households feel more secure against adverse events and do not feel the need to save as much. It should also be noted that all the explanatory variables, both significant and insignificant, follow the a priori assumption for anticipated signs in both Skinner's sample and the updated data.

Table 5 presents the regression results when the sample is broken into age brackets. It also shows the results of a test for asymmetric capital changes for ΔHC.

TABLE 5. Quantile Regressions for Active Saving, 2001-2003.

Active saving	Age≥45	Age<45	Asymmetric Capital Changes
ΔHC	-0.197 (-1.05)	-0.153*** (-7.23)	-
POS (Cap. Gain)	-	-	-0.144*** (-5.04)
NEG (Cap. Loss)	-	-	-.304*** (-6.51)
AGE	5028.35 (-1.32)	592.81 (0.24)	-71.7 (-0.06)
AGE^2	-47.04 (-1.32)	-11.33 (-0.33)	0.995 (0.08)
MALE	1751.65 (0.62)	-5594.99* (-1.82)	-2789.75 (-0.67)
FSIZE	-673.53 (-0.67)	326.55 (0.42)	-595.17 (-0.52)
dFSIZE	-4822.93** (-2.00)	-5766.61*** (-2.63)	-4998.57 (-1.68)
INCOME	-0.04*** (-5.06)	0.2075*** (12.41)	0.0038 (0.29)
Constant	-128257.6 (-1.25)	-10358.46 (-0.24)	9590.9 (0.39)
Sample Size	1482	1129	2611
Pseudo R squared	0.0014	0.0157	0.003

T-statistics are in parentheses. ***indicates significance at the 1% level. ** indicates significance at the 5% level. *indicates significance at the 10% level. All levels of significance are based on two-tailed tests.

Column 1 of Table 5 shows that for those households with a head aged 45 or older, Equation 1 does not provide a particularly good model. Not only is ΔHC not significant, but dFSIZE and INCOME are the only significant explanatory variables. INCOME, though significant at the 1% level in a two-tailed test, theoretically seems to be of the incorrect sign. The results indicate that for a dollar increase in income, households actually reduce active saving by 4 cents. It is normally expected that higher levels of income induce higher levels of saving. This negative coefficient potentially indicates some type of substitution effect, rather than the

normally expected income effect. Perhaps when households receive a higher income, they expect to be able to consume solely out of this and believe that they have less of a need overall for saving. While these older households most likely are receiving a higher level of pay than they have previously experienced, this type of behavior is extremely myopic and should be a cause of concern as these households approach retirement with reduced saving.

For those household heads under age 45, the coefficient on ΔHC is significant and of the expected sign. Skinner found the coefficient of ΔHC to be significant for either age bracket, with a statistically larger decline in active saving for younger households. In the case of the model for household heads under 45, INCOME is again significant, but this time results in the expected positive sign. Younger households seem to be saving a substantial portion of their income, and for every additional dollar of income, they add approximately 21 cents to active saving.

Despite the poor fit of the model for older households using the 2003 data, the model is able to provide some useful insight. Effectively, the 2003 data suggest that younger households reduce their active saving in the face of capital gains in housing whereas older households do not shift their saving. Since these older households are part of the baby boomers, their retirement will inevitably place a strain on resources such as Medicare and Social Security due to the sheer magnitude of the baby boomer population. These households are inevitably aware of this, and as they prepare for retirement, they no doubt become increasingly risk averse. Rather than chance various components of their portfolio, they instead hold this increase in wealth as a buffer against adverse events.

Like Skinner and Engelhardt, this updated study also tests for asymmetric effects of capital gains and losses. Both Skinner and Engelhardt find that capital gains have an

insignificant effect on active saving, whereas capital losses have a significant impact that causes households to increase saving.[19] The two authors suggest that this effect occurs because capital gains are fully anticipated, thus indicating that there would be no impact on consumption and saving. Losses however, are unanticipated and result in a change in consumer behavior.[20] For the updated 2001-2003 data set, there are 1,134 households that experience a capital loss from 2001 to 2003, and 2,763 households that experience a capital gain. Asymmetries are present in this sample, yet they differ from the asymmetries found in previous studies. In this analysis, both capital gains and losses have a statistically significant impact on active saving. Capital gains cause households to decrease active saving, while capital losses cause households to increase active saving.[21] Specifically, when a household experiences a capital gain they decrease active saving by 14 cents, whereas when a household experiences a capital loss, they increase active saving by 30 cents.

The coefficients on NEG and POS are statistically different from one another at the 2.5% level of significance. In absolute value, NEG is greater than POS, suggesting a similar effect to that found by Skinner and Engelhardt. In this case, however, positive gains are not fully anticipated due to the statistically significant reductions in active saving induced by changes in POS. With the dramatic fluctuations in both the stock market and housing prices during the late twentieth and early twenty-first centuries, it is likely that such rapid gains in housing capital were not fully expected. Thus, saving behavior, as a life cycle model suggests, declined as these gains in housing capital were realized.

[19] Skinner, 1996, p. 258-9; Engelhardt, 1996, p. 329.
[20] Skinner, 1996, p. 259.
[21] While the coefficient on capital losses is negative, it is important to note the construction of the variable to correctly interpret the coefficient. NEG is constructed as an interaction term of a binary variable equaling 1 for a capital loss, nHC, and the change in housing capital, ΔHC. Specifically, the interaction term is $(nHC*\Delta HC)$. For a household experiencing a capital loss, ΔHC is a negative value and nHC equals 1. Thus, a negative coefficient multiplied by $\Delta HC<0$ yields a positive change in active saving.

Overall, the results for the 2003 data are similar to the results found by both Skinner (1996) and Engelhardt (1996). While the magnitudes of the coefficients differ between the estimates for the 1980s and for the more recent data, an increase in housing capital does lead to a decline in active saving in both periods. Further, demographics also play an important role in the updated data. The response to increases in housing capital as households get older is significantly less than the response of younger households, thus indicating demographic implications surrounding saving behavior as the baby boom generation moves closer to retirement.

V. Retirement Saving

The work on active saving provides an interesting preliminary analysis of the 2003 PSID data and saving behavior. Although the negative relationship between changes in home equity and saving is noteworthy, for policy makers preparing for the retirement of the baby boomers, the real question is how home equity influences retirement saving. With many households using their housing wealth as a hedge against the poor returns of other financial assets, a potential cooling off in the U.S. housing market could have profound consequences. While Skinner's active saving model is able to serve as a baseline, to truly look at home equity and retirement saving, the model must be modified.

Turning to the literature for a definition of retirement saving, Lusardi (1999) considers both financial wealth and total net worth to be possibilities for retirement wealth. Gustman and Steinmeier (2003) use a measure of wealth made up of financial, real estate, and business wealth. Poterba, Venti, and Wise (1994) look at targeted retirement saving such as IRAs, 401(k)s, and Keogh accounts. It seems overall that the assets included in retirement saving would be fairly

illiquid. While financial and real estate wealth do seem important to include in retirement saving, including a household's total net wealth position, as is often done, means that some extremely liquid assets like checking accounts will also be included. Such liquid assets seem unlikely to be included in retirement saving. The 2003 PSID wealth survey breaks wealth into specific categories so it is possible to disaggregate saving in order to explicitly reflect an appropriate measure of retirement saving.

Starting with very illiquid retirement assets, it seems obvious that the value of private annuities and IRAs should be included in this measure. Poterba, Venti, and Wise (1994) designate these accounts as targeted retirement saving. This saving is marked solely for retirement and clearly is a portion of a household's retirement portfolio. Financial wealth should also be included in this measure, following the logic of Lusardi (1999) and Gustman and Steinmeier (2003). The PSID wealth survey includes a measure of the value of shares in publicly held corporations, mutual funds, and investment trusts, excluding IRAs and employer based pensions. Further, other assets and saving such as bonds, the cash value of a life insurance policy, valuable collections for the purpose of investment, or rights in an estate or trust are included as a portion of the definition of retirement saving. Finally, since this study is concerned with the importance of home equity in a household's retirement portfolio, it is also necessary to consider other real estate wealth that a household might own. Many households purchase second homes or extra property. The equity of these assets, also not particularly liquid, can subsequently be used to finance retirement. Thus, by using these pieces from the PSID, it is possible to attain a specific measure of retirement saving for this study. In addition to retirement saving, the other key variable for this analysis is home equity. While the active saving model used housing capital as home equity, in an age of continued refinancing, it seems imperative to

include some measure of a household's mortgage position. Subsequently, home equity is defined as the value of a house less the remaining principal on any existing mortgages.

Model 1:

To begin to examine the role of home equity in retirement saving, it seems obvious to regress retirement saving on home equity. The active saving model looked at changes in housing capital, yet in terms of retirement saving, it now seems more relevant to look at home equity on the level based on the theory of a life cycle model. This theory indicates that people have a target amount of retirement saving they seek to attain throughout their lifetime in order to finance retirement consumption of a particular level. The gains or losses in retirement saving will inevitably vary throughout the life cycle. When a household is sending children to college, for example, they are less likely to dramatically add to their retirement saving. Thus, levels of home equity and retirement saving help to eliminate the effects of varying positions in the life cycle on the model.

An initial model of retirement saving is created by regressing retirement saving on home equity and a vector of demographic variables, as shown below:

$$SAVE = \beta_0 + \beta_1 HE + \beta_2 AGE + \beta_3 RACE + \beta_4 dFSIZE + \beta_5 INCOME + \beta_6 EDU + \varepsilon \qquad (2)$$

where SAVE is retirement saving; HE is home equity; AGE is the age of the household head; RACE is a binary variable equaling 1 if the household head is white; dFSIZE is a binary variable

equaling 1 if the size of the household changed between 2001 and 2003; [22] INCOME is the household income in 2002; and EDU is the number of years of education of the household head.

HE is expected to have a positive coefficient. Since retirement saving now is defined essentially as a wealth variable, it seems likely that households that hold larger portions of home equity also have more non-housing retirement wealth. AGE is anticipated to be positive because as a household head gets older, the prospect of retirement becomes more imminent, causing retirement saving to increase. A positive coefficient is anticipated for the binary variable RACE. Due to the structure of dFSIZE, there is not an a priori assumption about the sign of the coefficient, although it seems probable that this variable will serve as a shock term and have a negative coefficient as in the case of the active saving model. INCOME is predicted to have a positive coefficient. Education is expected to result in an increase in retirement saving, yielding a positive sign for the coefficient on EDU.

Using the 8,620 families found in the 2001 and 2003 wealth and family files, the sample is restricted to only include homeowners and household heads who have not yet retired and define themselves in the PSID as still working.[23] This results in a sample size of 3,263 households. Summary statistics for a common sample for this model can be found in Table 1.

[22] A separate regression was estimated to check for different impacts from gains and losses in terms of family size. These effects turned out to be insignificant. This variable subsequently represents a shock to family size, and is generated in the same fashion as Skinner (1996).

[23] It further eliminates outliers by excluding households from the sample that had an income in 2002 of less than $1,000 and that had a house value in 2003 of less than $2,000. 18 observations were excluded from the sample as a result of these two restrictions.

TABLE 1. Summary Statistics.

	SAVE	HE	AGE	RACE	dFSIZE	EDU	INCOME
Mean	118,310	91,562	45.8	0.69	0.26	13.3	79,922
Median	6,000	51,401	46.0	1.0	0.0	13.0	64,000
Maximum	35,187,000	3,050,000	93.0	1.0	1.0	17.0	3,660,650
Minimum	0	-162,818	21.0	0.0	0.0	0.0	1,450
Std. Dev.	873,356	134,924	11.3	0.46	0.44	2.56	105,008

Both SAVE and HE have a wide range in terms of their maximum and minimum values. The ratio of HE to SAVE is 0.77, ie., for the average household, for every dollar of retirement saving, it has 77 cents of home equity. Clearly, home equity is a substantial asset for the average household. Household heads range in age from 21 to 93, indicating the varying positions in the life cycle of households in the sample. The average age, 45.8, cuts the sample cleanly between the baby boomers and the non baby boomers. Almost 70% of the sample is white. 26% of households experienced some shock in terms of size. Household heads, on average, have one year of college education. This degree of further education should lead to an overall greater awareness of saving decisions. Income has a great deal of variation in its range. For both SAVE and HE, the mean values are dramatically greater than the median values. This is potentially due to significant outliers in the sample. Thus, in order to better accommodate these potential outliers, this regression is performed using quantile regression techniques as were used previously to model active saving. The results of this regression are shown in Table 2.

TABLE 2. Quantile Regressions for Retirement Saving.

Retirement Saving	Total sample
HE	0.32 (63.87)***
AGE	300.12 (5.82)***
RACE	3025.87 (2.37)**
dFSIZE	-2,233.89 (-1.72)*
INCOME	.38 (60.75)***
EDU	600.53 (2.57)***
Constant	-42,874.24 (-10.85)***
Sample Size	3,263
Pseudo R squared	.085

T-statistics are in parentheses. ***indicates significance at 1% level. **indicates significance at the 2% level. *indicates significance at the 10% level. All levels of significance are based on two-tailed tests.

All explanatory variables in this equation are significant at the 1% level of significance in a two-tailed tests, except RACE which is significant at the 2% level and dFSIZE which is significant at the 10% level. The empirical results yield the anticipated signs of the coefficients. Unlike Lusardi's (1999) results, the coefficient on HE indicates that those households which have more home equity also have more retirement saving. Explicitly, for a 1 dollar increase in home equity, households increase retirement saving by 32 cents, ceteris paribus. AGE shows that households tend to save more as the head gets closer to retirement. Retirement saving is also greater when the household head is white. A change in family size causes retirement saving to

be reduced. Due to the construction of dFSIZE, the variable does not reveal whether or not the household experienced an increase or decrease in size. Yet, this variable essentially measures a shock to the household. Thus, this coefficient makes sense as some type of shock to the household would inevitably reduce the household's ability to save for retirement. INCOME has a positive coefficient, indicating that, ceteris paribus, for a 1 dollar increase in income, households increase retirement saving by 38 cents.[24] EDU also has the expected sign, indicating that those households in which the head has more education save more.

While these results are extremely significant econometrically, and this model begins to develop some insight regarding home equity and retirement saving, it is not able to fully study the role of home equity within a household's retirement portfolio. According to recent research by the Federal Reserve and the results of the 2004 SCF, home equity is taking an increasingly prominent position in total retirement saving.[25] In the case of Model 1, home equity is simply a level, and this model subsequently only indicates a type of correlation between home equity and retirement saving. It is expected that households with more home equity also have more retirement saving. In some cases this could be due to an overall market appreciation, where home equity and the components of retirement saving experience gains over the same period of time. This is probable, particularly with assets like non-primary real estate wealth. Overall, due to this construction, Model 1 is not able to capture the role of home equity within the portfolio.

[24] The variable INCOME was tested for endogeneity due to a suspicion that there are explanatory variables used to model retirement saving that also describe income. First, INCOME was regressed on all other explanatory variables and the residuals were calculated. After obtaining the residuals, the model can be tested for endogeneity by regressing retirement saving on all the explanatory variables and the predicted values of the residuals. If the coefficient on the residuals is statistically different from zero, the null hypothesis that the residuals are uncorrelated with the error term is rejected, and INCOME is believed to be endogenous. In the case of this model, it was not possible to reject the null hypothesis, thus indicating that endogeneity in INCOME is not a problem.

[25] Bucks et al., 2006, A1.

Model 2

To truly see the impacts of home equity's role in retirement saving, it is necessary to look at home equity as a portion of the retirement portfolio. By dividing home equity by retirement saving plus home equity, a share variable of home equity as a fraction of total retirement saving is created.[26] To address the role of home equity in retirement saving, it is important to gain insight into how changes in this share variable affect other retirement saving, particularly as the baby boomers begin to exit the workforce and the housing market potentially begins to contract.

The key explanatory variable is now HERATIO, the ratio of home equity to total retirement saving. To determine the relationship between retirement saving and home equity, retirement saving, as defined in Model 1, is regressed on this ratio and a vector of demographic variables. This serves as a way to better isolate the behavioral characteristics of households that are changing the weight of home equity in their retirement portfolio. Yet, it also leads to immediate concern since SAVE is located on both sides of the equation: once in the numerator and once in the denominator. Such a construction could lead to a simultaneity bias. Although the problem is not intrinsically one of endogeneity bias, this may manifest itself as an endogeneity issue in the model since endogeneity is a type of simultaneity bias. Thus, to test the validity of such a model, endogeneity tests were employed and performed on the variable, HERATIO.

In order to model this share variable, Model 1 was modified slightly. Specifically, the log is taken of SAVE, HERATIO, and INCOME. In general, this double log model facilitates the interpretation of the coefficients in the case of the share variable and income. It would not be sensible, for example, to discuss the impacts of a one unit change in HERATIO on retirement

[26] See Appendix 2 for a detailed description of the creation of this variable and the values it can assume.

saving, whereas it is logical to discuss the percent change in retirement saving based on a one percent increase in HERATIO. Because of the use of logs in this model, previous issues of extreme outliers for SAVE and HE are no longer a substantial problem. Thus, the model can be estimated using ordinary least squares regression techniques rather than quantile or median regressions as were used earlier in this analysis.

A final modification that has been made to the model is the inclusion of the binary variable, MOVE. While both the active saving model and the previous retirement saving model subset the data to exclude households that have recently moved from the sample, it is important to include these households as they still hold home equity, be it that it may have changed. Behaviorally, however, it is likely that moving may have implications in terms of retirement saving. Because of financing the purchase of a new home, these households may be unlikely to put excess funds into their retirement accounts. Thus, it seems necessary to not only include these observations in the sample, but to incorporate a binary variable that captures the effect that a move may have on retirement saving. While there is not an a priori assumption about the sign of this variable, it seems likely that a move acts as a shock to a household so the coefficient may be negative, as was the case for dFSIZE.

Thus, the model for retirement saving can be found below:

$$\ln(SAVE) = \beta_0 + \beta_1 \ln(HERATIO) + \beta_2 AGE + \beta_3 RACE + \beta_4 dFSIZE + \beta_5 \ln(INCOME) + \beta_6 EDU + \beta_7 MOVE + \varepsilon \qquad (3)$$

where ln(SAVE) is the log of retirement saving; ln(HERATIO) is the log of the ratio of home equity to total retirement saving; AGE is the age of the household head; RACE is a binary variable equaling 1 if the household head is white; dFSIZE is a binary variable equaling 1 if the

size of the household changed between 2001 and 2003; ln(INCOME) is the log of household income in 2002; EDU is the number of years of education of the household head; and MOVE is a binary variable which equals 1 if the household moved between 2001 and 2003.

Using this model, it is possible to test for endogeneity in order to see the validity of the model. HERATIO is instrumented using all the explanatory variables in the model as well as three purely exogenous variables not included in the model. These additional instruments prevent perfect multicollinearity in the case of a correction for endogeneity. They are: MARITAL, a binary variable which equals one if the household head is married; MALE, a binary variable equal to one if the household head is male; and FSIZE, the number of family members living in the household in 2003.

In order to test for endogeneity, a Hausman test was performed to look for endogeneity in ln(HERATIO). This test compares the coefficients in two versions of the model: one in which ln(HERATIO) was instrumented and one in which the observed values of ln(HERATIO) are used. The null hypothesis is that the difference in the coefficients is not systematic. For the endogeneity test for ln(HERATIO), the chi squared statistic equals 0.89, clearly indicating that the null hypothesis cannot be rejected. The difference in the coefficients is not significant. Thus, it is possible to conclude that endogeneity is not a problem for the model. While issues could still remain concerning the structure of the explanatory variable HERATIO, it seems legitimate to proceed with this analysis.

The sample is subject to the same restrictions as in Model 1, except movers are no longer excluded from the sample. Using the 2001 and 2003 PSID wealth and family files, this results in a sample of 1,930. The summary statistics can be found in Table 3.

TABLE 3. Summary Statistics.

	SAVE	HERATIO	AGE	INCOME	RACE
Mean	198,794	0.59	47.0	96,177	0.82
Median	50,000	0.59	47.0	76,055	1.0
Maximum	35,187,000	6.0	93.0	3,660,650	1.0
Minimum	1.0	0.01	21.0	1,450	0.0
Std. Deviation	1,128,578	0.33	11.19	129,884	0.38

	dFSIZE	EDU	MOVE	HE
Mean	0.22	14.1	0.17	121,108
Median	0.0	14.0	0.0	75,500
Maximum	1.0	17.0	1.0	3,050,000
Minimum	0.0	1.0	0.0	-162,818
Std. Deviation	0.42	2.23	0.38	160,415

Summary statistics for the level values of SAVE and HERATIO are included in Table 3, rather than the log values. It should be noted, however, that these values are restricted by a lower bound of positive 1 since in the actual regression model the log of these values is taken. On average, home equity accounts for 59% of a household's total retirement portfolio. Further, as this statistic indicates, households in this sample have on average more other retirement saving than home equity. Yet, clearly, home equity itself maintains an extremely large portion of the retirement portfolio. The median amount of home equity is larger than the median amount of other retirement saving. Statistically, this implies that the values of SAVE are more easily skewed due to the presence of extreme outliers. The maximum value of SAVE, approximately 35 million, is clearly a severe outlier, particularly when compared to the median and mean values of 198,794 and 50,000 respectively. Such an outlier has a dramatic effect on the mean value. Since the median for HE is larger than that of SAVE, these statistics also preliminarily indicate that American households in general place a large emphasis on home equity as a retirement asset. Household heads are slightly older, better educated, and whiter than in the sample used in Model 1. About 17% of households moved between 2001 and 2003; this has the potential to cause

some type of shock to their saving behavior. A change in family size also seems to serve as a shock to households. 22% of the families in the sample experienced either a gain or loss in the number of family members living within the household between 2001 and 2003.

Further concern about endogeneity arises with respect to INCOME. It seems evident that a household's income level could likely be determined endogenously by some of the other explanatory variables within the model. Variables like education and age clearly have some impact on income levels, yet these variables are also used to model retirement saving. In order to determine if this was a problem within the model, a Hausman test was again utilized. To perform this test, the explanatory variables in the model as well as three other variables were selected to instrument ln(INCOME). These other instrumental variables are purely exogenous to the model and are again MARITAL, a binary variable equaling 1 if the household head is married; MALE, a binary variable which equals 1 if the household head is male; and FSIZE which is the size of the household in 2003.

To test if these three variables do in fact serve as a good instruments, ln(INCOME) was regressed on all the explanatory variables within the model and these three additional instruments. An f-test was used to test if the three exogenous instruments are jointly statistically different from zero. This test resulted in an f statistic of 88.92 which clearly leads to the rejection of the null hypothesis that the coefficients are not jointly different from zero. As a result, this indicates that these three exogenous variables serve as instruments for ln(INCOME).

With these instruments, it is now possible to reliably perform a Hausman test. In this case, a chi squared statistic of 5.31 was attained. Thus, the null hypothesis that the coefficients of both the instrumented model and the non-instrumented model are the same can be rejected at the 5% level of significance, and endogeneity is considered to be a problem for ln(INCOME).

Due to this, the results for Model 2 are acquired using a two stage approach. The first stage models ln(INCOME) based on the aforementioned instruments, and the second stage utilizes these predicted values in a OLS regression. The results of this are found in Table 4.

TABLE 4. Two Stage Least Squares Results for SAVE.

ln(SAVE)	Total sample
ln(HERATIO)	-1.63 (-32.91)***
AGE	0.04 (13.17)***
RACE	0.27 (2.97)***
dFSIZE	-0.29 (-3.35)***
ln(INCOME)	0.90 (5.91)***
EDU	0.08 (3.79)***
MOVE	-0.49 (-5.25)***
Constant	-3.99 (-2.61)***
Sample Size	1,930
Adjusted R squared	0.496

T-statistics are in parentheses. ***indicates significance at 1% level.
All levels of significance are based on two-tailed tests.

Overall, the fit of this model is extremely strong. All of the explanatory variables are significant at the 1% level in two-tailed tests and have the anticipated signs. The adjusted R squared is 0.498. The variable of the most interest is HERATIO. This variable has a negative coefficient, indicating that increases in the share of home equity in the retirement portfolio lead

to decreases in retirement saving. Explicitly, a 1% increase in the ratio of home equity to total retirement saving leads to 1.63% decrease in retirement saving. Thus, as American households continue to put more emphasis on their house as an asset within their retirement portfolio, other retirement saving is in fact declining.

The intuition behind the coefficient for HERATIO is somewhat difficult due to the fact that the construction of this variable places retirement saving on both the left and right sides of the equation. While the negative coefficient on HERATIO indicates that an increase in this variable causes other retirement saving to fall, it is hard to say anything about the magnitudes of the changes. Specifically, it is difficult to isolate the effects of changes in the level of home equity on other retirement saving due to the ceteris paribus assumption. Appendix 3 provides an analysis of the total differentiation of this variable.

There are three cases that could cause changes in HERATIO: a change in the amount of home equity, a change in the amount of other retirement saving, or a combination of the two. Despite the checks for endogeneity, solely considering a change in other retirement saving is dangerous due to the likelihood of a spurious regression. Clearly, if this variable increases in the denominator on the right side of the equation, this will result in a negative coefficient since it also appears in the numerator on the left hand side of the equation. Besides the difficult econometrics of this specific case, any of the three cases represents a shift in how a household allocates its resources in the retirement portfolio. This study is most interested in the case of changes in home equity causing this allocative shift. These results indicate that if a household places more of its retirement portfolio in home equity, other retirement saving will fall.

In terms of the other demographic variables, all of the coefficients follow the a priori assumptions, though the interpretations are slightly different than in Model 1 due to the double

log and log-linear format of this model. For example, a one year increase in age leads to a 4% increase in retirement saving, confirming that as households get older, they in fact do increase their retirement saving. White households have 27% more retirement saving than non-White households. The variable dFSIZE continues to serve as a shock term as in Model 1 and the active saving model. Households reduce their saving when the size of the family changes. The variable INCOME can be interpreted such that a 1 percent increase in income leads to a 0.9% increase in retirement saving, ceteris paribus. An additional year of education increases retirement saving by 8%, thus suggesting substantial gains to saving from education. MOVE has a negative coefficient. Similar to dFSIZE, this seems to imply that this variable serves as a shock term. When a household moves, they experience a variety of other expenses and financial strains that subsequently have negative implications for retirement saving. Specifically, this variable indicates that when a household moved between 2001 and 2003, their retirement saving decreased by approximately 50%, ceteris paribus.

Further information can be attained by breaking the sample into age brackets as Skinner (1996) and Engelhardt (1996) both did in their studies of active saving. The sample is broken into two groups: those household heads of age 45 or older and those households younger than 45 years of age. This division of the sample splits it between the baby boom generation and younger generations and thus enables a closer look at the retirement saving behavior of the baby boomers. There are 1,135 households with heads of 45 years or older in age and 795 with household heads younger than 45 years of age. Summary statistics for these two age groups are found in Tables 5 and 6.

TABLE 5. Summary Statistics for household heads 45 years of age or older.

	SAVE	HE	HERATIO	AGE	RACE	dFSIZE	EDU	INCOME	MOVE
Mean	268,110	140,526	0.56	54.5	0.83	0.19	14.1	99,353	0.11
Median	70,800	91,000	0.55	53.0	1.0	0.0	14.0	79,500	0.0
Maximum	35,187,000	3,050,000	6.00	93.0	1.0	1.0	17.0	3,660,650	1.0
Minimum	1.0	-12,000	0.01	45.0	0.0	0.0	1.0	1,450	0.0
Std. Dev.	1,451,636	170,993	0.31	7.7	0.37	0.39	2.35	146,629	0.31

TABLE 6. Summary Statistics for household heads younger than 45 years of age.

	SAVE	HE	HERATIO	AGE	RACE	dFSIZE	EDU	INCOME	MOVE
Mean	99,832	93,384	0.63	36.5	0.8	0.27	14.0	91,642	0.27
Median	29,000	52,000	0.66	37.0	1.0	0.0	14.0	73,700	0.0
Maximum	3,970,000	2,000,000	5.0	44.0	1.0	1.0	17.0	2,104,200	1.0
Minimum	1.0	-162,818	0.01	21.0	0.0	0.0	8.0	4,568	0.0
Std. Dev.	261,000	139,463	0.35	5.49	0.39	0.45	2.05	101,209	0.44

These summary statistics indicate that older households tend to have considerably more retirement saving and home equity, in terms of both the mean and median values. Younger households, however, tend to have a larger fraction of their retirement saving in home equity, with the average value of HERATIO for households younger than 45 years of age equaling 63% and the average for households of 45 years of age or older equaling 56%. This seems sensible since younger households are probably more concerned with the purchase of a home for a potentially growing family rather than putting money into IRAs or other pension funds, for example. In some respects, this may indicate a sense of myopia in younger households. Since retirement is further off, they prefer the present consumption benefits from the purchase of and investment in a home rather than placing money away in targeted retirement accounts. Younger households are also much more likely to move than older households. Both generations seem to benefit from the mean levels of education, with the average household head spending two years in college. INCOME is higher for older households as is expected since these household heads have almost certainly spent more time as a part of the workforce.

Model 2 is subsequently run for these subsets of the data. The same restrictions imposed for the whole sample are still in effect. After testing for and finding endogeneity in ln(INCOME) for each sample, the model is again estimated using a two stage approach in order to instrument ln(INCOME) and correct for endogeneity. The results can be found in Table 7.

TABLE 7. Two Stage Least Squares Results for SAVE.

ln(SAVE)	>=45	<45
ln(HERATIO)	-1.59 (-26.54)***	-1.67 (-20.11)***
AGE	0.03 (5.66)***	0.07 (4.85)***
RACE	0.35 (3.19)***	0.24 (1.49)
dFSIZE	-0.32 (-2.93)**	-0.26 (-1.84)*
ln(INCOME)	0.86 (5.43)***	0.87 (2.15)**
EDU	0.085 (3.88)***	0.077 (1.55)
MOVE	-0.49 (-3.87)***	-0.41 (-2.71)***
Constant	-3.08 (-1.78)*	-4.64 (-1.26)
Sample Size	1,135	795
Adjusted R squared	0.504	0.428

T-statistics are in parentheses. ***indicates significance at 1% level. **indicates significance at the 5% level. *indicates significance at the 10% level. All levels of significance are based on two-tailed tests.

For both older and younger households, all variables have the expected signs. Each of the variables other than EDU and RACE in the younger sample are significant, at least at the 10% level of signficance in a two-tailed test. Both EDU and RACE are expected to have

positive coefficients. Thus, when these variables are tested for significance in a one-tailed test, they are significant at the 10% level. The main variable of interest, HERATIO, is significant at the 1% level in a two-tailed test for both samples. Overall, the fit of this model appears to be quite strong. The older sample has an adjusted R^2 of 0.504, whereas the younger sample has an adjusted R^2 of 0.428.

In both samples, an increase in the share of home equity as a portion of the total retirement portfolio causes a decrease in other retirement saving. In magnitude, the coefficient on HERATIO is greater in absolute value for younger households. Notably, in terms of the age brackets, these results indicate that younger households reduce retirement saving more than older households as a result of an increase in HERATIO. Specifically, for older households, a 1% increase in HERATIO causes a 1.59% decrease in retirement saving, whereas a 1% increase in HERATIO for younger households leads to a 1.67% decline in retirement saving. However, the coefficient for each sample is within the confidence interval of the coefficient for the other sample. Subsequently, it is difficult to say with certainty whether or not the emphasis placed on the home in the retirement portfolio has a stronger influence for older or younger households.

Moving appears to cause more of an adverse shock to older households than younger households, as the households over 45 years of age reduce their retirement saving more if they have recently moved. Age within these two subsets is also significant. It is, however, of a greater magnitude for younger households. This seems sensible because the youngest households will not yet be thinking about retirement. As households get closer to 45, however, they most likely become more stable and more able to save for retirement. Thus, within this bracket, the aging of household heads has a more dramatic impact on retirement saving. For households older than age 45, they are most likely all thinking about retirement since it is in the

more immediate future. Thus, variations in age do not have as dramatic an impact. In terms of saving behavior and race, younger households' retirement saving does not benefit as much from a household head being white. For older households, white household heads add 35% more to their retirement saving than racial minorities. Younger white households, however, only benefit from 24% more retirement saving than minorities. While these values are found within the confidence intervals of each sample, this begs for further investigation of racial equality at various points within the life cycle with regards to retirement saving. Income has an almost identical effect for the two subsets. In both cases, increases in income lead to increases in retirement saving, as is expected.

In general the position of a household within the life cycle does not appear to be particularly significant with regards to HERATIO since the two coefficients are found within the confidence bands. The baby boomers do not seem to be altering their saving behavior in light of their both imminent retirement as well as the potential strain on retirement resources. However, there are some factors, such as AGE, which clearly have stronger implications depending on where a household is within its life cycle.

VI. Conclusion

Declines in saving and rising house prices in the U.S continue to be pressing macroeconomic policy issues. While a considerable amount of research based on data from the 1980s explored the link between home equity and saving rates, there is a lack of current research addressing this relationship. Following the modeling framework used by Skinner (1996), this study first models the relationship between active saving and changes in housing capital for 2001 and 2003. The most striking finding of these empirical results is the difference in the reaction of

older and younger households to changes in housing capital. Since older households are facing retirement in the more immediate future, they do not reduce active saving as much as younger households when they experience a gain in housing capital.

Although this active saving analysis provides some useful insights, the imminent demographic shift in the U.S. due to the retirement of the baby boomers makes not active saving, but retirement saving the more pressing concern for policy makers. With an uncertain future for Social Security and record low saving rates, it is apparent that financing retirement could be difficult for a large fraction of the population. Using data from the 2004 Survey of Consumer Finances, the Federal Reserve finds that housing wealth is becoming an increasingly important share of a household's retirement portfolio.[27] While the housing market has been appreciating since the decline of the stock market in 2001, this market will inevitably cool off, causing many households' retirement portfolios to be worth less than was otherwise anticipated. Thus, this paper empirically models the link between home equity and retirement saving in order to understand the implications of rising house prices, the baby boomers, and low saving rates. The analysis begins with a simple model regressing a level of retirement saving on home equity. This relationship is positive, indicating that an increase in home equity leads to an increase in non-housing retirement saving. While this result is meaningful, it could be a result of assets appreciating simultaneously. It does not truly capture the behavioral shift that the Federal Reserve has noted in terms of retirement saving behavior.

To look at this behavioral shift, a variable is created that measures home equity as a portion of total retirement saving. The study models how changes in the share variable impact other retirement saving. Increases in this ratio cause other retirement saving to decline.

[27] Bucks et al., 2006, A1.

Specifically, when home equity occupies a more significant portion of a household's retirement portfolio, other retirement saving fall. This validates potential policy concerns regarding a cool down in the housing market. Further results suggest that older households may increase retirement saving more than younger households. This is an indication that the point a household is at in the life cycle plays a significant role in determining how much the household saves. When households experience a shock, such as a change in family size or a move, they also reduce retirement saving.

Due to the construction of the ratio variable, it is difficult to explicitly say how a specific increase in home equity in the retirement portfolio changes the magnitude of retirement saving. This construction also raises concern about a potential simultaneity bias due to the fact that retirement saving is found on both the right and left sides of the equation. Because of this, it seems clear that the best approach to modeling this is to use a multiple equation model. This will be the subject of further research efforts.

The empirical findings of this study clearly indicate the significant role of home equity in the retirement portfolio. If the home is occupying a more prominent position in total retirement saving, these results should be a cause of concern for policy makers. This shift in portfolio allocation is inducing households to reduce other retirement saving. Inevitably, however, the appreciation of the housing market will slow, leaving many in the baby boom generation with insufficient financial resources for retirement.

References

Angrist, Joshua, Victor Chernozhukov, and Ivan Fernandez-Val. (2005) "Quantile Regression under Misspecification, with an Application." NBER *Working Paper 10428*.

Bernheim, B. Douglas, Jonathan Skinner, and Steven Weinberg. (1997) "What Accounts for the Variation in Retirement Wealth among U.S. Households?" NBER *Working Paper 6227*.

Bosworth, Barry Gary Burtless, and John Sabelhaus. (1991) "The Decline in Saving: Evidence from Household Survey." *Brookings Papers on Economic Activity,* 1: 183-256.

Bucks, Brian K., Arthur B. Kennickell, and Kevin B. Moore. (2006) "Recent Changes in U.S. Family Finances: Evidence from the 2001 and 2004 Survey of Consumer Finances." Board of Governor's *Federal Reserve Bulletin,* A1-A38.

Carroll, Christopher, D., Karen E. Dynan, and Spencer D. Krane. (2003) "Unemployment Risk and Precautionary Wealth: Evidence from Households' Balance Sheets." *The Review of Economics and Statistics,* 85(3): 586-604.

Engelhardt, Gary V. (1996) "House Prices and Home Owner Saving Behavior." *Regional Science and Urban Economics,* 26: 313-336.

Gustman, Alan and Thomas Steinmeier. (2003) "Retirement and the Stock Market Bubble." NBER *Working Paper 9404*.

Hoynes, Hilary W. and Daniel McFadden. (1997) "The Impact of Demographics on Housing and Non-Housing Wealth in the United States." in *The Economic Effects of Aging in the United States and Japan,* ed. Michael D Hurd. and Naohiro Yashiro. NBER Project Report: 153-94.

Juster, Thomas F., Joseph P. Lupton, James P. Smith, and Frank Stafford. (2004) "The Decline in Household Saving and the Wealth Effect." *Finance and Economics Discussion Series.* Washington, DC: Federal Reserve Board.

Lehnert, Andreas. (2003) "Housing, Consumption, and Credit Constraints." Manuscript, Board of Governors of the Federal Reserve System.

Lusardi, Annamaria. (1999) "Information, Expectations, and Savings for Retirement." in *Behavioral Dimensions of Retirement Economics,* ed. Henry J. Aaron. Washington DC: Brookings Institution Press: 81-115.

Merrill, Sally. (1984) "Home Equity and the Elderly." in *Retirement and Economic Behavior* ed. Henry J. Aaron. Washington DC: Brookings Institution Press: 197-225.

Porter, Eduardo, and Motoko Rich. (2006) "Increasingly, the Home is Paying for Retirement." *The New York Times,* 24 February: C1.

Poterba, James M. (1991) Comments in "The Decline in Saving: Evidence from Household Survey." *Brookings Papers on Economic Activity*, 1: 183-256.

Poterba, James M., Steven F. Venti, and David A. Wise. (1996) "Personal Retirement Saving Programs and Asset Accumulation: Reconciling the Evidence." NBER *Working Paper 5599*.

Poterba, James M., Steven F. Venti, and David A. Wise. (1994) "Targeted Retirement Saving and the Net Worth of Elderly Americans." *The American Economic Review*, 84: 180-185.

Sheiner, Louise and David Weil. (1992) "The Housing Wealth of the Aged." NBER *Working Paper 4115*.

Skinner, Jonathan. (1989) "House Wealth and Aggregate Saving." *Regional Science and Urban Economics,* 19: 305-324.

Skinner, Jonathan. (1996) "Is Housing Wealth a Sideshow?" in *Advances in the Economics of Aging,* ed. David A. Wise. NBER Project Report: 241-271.

Stata Corporation. (2003) Stata User's Guide: Release 8. College Station, TX: Stata Press.

Venti, Steven and David Wise. (1996) "The Wealth of Cohorts: Retirement Saving and the Changing Assets of Older Americans." NBER *Working Paper 5609*.

Wooldridge, Jeffrey M. (2002) *Econometric Analysis of Cross Section and Panel Data*. Cambridge, MA: The MIT Press, 1st Edition.

Appendix 1

Active saving is defined as the change in wealth net of capital gains and losses. Intuitively, this means it should include, for example, components such as stocks purchased since 2001, improvements made to one's home in the form of additions and repairs since 2001, and the amount invested in a business or farm since 2001. It should exclude inheritances, gains to stocks purchased before 2001, and pensions that have been cashed in. By extracting variables from the 2001 and 2003 Wealth and Family files from the PSID, it is possible to generate a measure of active saving that is consistent with the measure used in previous studies for the 1989 and 1994 data. A detailed outline of the variables used to create active saving is included below.

To create active saving:
Add
- 2001 House Value
- Value of Private Annuities in 2003
- Value of Real Estate Purchased since 2001
- Cost of Additions/Repairs to Real Estate since 2001
- Amount Invested in Business/Farm since 2001
- Amount of Stocks Purchases Since 2001
- Assets removed by movers since 2001
- Debs added by movers since 2001
- Total wealth in 2003 - including Home Equity
- Equity in Real Estate in 2001
- Equity in Farm/Business in 2001
- Value of Stocks Held in 2001

and Subtract
- 2003 House Value
- Equity in Real Estate in 2003
- Equity in Farm/Business in 2003
- Value of Stocks Held in 2003
- Value of Pensions/Annuities Cashed in since 2001
- Value of Real Estate Sold since 2001
- Value of Farm/Business Sold since 2001
- Value of Stock Sold since 2001
- Debts Removed by Movers out since 2001
- Assets from Movers in since 2001
- Value of Inheritances
- Total Wealth in 2001-including home equity

Theoretically, this variable is difficult to interpret due to the inclusion of house value and home equity. An algebraic manipulation of this seems to provide some insight. It is easiest to see the intuitive interpretation by isolating the variables in question. Subsequently, the definition states:

H01+HE03
-H03-HE01
ΔH0103+ΔHE0301

where H01 is the House Value in 2001, HE03 is Home Equity in 2003, H03 is the House Value in 2003, and HE01 is the Home Equity in 2001.

Since capital gains are excluded from active saving, the sole relevant component of housing is changes in mortgages. Mortgages serve as debts and must be removed from active saving.

The first equation can be rewritten such that ΔH0103 and ΔHE0301 are expressed as mortgage rates. Thus, an equivalent expression is:

H01+HE03
-H03-HE01
M01-M03

where M01 is the value of mortgages in 2001 and M03 is the value of mortgages in 2003.

A general expression for mortgages can be written as:
H03-H01
-(HE03-HE01)
M03-M01

Multiplying this equation by -1 yields:
-H01-H03
-(HE01-HE03)
M01-M03

Which equals our original expression as included in the active saving definition.
H01+HE03
-H03-HE01
M01-M03

Thus, the PSID definition of active saving is simply adding the value of mortgages in 2001 and subtracting the value of mortgages in 2003. This effectively causes the change in the mortgage position from 2001 to 2003 to be counted as either a debt or as saving. For example, if the value of a household's mortgage has decreased in 2003, this means that the household is saving more. The increase in saving should subsequently be included in the measure of active saving.

Further explanation is also needed concerning the wealth variable. Wealth is comprised of the sum of the equity in farms/businesses, the value of checking and savings accounts, equity in other real estate, the value of stocks, the value of personal vehicles, the value of other savings and assets, and the value of pensions and annuities. All debts are subtracted from this total. Because active saving is a measure of wealth net of capital gains, all of these components of wealth should not be included in active saving. Due to the construction of the variable, many of the pieces of the wealth term are canceled and consequently not included in the measure of active saving. Once active saving is constructed, the only remaining components of wealth are the value of checking and savings accounts, the value of vehicles, the value of all other savings, and the value of annuities. Debts are still removed from this remaining amount. It is imperative to note the structure of the wealth term in order to correctly interpret the construction and interpretation of active saving.

Appendix 2

It is important to carefully analyze the construction of the variable HERATIO and the components of it in order to fully understand the implications for various values of this variable.

$$HERATIO=HE/(HE+SAVE)$$

where HE is a level measure of home equity and SAVE is retirement saving. HE has a range of $(-\infty,\infty)$ since households can have varying house values and mortgages, particularly in an age of refinancing. SAVE has a range of $[0, \infty)$. The minimum value for SAVE in the total PSID sample, even once debts are removed, is 0. Further, this is a necessary condition since Model 2 takes the log of this variable. Values of SAVE=0 are also excluded since the natural log of zero is undefined. While this restriction does remove observations from the sample, it seems irrelevant to study households' retirement saving decisions if they do not have any saving. Further, for those observations where SAVE=0, these households also do not have any home equity. Thus, they are not relevant households to sample for this study.

Based on these values of HE and SAVE, there are 4 main cases which HERATIO can assume:

Case 1: If $HE>0$, $SAVE\leq HE\rightarrow 0\leq HERATIO\leq 1$

Case 2: If $HE>0$, $SAVE>HE\rightarrow 0<HERATIO<1$

Case 3: If $HE<0$, $SAVE\leq|HE|\rightarrow 0\leq HERATIO<\infty$

Case 4: If $HE<0$, $SAVE>|HE|\rightarrow -\infty<HERATIO<0$

Trivial Case: If $HE=0$, $SAVE\neq 0\rightarrow HERATIO=0$

These cases indicate that HERATIO, in theory, can take on a range of values of $(-\infty,\infty)$. However, intuitively, it is not necessary to include values of HERATIO that are negative. Houses with negative home equity are clearly behaving in some outlying manner and do not

serve as viable representatives of household behavior. Mathematically, this would mean taking the natural log of zero which clearly is undefined. Thus, HERATIO can take values in the range $(0, \infty)$. There are only 10 observations in the sample which have a value of HERATIO>1. For these few households, as Case 3 indicates, HE is greater than SAVE. For the other 1,920 observations, HE is bounded by 0 and 1.

Appendix 3

Since retirement saving is found on both the right hand and left hand sides of the equation, it is difficult to separate out exactly how retirement saving changes.

Assume the basic double-log functional form:

$$\ln(SAVE) = \beta_0 + \beta_1 \ln(HERATIO) + \varepsilon$$

Totally differentiating this equation results in the following:

$$dSAVE / dHE = \beta_1 SAVE^2 / (HE^2 + HE \cdot SAVE(1 + \beta_1))$$

It is possible to calculate dSAVE/dHE by substituting the mean values of these variables into the derivative expression. Thus, dSAVE/dHE=139.46. While the magnitude of this derivative does not provide much information, the sign affirms the results of Model 1. This result suggests an overall market appreciation effect, but does not indicate the explicit magnitude of such a change. However, this study is concerned with the behavioral or causal effects, rather than just the correlation between various sectors of the market. As a result of this model, the most that can be said of the behavioral effect is that increases in the share lead to decreases in retirement saving.