The Financial Crisis and Saving in Personal Retirement Accounts

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Abstract
Personal retirement accounts (PRAs), especially 401(k) plans, have become an increasingly important mode of retirement saving. This paper provides new evidence on the effect of the recent financial crisis, and the associated decline in employment, on PRA saving. We particularly examine how these effects vary across demographic groups. We explore how crisis-related changes in employment and earnings affected PRA balances. We do this by estimating the effect of the crisis on these outcomes and then by considering how PRA ownership and balances depend on employment and earnings as well as other covariates. To assess the effect of the crisis we estimate the relationship between age (and other covariates) and the labor market and PRA outcomes in years prior to the crisis (2004-2006) and then estimate how these relationships change during the crisis period (2008-2010). We find very few statistically significant differences in the parameter estimates for the pre-crisis and the crisis periods. We use the model to predict age profiles of employment rates, earnings given employment, PRA ownership, and PRA balances given ownership in the pre-crisis and crisis periods. We give special attention to the relationship between education and PRA ownership and balances.

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The financial crisis of 2007-2008 had devastating effects on the finances of many American households. This analysis focuses on the impact of the crisis on one component of household wealth, namely accumulations in Personal Retirement Accounts (PRAs) defined broadly to include saving in 401(k) and similar employer-based retirement accounts, Individual Retirement Arrangements (IRAs) and Keogh plans for the self-employed. PRAs are now the principal source of retirement saving in the US. On the eve of the financial crisis in 2007, assets in private sector PRAs were over $9.1 billion, more than 3 times as much as the $2.6 billion held in private sector defined benefit plans. With PRAs becoming a keystone of retirement saving, early withdrawals from the accounts, declines in asset values, and reduced contributions can have a significant effect on financial preparation for retirement and could have important implications for potential reforms. A particular concern is that "self-directed" PRA saving may have been drawn down when households faced hardship during the financial downturn.

The aggregate effect of the crisis on PRA balances may not be evenly distributed across households and different households may have been affected in very different ways. Some households may have experienced declines in existing PRA holdings. Other households may have responded to the crisis by discontinuing (or not starting) contributions or by commencing the withdrawal of funds from these accounts. In many cases these contribution and withdrawal responses may have been triggered by the need to compensate for lost earnings following job loss. Still other households may have experienced reduced PRA asset growth because their employers suspended matching contributions.

We estimate the effect of the crisis on PRA ownership and on PRA balances given ownership. We assume that PRA ownership and PRA balances in particular are likely to be affected by crisis-related changes in employment and earnings. Thus we first estimate the effect of the crisis on these labor market outcomes and then consider the effect of these labor market outcomes on PRA ownership and balances. We give special attention to how crisis effects vary by age, health and education. Our general approach is to estimate the relationship between age (and other covariates) and employment, earnings, PRA ownership and PRA balances in the pre-crisis period (using 2004 and 2006 data) and then to estimate the incremental effect of each of the variables in the

"crisis" period using 2008 and 2010 data. The results are shown by using these estimates to predict the age profiles of employment and earnings and PRA ownership and balances in the pre-crisis and crisis periods.

In particular, we will consider how the response to the crisis varies with the level of commitment to saving (or "saving propensity") that individual households have displayed in the past. A recent Wall Street Journal blog by Kelly Greene (May 23, 2012) highlights this issue: "Americans overall stayed on track with their retirement savings in the past year--but households that were less prepared last year are even worse off this year. And households that were more prepared are saving even more aggressively for retirement. 'It's a very striking, polarizing impact on the distribution' of retirement savings,' says Merl Baker, principal of Brightwork Partners, the research firm that surveyed almost 4,000 U.S. workers for Putnam Investments, a Boston asset manager." We explain below that we can use education level as a marker for this "saving propensity."

There are a large number of studies assessing the impact of the financial crisis on the wealth and the employment of older Americans, including some that track the variation in 401(k) balances during the stock market decline of 2008-9. However, few studies have considered the effect of the financial crisis on the flow of contributions to retirement plans. Two recent papers by Dushi, Iams and Tamborini (2013) and Tamborini, Purcell and Iams (2013) are exceptions. These papers use data from the Survey of Income and Program Participation (SIPP) linked to administrative W-2 tax records to track contributions to DC plans. An important feature of these studies is their tracking of the same individuals over time. Both studies compare contribution rates during the crisis (2007-2009) to rates prior to the crisis (2003-2005). One finding is that the proportion of DC participants who decreased contributions by more than 10 percent over the two year window was 39 percent during the crisis but only 29 percent prior to the crisis. The studies also find that the proportion of participants who stopped contributions was 16 percent during the crisis, but only 13 percent prior to the crisis. Workers who experienced a decline in earnings during the crisis were more likely to both stop contributing and to decrease their contribution rate. Overall, the findings suggest that the financial crisis had a non-negligible effect on DC contribution behavior.

There are several key differences between these studies and the present analysis. First, their results pertain solely to contributions to DC plans. The present analysis looks more broadly at all types of PRAs, including IRAs and Keogh plans for the self-employed. Second, their analysis is restricted to persons who remained employed throughout the financial crisis. Thus, as they note, their estimates do not incorporate the effects of job loss on DC contributions and balances.

The studies that have tracked the balances of 401(k) plans and IRAs over the course of the crisis have found that account balances have followed the overall value of asset markets. An early study, by VanDerhei (2009), used data on 401(k) participant account balances and asset allocations to make projections of how the stock market decline of 2008 and early 2009 would reduce 401(k) balances. Subsequent work has examined actual account balances and allocations. Copeland (2012) uses the EBRI IRA database to examine changes in mean and median IRA balances over the period spanned by the recent financial crisis. He finds that mean IRA balances rose from $54,863 in 2008 to $67,438 in 2010; the median also rose, from $15,756 to $17,863. VanDerhei (2011) examines the balances in 401(k) plans, and notes that the average balance at year-end 2010 was 3.4 percent higher than at year-end 2009, but he notes that the changes for continuing participants might be substantially different.

David Wray (2012) uses data from 401(k) plan sponsors to assess the effects of the financial crisis on the private sector DC system. He finds minimal impacts: no on-going employers terminated plans and only 15 percent of plans suspended contributions in 2009. However, the data from plan sponsors does show that investors shifted out of equities in response to market volatility. Another study by Tang, Mitchell and Utkus (2012) using data from Vanguard also found a strong shift out of equities. A Towers Watson (2009) survey of 500 employers in 2009 also found that most plans did not change their structure, and that in particular only 5 percent of employers suspended company matching.

Several studies have looked at the effect of the financial crisis on wealth defined more broadly to include holdings both inside and outside of retirement plans. Gustman, Steinmeier and Tabatabai (2010, 2012) note that in aggregate, stock market investments accounted for 15.2 percent of total wealth of near-retirees. They argue that this implies

that the stock market decline, in and of itself, is unlikely to have major financial consequences for most households although some have much greater equity exposure. Using data from the HRS, they find that total wealth declined only 2.8 percent between 2006 and 2010 with most of the drop accounted for by the decline in housing wealth. They found no effect of the financial crisis on work or retirement. Coronado and Dynan (2012) find that near-retirees responded to the crisis by aggressively reducing consumption and debt so that active saving, as measured by the personal saving rate, may actually have increased. They also find that, on net, older households are delaying retirement. Hurd and Rohwedder (2012) find that households responded to the collapse in stock and housing prices by sharply reducing consumption. They also find that workers intend to work longer than they did before the crisis.

The relatively modest effects that are reported in these studies should not be interpreted as evidence that the financial crisis did not have an important and systematic effect on retirement account balances, particularly in in the depths of the 2009 stock market decline. Federal Reserve Board data from the Flow of Funds show that household net worth peaked at $68.1 trillion in 2007:Q3, and fell to $52.0 trillion in 2009:Q1. It was back to $60.2 trilion by year-end 2010. There was a 25 percent loss of wealth over an 18-month period, but half of the loss had been recouped by two years after the trough. The fact that this sharp drop does not appear in some of the studies mentioned above reflects a combination of factors. The studies don't look at the peak and the trough precisely, and many respondents may not have up-to-date information on PRA balances and other financial magnitudes, so self-reported asset values may not track the market decline. In addition, the concentration of equity ownership at the top of the wealth distribution may not be well represented in the survey. All of these considerations should be kept in mind in evaluating our findings, too.

Whether households preserve the balances that they accumulate in retirement saving accounts such as 401(k) plans and other PRA arrangements can have an important effect on the contribution of these accounts to retirement income security. Argento, Bryant and Sabelhaus (2013) consider patterns of pre-retirement withdrawals before, during and after the financial crisis. Using data from IRS forms 1099R and 5498, they find that the share of taxpayers under the age of 55 making withdrawals, while substantial

in all years, increased only modestly between 2004 and 2010. Withdrawals are slightly more likely among households experiencing marital shocks and considerably more likely in response to income shocks. Poterba, Venti and Wise (2012) study the withdrawal behavior of *post-retirement* households between 1997 and 2010 and find a relatively modest rate of withdrawals prior to the age at which households are required to take minimum required distributions. On average, households age 60 to 69 with PRA accounts withdraw only about two percent of their account balances each year, less that Argento, Bryant and Sabelhaus (2013) find for pre-retirees and considerably less than the rate of return on account balances during the sample period. Even at older ages—after the required minimum distribution age--the percentage of balances withdrawn remains at about five percent. They also find that the rate of withdrawal in 2010 is lower than the rate of withdrawal in 2005, a finding that may be partly due to the suspension of minimum distribution requirements from these accounts in 2009.

The remainder of the paper is organized into five sections. Section 1 explains the data and provides background information. Section 2 describes the estimation approach. Section 3 presents the estimation results. Section 4 presents predictions that allow us to compare the age profiles of each outcome before the crisis to the age profile during the crisis. This section also highlights the relationship between education and PRA ownership and balances. The final section provides a brief discussion of results.

Section 1. Data and Background

Health and Retirement Study Data: The analysis is based on data from the Health and Retirement Study (HRS), a nationally representative sample of adults over the age of 50 in the United States. The HRS is a longitudinal survey that resurveys respondents every two years. Respondents are followed until death and the sample is replenished with new (younger) respondents every six years. The analysis that follows uses data from the 2004, 2006, 2008 and 2010 waves. The correspondence between the interview dates for each of these waves and the timing of the financial crisis is detailed in the next section.

We focus our attention primarily on four outcome variables. The first is whether a respondent is working for pay at the time of the interview, which we denote as "employment." The second is the level of earnings, given employment, in the prior calendar year converted to 2010 dollars using the CPI. The third is whether the

respondent (or spouse if married) had a positive balance in a PRA account and the fourth is the balance in the PRA account, given a PRA, also converted to 2010 dollars. PRA accounts are defined broadly to include IRAs, Keogh plans, 401(k)s, and other similar retirement saving plans. One shortcoming of the HRS, described in Venti (2011), is that the data on 401(k) balances may be incomplete, particularly for persons who have retired but whose 401(k) accounts remain with a previous employer.

There are several additional advantages to using the HRS. It provides detailed information on health conditions, functional limitations, and the utilization of medical services. This information is used to construct a health index that is described below. The HRS also allows us to construct a measure of "saving propensity" which we define as the ratio of total wealth to lifetime earnings. Total wealth is obtained from respondent reports of holdings of home equity, other real estate, financial assets, business assets, and personal retirement accounts. Lifetime earnings are obtained from linked Social Security earnings records. We discuss the interpretation of the "saving propensity" and some of its properties below.

The Financial and Employment Crises: We first review the magnitude and timing of the financial and employment fluctuations over past decade and then ask how these events match up with the HRS survey data collected on a two year cycle. The top two panels in Figure 1-1 show trends for the S&P 500 index and the Case-Shiller housing price index. The S&P 500 index shows that stock market wealth fell by about half between October 2007 and March 2009 but rose to its pre-crisis level by March 2013. The Case-Shiller index shows that at the national level housing wealth fell by about 35 percent between February 2007 and March 2009. House prices fell by over 50 percent in some regions. The low point in national housing prices occurred in January 2012. Housing prices increased about 14 percent between the trough and March 2013.

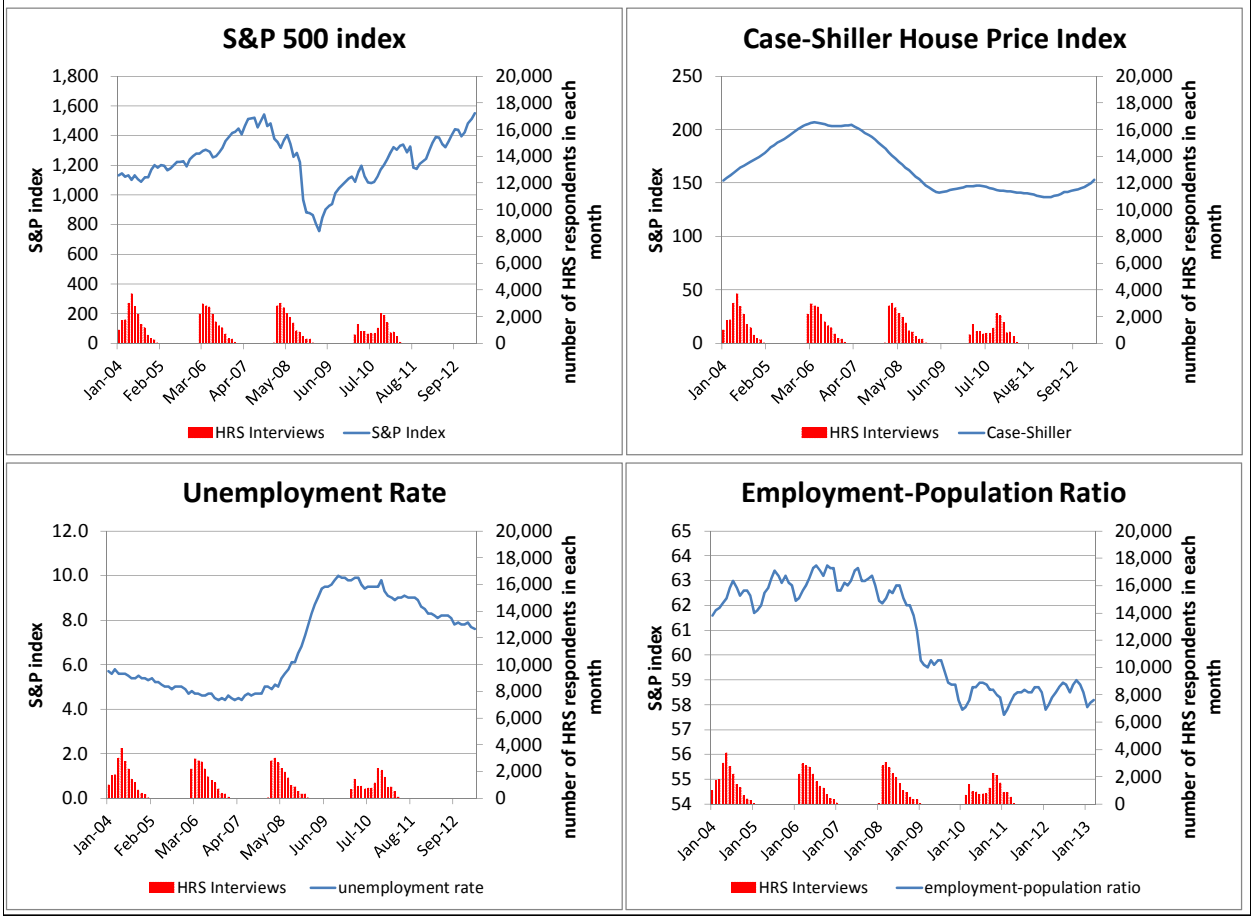
The bottom two panels of Figure 1-1 show trends for the unemployment rate and the ratio of employment to population. The unemployment rate declined from about 5.7 percent in January 2004 to about 4.6 percent in February 2007, then increased to 10 percent in October 2009. By February 2013 the unemployment rate had fallen to 7.7 percent, still well above pre-crisis levels. Perhaps the most inclusive measure of labor market health is the employment to population ratio. The pre-crisis ratio was around 63

percent. By January 2010 the ratio had fallen to around 58.5 percent and it has remained at about that level since then. Thus the recovery in the employment to population ratio has also been very slow and the ratio is still well below pre-crisis levels.

Each of the four panels in Figure 1-1 also shows the timing of the HRS survey interviews that we use in our analysis. The number of interviews in each month is shown by the vertical bars at the bottom of each panel. We note that the HRS data do not allow us to continuously follow price and employment trends on a month-to-month basis. In particular, there are two-year intervals between the HRS survey waves – we use the 2004, 2006, 2008 and 2010 waves. Each wave collects data on interview dates that are spread over approximately a one-year interval. Thus, depending on the interview date, respondents in a particular wave may have faced very different overall financial and employment market conditions. For example, some 2008 respondents may have been interviewed in March 2008 shortly after the stock market decline began and other respondents may have been interviewed in December 2008 when the stock market's value was near its low point.

Our analysis refers to data from the 2004 and 2006 waves as "pre-crisis" and data from the 2008 and 2010 waves as from the crisis period. We choose these designations because, with the exception of stock prices, housing prices and employment indicators were well below pre-crisis levels in 2010. However with respect to stock prices, the 2010 data might better be considered "post-crisis." In addition, the most recent HRS data (the 2012 survey wave), corresponding to price and employment trends after 2010, are not yet available. This is significant because these data might show some of the modest rebound in housing and labor market conditions that occurred after 2010. Nonetheless, the analysis allows us to compare the level of PRA assets, for example, of households that attained ages 60 to 64 in "crisis" years (2008 and 2010) to the level of assets of households in this age range in the "pre-crisis" years (2004 and 2006).

Figure 1-1. Monthly changes in stock and housing price indices, the unemployment rate and the employment to population ratio and the number of respondents in each HRS interview wave



Health Measure: We use a health index constructed from responses to 27 health-related questions concerning self-reported functional limitations, health conditions, and medical care usage. The index is the first principal component of these 27 indicators based on a sample that includes all HRS respondents in all years between 2004 and 2010. The principal component loadings on the health variables were used to predict a raw health score for each respondent. This score was then converted to a percentile index (ranging from 1 to 100). Thus each person's value of the percentile health index shows that person's position relative to the health of all persons in all HRS cohorts between 1994 and 2010. A more detailed description of the index, a list of included variables, and a discussion of the important features of the index is presented in PVW (2013).

Education and the Propensity to Save: As noted above, we want to understand how the effect of the crisis varied with the "saving propensity" that individual households

have displayed in the past. In this section we develop a measure of the propensity to save (or past saving commitment) and show that, given earnings, it is strongly associated with the level of education. In the model estimated below we will use education as a marker for this saving propensity. Using education rather than a direct measure of the "propensity" to save allows us to estimate the model using a larger data set, since we do not have lifetime earnings records for all households in the HRS. .

Persons with low levels of education have low earnings during their working years and thus tend also to have low assets at retirement. Education also has a strong effect on asset accumulation independent of the level of lifetime earnings: it appears to be related to the "propensity to save." We use a series of tables to show the relationship between education and the propensity to save. Table 1-1 shows the relationship between lifetime earnings and wealth (excluding Social Security and DB pension annuity wealth) for each decile of lifetime earnings. The data used in this table pertain to persons aged 55 to 70 in the 2010 wave of the HRS. Lifetime earnings are calculated from linked Social Security earnings records. Earnings are converted to 2010 dollars using the CPI. The earnings records used are capped at the Social Security taxable earnings limit so estimates of lifetime earnings, particularly in the top decile may be too low and thus estimates of the ratio of wealth to earnings may be too low. There are two issues that may produce spurious high estimates of the ratio in the lower deciles. ~~Also~~First, some persons may have considerable earnings not reported as SS covered earnings because they worked in jobs not covered by Social Security or were recent immigrants. This may lead to an underestimate of earnings and an over estimate of the ratio. We experimented with excluding all persons who ever worked in state or local government and excluding recent immigrants, but neither had an appreciable effect on the results. The second issue is that for widows and widowers the numerator of the ratio reflects wealth accumulated as a two-person household but because of data limitations the denominator in most cases reflects only the lifetime earnings of the surviving spouse. This will result in an overestimate of the ratio. Excluding widows and widowers from the estimates does have an appreciable effect on the estimated ratio in the lower deciles. The estimates in Tables 1-1 and 1-2 below reflect this exclusion.

The last column shows the ratio of wealth to lifetime earnings. This is our empirical indicator of the propensity to save. For most households this ratio reflects the cumulation of household spending and saving decisions over a lifetime. However, this ratio is also influenced by differences among households in rates of return earned on assets, inheritances, and unanticipated consumption shocks. Once we exclude the problematic lowest deciles the ratio is flat throughout most of the range of lifetime earnings. The ratio jumps up for the ninth decile and is likely severely underestimated for the tenth decile because the earnings data are top-coded. There is some evidence that those who earn more – at least those in the top fifth of the lifetime earnings distribution – also save more.

Table 1-1. Lifetime earnings, wealth at retirement age, and the ratio of mean wealth to mean lifetime earnings, by lifetime earnings percentile.

Lifetime earnings decile	mean lifetime earnings	mean wealth (excluding Social Security and DB annuity wealth)	ratio of mean wealth to mean earnings
1	256,733	131,104	0.51
2	702,480	294,913	0.42
3	1,125,829	266,414	0.24
4	1,524,132	308,635	0.20
5	1,887,471	344,339	0.18
6	2,237,103	494,438	0.22
7	2,569,323	493,713	0.19
8	2,983,265	669,917	0.22
9	3,454,882	1,109,689	0.32
10	4,538,507	1,251,429	0.28

Table 1-2. Ratio of mean wealth to mean lifetime earnings, by income decile and by education

Lifetime earnings decile	<HS	HS	Some college	College or more
1	0.38	0.26	0.25	1.70
2	0.07	0.24	0.43	1.05
3	0.11	0.18	0.20	0.45
4	0.17	0.13	0.20	0.35
5	0.13	0.17	0.18	0.22
6	0.18	0.12	0.23	0.41
7	0.07	0.16	0.20	0.27
8	0.10	0.14	0.20	0.33
9	0.15	0.12	0.18	0.61
10	0.12	0.16	0.28	0.30
Average of deciles 3-10	0.13	0.15	0.21	0.37

Table 1-2 shows how the ratio of wealth to lifetime earnings varies by education and lifetime earnings decile. By comparing the two tables it can be seen that the association between lifetime earnings and the wealth-to-lifetime earnings ratio can in part be explained by the correlation between education and earnings. The last row of Table 1-2 shows that within earnings deciles 3 to 10 the ratio of mean wealth to mean lifetime earnings rises from 0.13 for persons with less than a high school degree to 0.37 for persons with a college degree or more. At each level of education the positive association between lifetime earnings and wealth is modest if we ignore the top and bottom earnings deciles. In short, education affects lifetime earnings, but also is strongly related to the propensity to save independent of the level of lifetime earnings. For this reason, in the analysis in section 3 we use education as a proxy to control for differences in the propensity to save.

Section 2. Estimation Approach

PRA withdrawals may be precipitated by job loss. We begin with estimates of the effect of the financial crisis on employment and on earnings given employment. Then we

estimate the effect of employment and earnings, as well as other covariates, on PRA ownership and balances in the pre-crisis and crisis period. This allows us to determine the pre-crisis relationship between PRA ownership and balances on the one hand and employment and earnings on the other, and to assess how changes in ownership and balances responded to changes in employment and earnings that resulted from the crisis. We restrict the analysis to persons age 50 and older.

We use an indicator variable of whether a person is currently employed for pay as our measure of employment (denoted by *E*). The earnings variable (denoted by *Y*) is earnings over the past year. We only estimate an earnings equation for persons who are employed. Both employment and earnings are functions of age (*A*), health (*H*), education (*S*), and marital status (*M*). The estimated employment and earnings equations are:

$$E = \left(k + \alpha A + mM + hH + sS\right) + \left(\tilde{k} + \tilde{\alpha} A + \tilde{m} M + \tilde{h} H + \tilde{s} S\right) * Y_{08\text{–}10}$$

$$Y = \left(k + \alpha_y A + m_y M + h_y H + s_y S\right) + \left(\tilde{k} + \tilde{\alpha}_y A + \tilde{m}_y M + \tilde{h}_y H + \tilde{s}_y S\right) * Y_{08\text{–}10}$$

In this specification age is specified as a linear spline with breakpoints at ages 55, 60, 65, 70, and 75. Education is specified as four completion levels—less than high school, a high school degree, some college, and college or more—less than high school is the base (excluded) group. Separate estimates are obtained for men and women. The parameter estimates (α, *m* ,*h*, and *s* in the employment equation and their counterparts in the earnings equation) are estimates of the average effect of each covariate over the entire 2004 to 2010 period. The estimates indicated by a ~ are the additional effect of each covariate in the crisis period. Thus the specification allows the relationship between education and employment to differ between the pre-crisis and the crisis periods.

The relationships between covariates and PRA ownership (PRA_O) and balances (PRA_B) are specified in the same way but employment and earnings are also allowed to affect PRA ownership and balances.

$$PRA_O = \left(k + \gamma_O E + \lambda_O Y + \alpha A + mM + hH + sS\right)$$
$$+\left(\tilde{k} + \tilde{\gamma} E_O + \tilde{\lambda}_O Y + \tilde{\alpha} A + \tilde{m} M + \tilde{h} H + \tilde{s} S\right) * Y_{08-10}$$
$$PRA_B = \left(k + \gamma_C E + \lambda_C Y + \alpha_y A + m_y M + h_y H + s_y S\right)$$
$$+\left(\tilde{k} + \tilde{\gamma}_C E + \tilde{\lambda}_C Y + \tilde{\alpha}_y A + \tilde{m}_y M + \tilde{h}_y H + \tilde{s}_y S\right) * Y_{08-10}$$

In the first equation, the overall effect of the financial crisis on employment is given by $\left(\tilde{k} + \tilde{\alpha} A + \tilde{m} M + \tilde{h} H + \tilde{s} S\right)$. Similar effects can be calculated for earnings, PRA ownership and PRA balances. The individual parameter estimates also allow us to determine which subgroups of persons (identified by age, marital status, education, saving propensity and health) had outcomes affected by the crisis. An additional advantage of this specification is that it allows us to compare outcomes (such as the employment rate or PRA ownership) for persons who were a given age, say 60 to 64, in the crisis period to persons who were the same age in the pre-crisis period.

In the estimates presented below we exclude saving propensity, which is available for only 65% of the HRS sample. The constraint in this regard is data on lifetime earnings, which require linked Social Security earning records. We experimented the ratio of wealth to lifetime earnings (a proxy for the saving propensity) as an additional covariate, but with education included in the specification, the coefficient on the saving propensity was typically insignificant from zero. Thus we only include education in the results reported here. Estimates are obtained for men and women separately. The unit of observation in each of these equations is the person. This means that in a two-person household each partner enters as a separate observation. Employment status, earnings, health, and the other covariates pertain to the person. However, PRA ownership and the PRA balance are calculated at the household level because we cannot distinguish individual ownership of PRA accounts in our data.

Section 3. Results

Parameter Estimates: The parameter estimates for the four equations are shown for men and women in Tables 3-1 and 3-2 respectively. The top panel of each table shows estimates for 2004 and 2006 and the bottom panel shows the *additional* effect for 2008 and 2010. Probit marginal effects are reported for the employment and the PRA ownership equations. Earnings are estimated by least squares regression; the equations

for PRA balances given ownership are estimated by poisson regression. Very few of the crisis period coefficient estimates are significantly different from zero—only four for men and five for women. Each equation also contains a crisis period intercept, $\tilde{k}$, that is an estimate of the crisis period effect controlling for the covariates. None of these crisis period intercept coefficients is statistically significant.

For men near the retirement age (60 to 64), employment was 2.3 percent higher in the crisis than in the pre-crisis period, suggesting that the age of retirement was delayed. The earnings of men who were married also declined somewhat. The link between earnings and PRA ownership was also a bit stronger in the crisis period—the probability of owning a PRA increased by an additional one tenth of a percent for each $1,000 in additional earnings. Men were also somewhat more likely to have a PRA at ages 75-79. For women, all of the five significant crisis period coefficients (z of 1.98 or greater) were for PRA ownership. As for men, earnings for women were also more strongly related to PRA ownership in the crisis period, suggesting that earnings shocks were more likely to result in the closure of PRA accounts during the crisis. Also, the relationship between a college education and PRA ownership was substantially greater for women during the crisis period. The estimates suggest that women were less likely to have a PRA in the 55-59 age range and more likely to have a PRA in the 60-64 age range.

In general, the relationship between personal attributes on the one hand and employment outcomes, PRA ownership and balances on the other did not differ much between the pre-crisis and crisis periods. There are, however, two noticeable features of the pre-crisis estimates. First, the education gradient is very strong for all four of the outcomes. Employment and earnings are also related to PRA ownership but the estimated effects of these variables are not nearly as large as the effect of education. This is true for both men and women. A surprising result is that for both men and women, employment is associated with lower PRA balances in our data.

Table 3-1. Estimated marginal effects for pre-crisis and crisis periods, men

	Probability of Employment		Earnings given Employment		Probability of PRA Ownership		PRA Balance given Ownership	
	estimate	z	estimate	z	estimate	z	estimate	z
effects for pre-crisis period (2004-2006)								
employed					0.059	3.82	-46,698	-3.28
earnings (000's)					0.002	10.28	611	7.99
age 50-54	-0.011	*-1.01*	239	*0.22*	0.012	*1.25*	3,921	*0.38*
age 55-59	-0.011	*-1.77*	-219	*-0.33*	0.007	*1.18*	11,522	*2.35*
age 60-64	-0.059	*-10.26*	-2,480	*-3.34*	0.004	*0.65*	11,215	*2.40*
age 65-69	-0.026	*-5.13*	-3,791	*-3.45*	0.011	*2.22*	-2,119	*-0.48*
age 70-74	-0.023	*-4.00*	-3,784	*-1.28*	-0.007	*-1.39*	-4,727	*-0.56*
age 75-79	-0.040	*-5.34*	-976	*-0.29*	-0.009	*-1.54*	-12,530	*-2.11*
health	0.006	*22.93*	230	*6.41*	0.002	*9.14*	874	*4.14*
high school	0.044	*2.15*	21,488	*8.56*	0.230	*12.89*	50,953	*2.41*
some college	0.090	*4.09*	32,288	*11.55*	0.269	*14.32*	145,096	*5.93*
college or more	0.143	*6.68*	55,145	*19.82*	0.382	*20.73*	248,339	*11.05*
married	0.131	*6.83*	19,377	*8.17*	0.183	*10.68*	64,611	*3.34*
additional effect for crisis period 2008-2010								
employed					0.015	*0.74*	-2,819	*-0.12*
earnings (000's)					0.001	*2.87*	192	*1.52*
age 50-54	-0.019	*-0.67*	625	*0.23*	0.012	*0.45*	1,879	*0.11*
age 55-59	-0.004	*-0.39*	-1,506	*-1.35*	-0.006	*-0.60*	1,558	*0.19*
age 60-64	0.023	*2.69*	1,225	*1.16*	-0.006	*-0.76*	-11,190	*-1.44*
age 65-69	-0.011	*-1.41*	587	*0.38*	-0.006	*-0.83*	13,116	*1.88*
age 70-74	0.010	*1.11*	3,855	*1.08*	0.011	*1.38*	-3,039	*-0.29*
age 75-79	-0.008	*-0.76*	-7,059	*-1.77*	0.018	*2.18*	-6,579	*-0.73*
health	0.000	*-1.05*	58	*0.99*	0.000	*-0.11*	104	*0.25*
high school	0.024	*1.10*	-5,532	*-1.23*	-0.002	*-0.12*	15,003	*0.43*
some college	-0.001	*-0.06*	-532	*-0.11*	0.012	*0.56*	-7,778	*-0.21*
college or more	0.029	*1.22*	-1,647	*-0.36*	0.024	*1.12*	-3,698	*-0.10*
married	-0.027	*-1.35*	-8,752	*-2.28*	-0.004	*-0.26*	15,608	*0.54*
crisis period	0.079	*0.58*	5,043	*0.37*	-0.036	*-0.03*	-5,462	*-0.06*
N	23,549		9,455		23,549	0.079	12,572	
pseudo R2	0.2456				0.1762			
Wald			1,608				1,338	

Note: The probability of employment and the probability of ownership are estimated using a probit model. The earnings and PRA balance equations are estimated using poisson regression. Marginal effects are evaluated at the means of the data. The pre-crisis estimates are from 2004 and 2006 responses and the crisis period estimates are from 2008 and 2010 data.

Table 3-2. Estimated marginal effects for pre-crisis and crisis periods, women

	Probability of Employment		Earnings given Employment		Probability of PRA Ownership		PRA Balance given Ownership	
	estimate	z	estimate	z	estimate	z	estimate	z
effects for pre-crisis period (2004-2006)								
employed					0.108	*7.37*	-89,079	*-9.28*
earnings (000's)					0.003	*7.02*	589	*6.08*
age 50-54	-0.007	*-0.78*	-543	*-0.91*	0.011	*1.36*	12,015	*2.12*
age 55-59	-0.020	*-3.80*	-437	*-1.11*	0.021	*3.97*	11,404	*3.71*
age 60-64	-0.041	*-8.28*	-1,575	*-3.42*	-0.008	*-1.61*	2,017	*0.60*
age 65-69	-0.037	*-7.88*	-2,807	*-4.73*	0.005	*1.20*	-6,273	*-1.77*
age 70-74	-0.029	*-5.18*	-3,500	*-3.88*	0.001	*0.29*	2,644	*0.36*
age 75-79	-0.061	*-7.50*	-3,862	*-1.78*	-0.008	*-1.36*	-9,971	*-2.19*
health	0.005	*23.23*	140	*7.25*	0.003	*13.27*	1,041	*5.96*
high school	0.137	*7.47*	11,725	*5.94*	0.304	*17.71*	42,095	*1.79*
some college	0.194	*9.62*	19,821	*9.79*	0.364	*20.30*	95,746	*3.77*
college or more	0.234	*10.91*	36,522	*16.98*	0.424	*23.11*	153,975	*6.35*
married	-0.091	*-6.91*	-2,401	*-2.23*	0.180	*14.51*	77,962	*8.56*
additional effect for crisis period 2008-2010								
employed					0.027	*1.43*	6,108	*0.44*
earnings (000's)					0.002	*2.79*	110	*0.78*
age 50-54	-0.012	*-0.73*	593	*0.55*	0.020	*1.19*	-8,751	*-0.81*
age 55-59	0.004	*0.49*	183	*0.30*	-0.018	*-2.06*	-8,497	*-1.73*
age 60-64	-0.005	*-0.62*	480	*0.73*	0.022	*2.79*	6,420	*1.32*
age 65-69	0.003	*0.36*	606	*0.68*	-0.014	*-1.97*	5,344	*1.02*
age 70-74	0.004	*0.49*	-406	*-0.30*	0.005	*0.66*	-8,009	*-0.93*
age 75-79	-0.010	*-0.88*	-4,682	*-1.76*	0.014	*1.73*	-3,345	*-0.41*
health	0.000	*0.23*	31	*0.99*	0.000	*0.33*	365	*1.51*
high school	0.001	*0.03*	-1,197	*-0.33*	0.019	*1.02*	32,453	*1.04*
some college	-0.005	*-0.24*	-513	*-0.14*	0.012	*0.57*	14,218	*0.44*
college or more	-0.011	*-0.52*	-3,387	*-0.91*	0.069	*3.08*	29,475	*0.93*
married	0.007	*0.54*	2,900	*1.74*	-0.005	*-0.39*	6,407	*0.54*
crisis period	0.055	*0.76*	-4,810	*-0.77*	-0.112	*-1.57*	4,755	*0.08*
N	31,648		11,318		31,648		15,228	
pseudo R2	0.2449				0.1983			
Wald			1,887				1,177	

Note: The probability of employment and the probability of ownership are estimated using a probit model. The earnings and PRA balance equations are estimated using poisson regression. Marginal effects are evaluated at the means of the data. The pre-crisis estimates are from 2004 and 2006 responses and the crisis period estimates are from 2008 and 2010 data.

Figures 3-1 (men) and 3-2 (women) graph the covariate estimates in each of the four equations. This allows us to easily compare relative magnitudes of the covariate effects. The most striking result is the relationship of education to each of the outcomes.

It is common understanding that education is strongly related to employment at older ages and to earnings given employment. What is less commonly understood is the strong association between education and saving, *independent* of earnings. In section 2 we showed that education is not only strongly associated with lifetime earnings, but also has a strong effect on the propensity to save at all lifetime earnings levels. The results here show the strong relationship between PRA ownership and education, controlling for earnings. For example, for men, the increase in the probability of PRA ownership associated with having a high school degree is over nine times as great as the increase associated with a $10,000 increment in earnings. The effect of a college degree is over 15 times as large as the increase associated with a $10,000 increment in earnings.

Controlling for earnings, the association between education and the PRA balance is also very large. While a $10,000 increment in earnings is associated with about a $6,000 increment is the PRA balance, the effect of education ranges from about $51,000 for a high school degree versus less than a high school education to almost $250,000 for a college degree or more versus less than a high school degree. For both PRA ownership and the PRA balance given ownership, the relationship between these outcomes and a ten percentage point increase in health is approximately equivalent to the effect of a $10,000 increase in earnings. Men who are married are also substantially more likely than single men to have a PRA and also have larger PRA balances given ownership. The results for women are very similar to the results for men.

Figure 3-1. Estimated effect of household attributes on each outcome: men

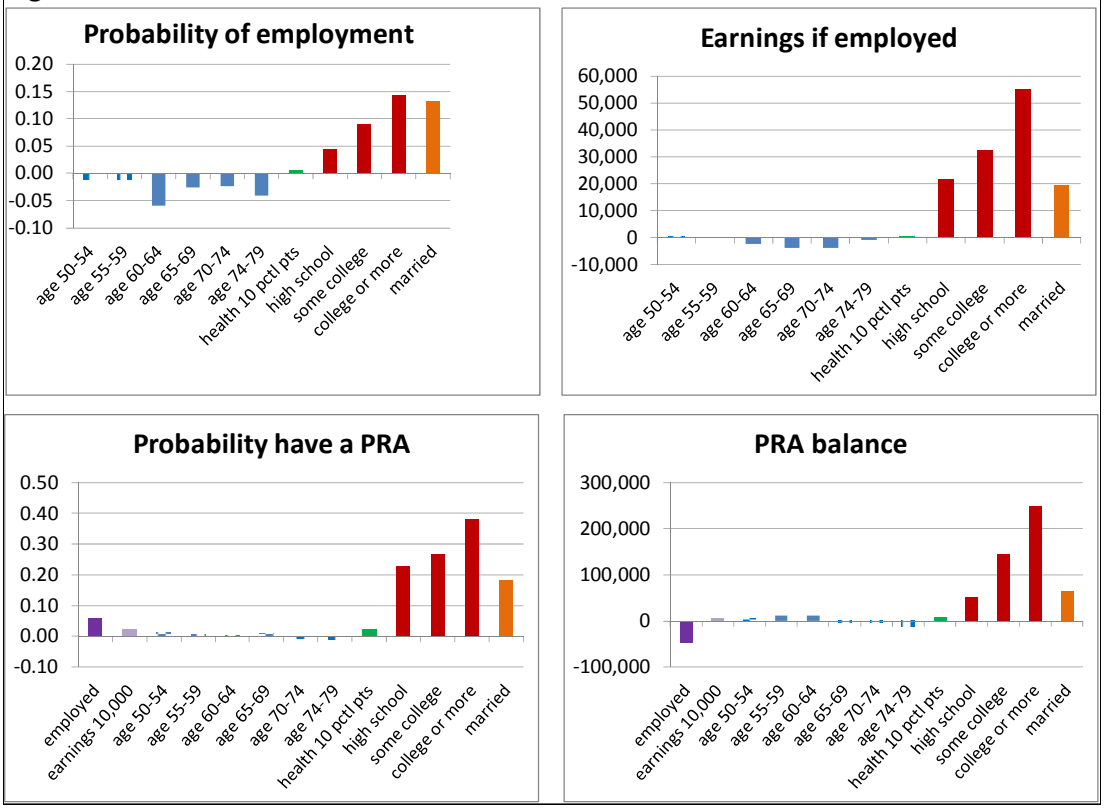
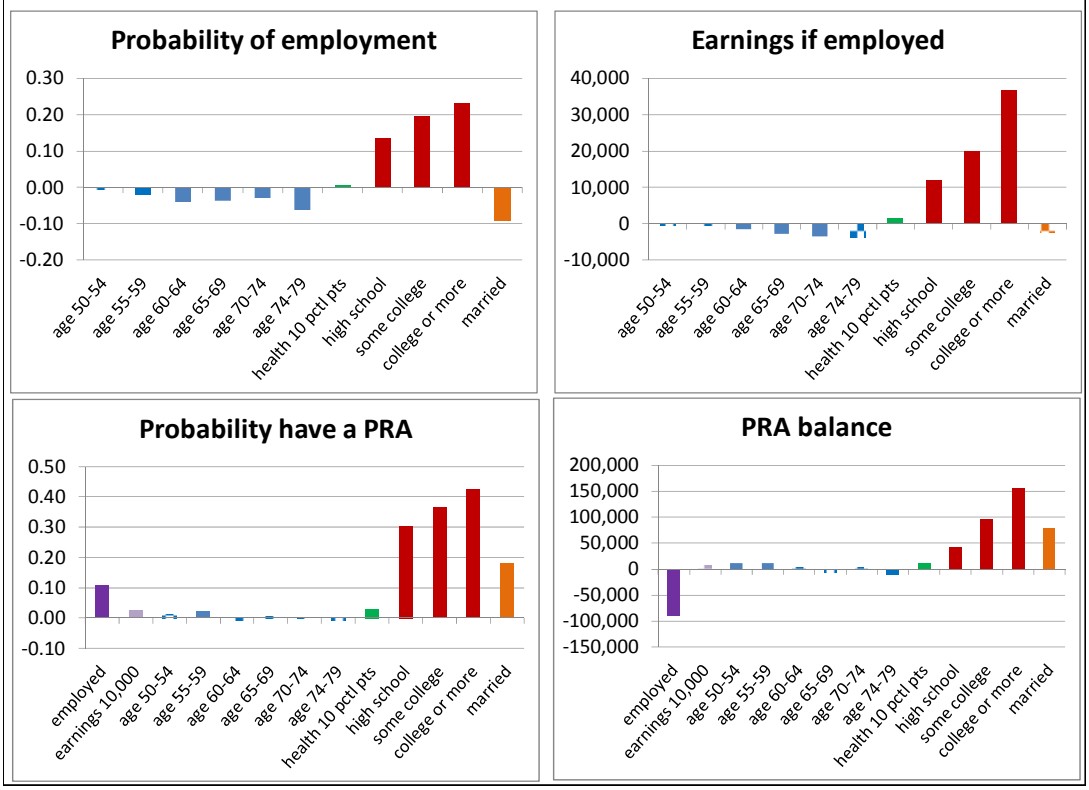


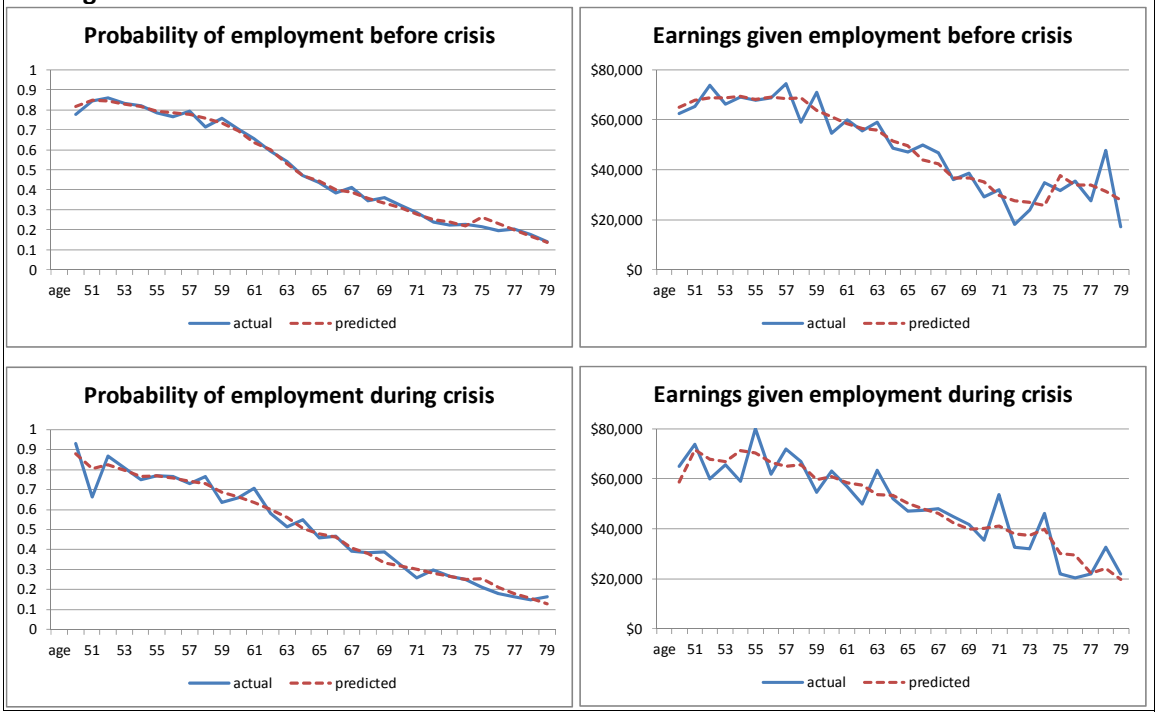
Figure 3-2. Estimated effect of household attributes on each outcome: women



Section 4. Predictions of Crisis-Period Effects and Education Effects

Predicted versus Actual: We use the estimates shown in Tables 3-1 and 3-2 to predict outcomes based on the full set of covariates for each sample member. We then calculate the weighted average of each outcome at each age. The advantage of using predicted values rather than actual values is that the age profile of predictions is much smoother. The relatively small number of observations at each age makes the actual age profile highly variable. The top left panel of Figure 4-1 compares the actual age-profile of employment to the model prediction for the pre-crisis period for men. The top right panel compares actual and predicted age-profiles for earnings given employment before the crisis. The bottom two panels make the same comparisons for the crisis period. In general, the actual and predicted series appear to be very similar although the model predictions are much smoother than the actual data, due largely to the piecewise linear age specification. The actual and predicted values for PRA ownership and PRA balances given ownership (not reported) are similarly close. In all cases the fit for women is similar to that of men.

Figure 4-1. Predicted vs actual employment and earnings outcomes before and during crisis at each age for men



Pre-Crisis versus Crisis: Model predictions for the crisis and pre-crisis periods by age for each of the two employment outcomes are shown for men (top panels) and women (bottom panels) in Figure 4-2. Note that for the most part the differences between the estimated parameters in the pre-crisis and crisis periods are not statistically significant, as shown in lower panel of Table 3-1. At younger ages, below age 61, men were less likely to be employed—for example at age 56 the probability of employment was 0.758 during the crisis and 0.786 before the crisis; at age 66 the probabilities were 0.462 and 0.401. The higher employment at older ages apparently represents delayed retirement in the crisis period. For women the probability of employment is higher in the crisis period between ages 55 and 63, suggesting that some women in this age range may have re-entered the labor force during this period.

The differences between crisis and pre-crisis outcomes are more pronounced for the age profiles of earnings given employment. Earnings may have been somewhat lower during the crisis period for men under age 62 but earnings were substantially higher at older ages. For women, crisis period earnings are higher beginning about age 55 and continuing well into old age, again suggesting that the crisis stimulated female labor supply--for example at age 57 the difference is $65,047 v $68,314, while at age 72 it is $37,521 v $26, 396.

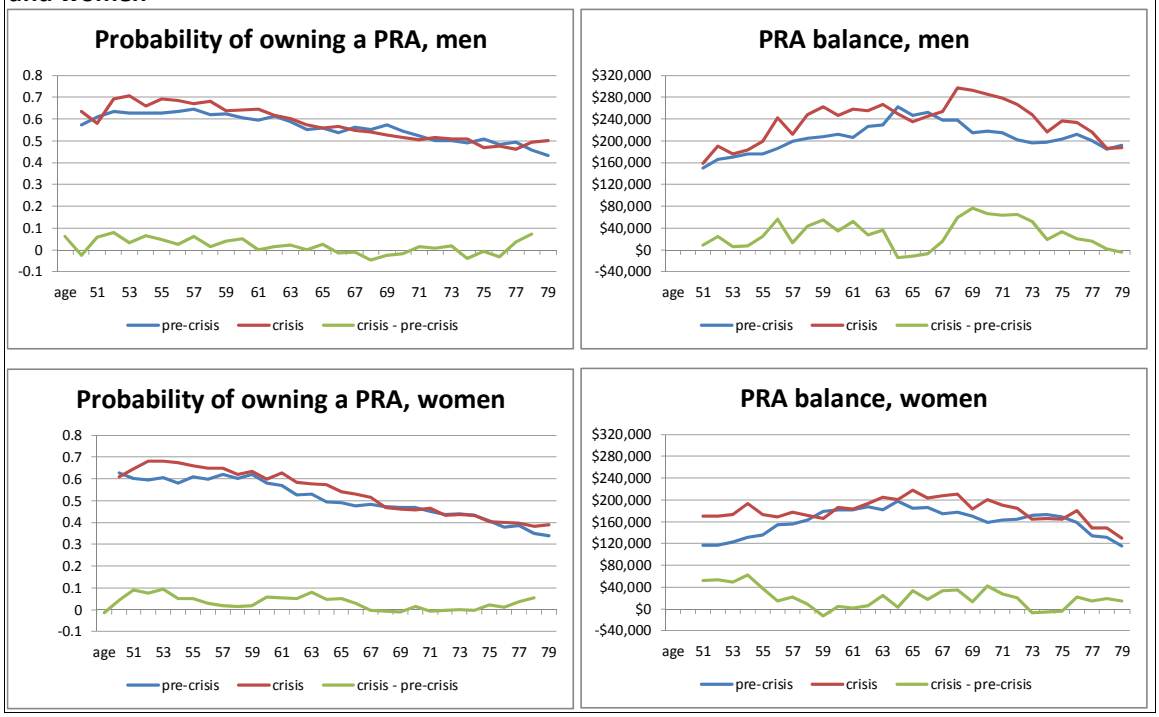
Figure 4-3 shows crisis and pre-crisis age profiles for PRA ownership and balances. For both men and women under age 66 PRA ownership rates are higher during the crisis than before it. For example, for men the probability of PRA ownership was 0.68 during the crisis and 0.62 before the crisis at age 58, but there was little difference at older ages. That is, persons who attained age 58 at a later date—in the crisis period compared to the pre-crisis period—are more likely to have a PRA. This would suggest that when the younger age group attains age 65, a greater proportion will have a PRA than the proportion among those who were age 65 during the pre-crisis period. PRA ownership may decline at older ages because of cohort differences in the age profiles (the group attaining age 65 in the crisis period reached this age between two and six years later than the group that attained age 65 in the pre-crisis period).

PRA ownership may also decline at older ages because some households may exhaust their PRA balance, although our analysis elsewhere of drawdown behavior

suggests that this proportion is likely to be quite small. Given a PRA, the PRA balance was larger during the crisis period than the pre-crisis period at almost all ages for both men and women—for example $262,073 versus $207,910 at age 58 and $284,980 versus $218,431 at age 69 for men. The increase reflects a combination of trends in financial asset prices and contributions and withdrawals from PRAs. We know the trend in financial asset prices but do not have complete data from the HRS on PRA contributions and withdrawals. Nonetheless the data suggestthat households that attained age 66 in 2008-2010 had greater PRA balances than those who attained this age in 2004-2006.

Figure 4-2. Predicted employment and earnings outcomes before and during crisis at each age for men and women

Figure 4-3. Predicted PRA ownership and balance before and during crisis at each age for men and women



The Role of Education: For each of the four outcomes we show predictions like those above by education group. The results for men are shown in Figures 4-4a through 4-4d. For each outcome the age profiles generally have the same shape, but the levels differ substantially. Differences by level of education in the employment rate and especially earnings are well understood. At age 50, employment of men with less than a high school degree is about 70 percent compared to over 90 percent for college graduates. At age 50 earnings of men with less than a high school degree are about $40,000 on average, compared to almost $100,000 for those with a college degree.

The differences for PRA ownership and balances given ownership are of greater interest. The relationship between PRA ownership and education is striking. In the early 50s fewer than 30 percent of those with less than a high school degree have a PRA. Well over 50 percent of high school graduates, over 60 percent of those with some college, and over 80 percent of college graduates in this age range have a PRA. These differences are likely explained in large part by access to 401(k) accounts that are much less prevalent in small firms, firms with low-paying jobs, and with substantial job turnover. Given a PRA, the PRA balance also differs a great deal by education. At age 65, the average balance is

about $100,000 for those with less than a high school degree, about $150,000 for those with a high school degree, about $200,000 for those with some college, and over $350,000 for those with a college degree.

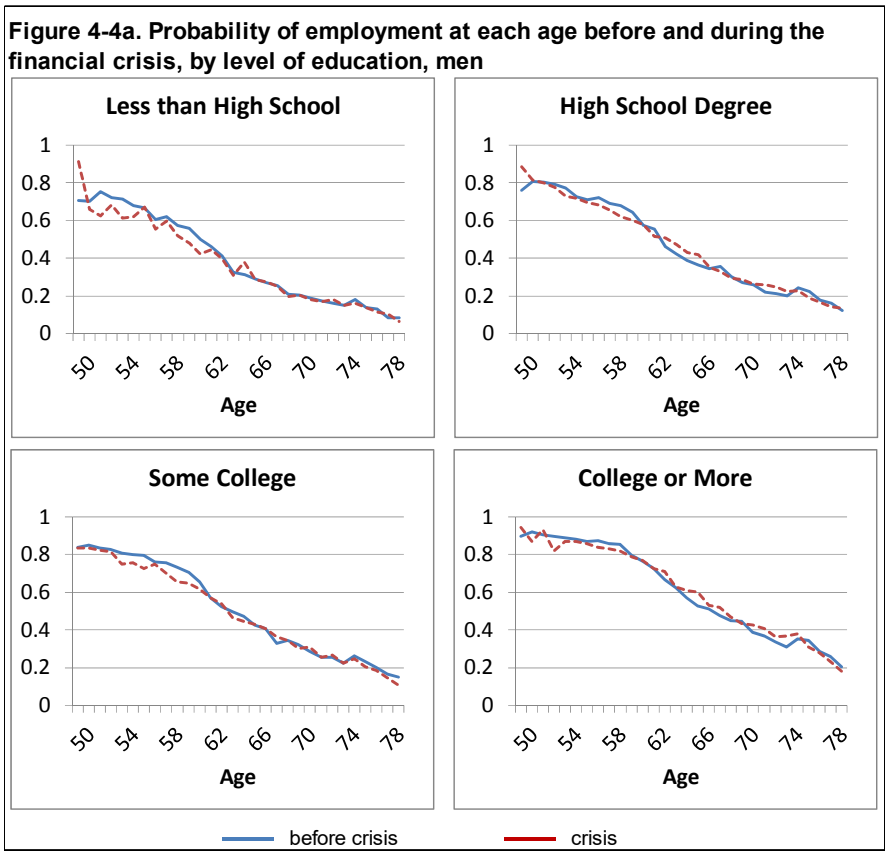


Figure 4-4b. Earnings given employment at each age before and during the financial crisis, by level of education, men

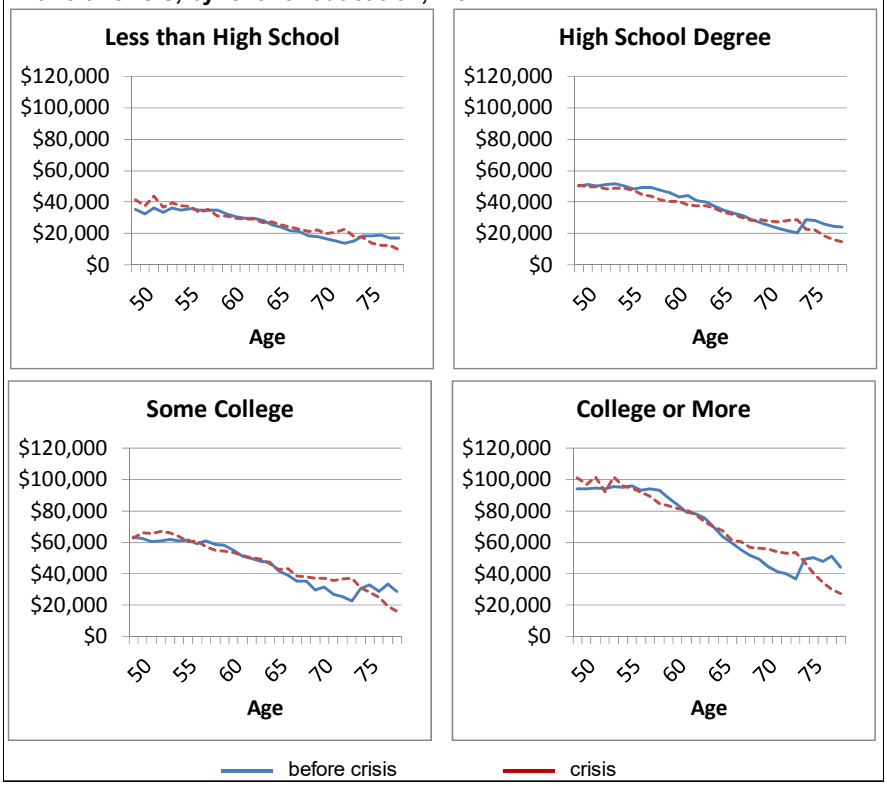


Figure 4-4c. Probability of owning a PRA at each age before and during the financial crisis, by level of education, men

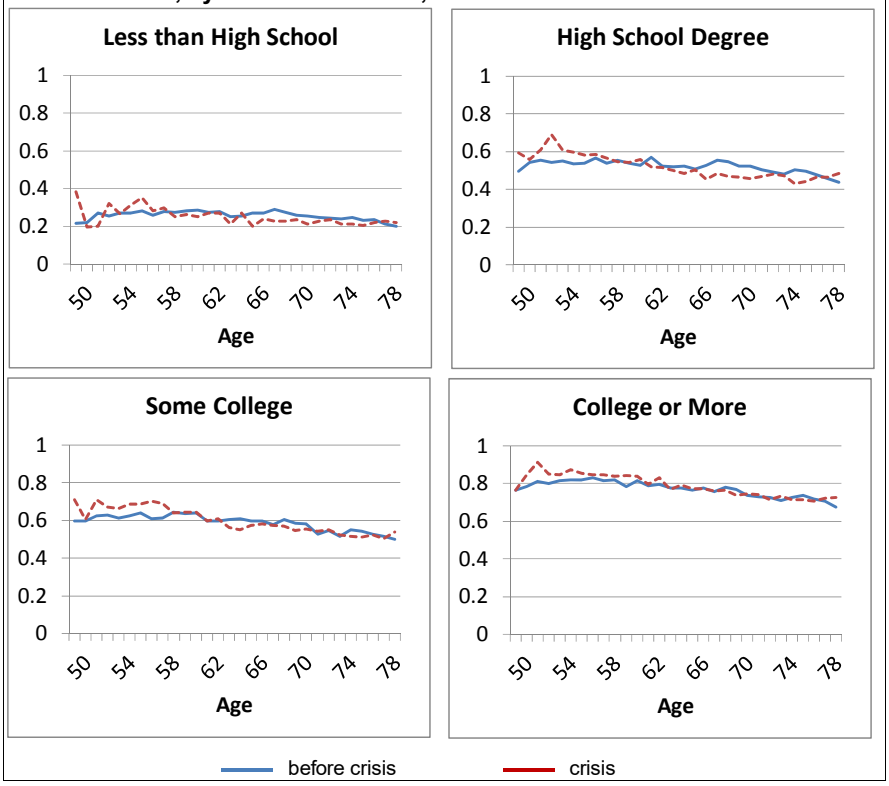
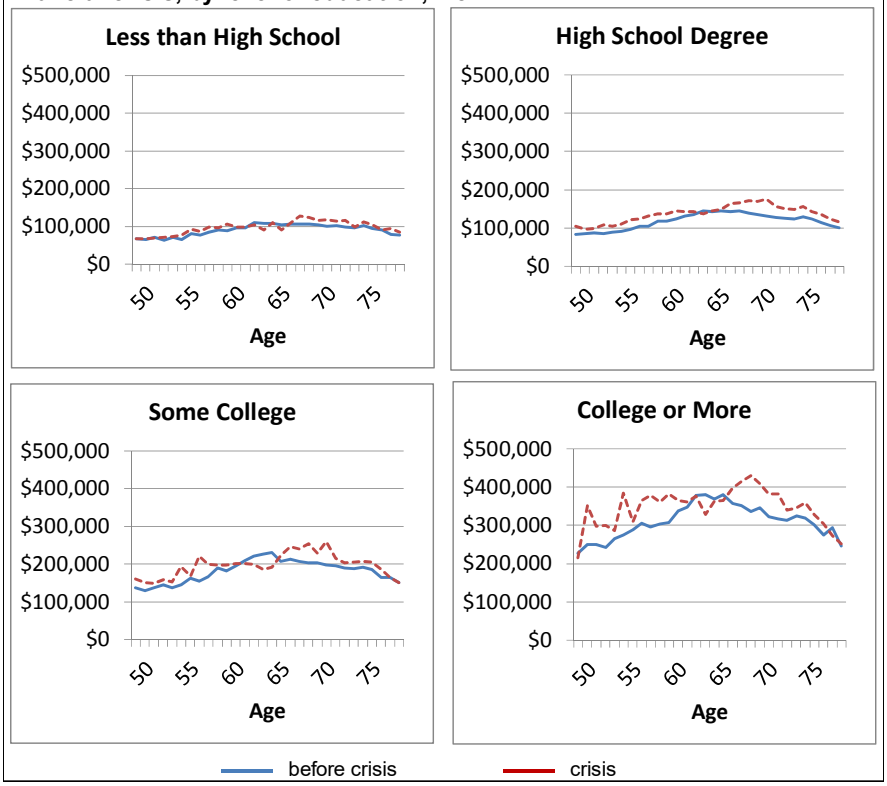


Figure 4-4d. PRA balance given ownership at each age before and during the financial crisis, by level of education, men



Section 5. Conclusions and Discussion

We have estimated the effect of the financial and employment crises on PRA ownership and PRA account balances. We have also estimated the effect of the crises on the employment and earnings of older Americans. We caution that the HRS data we use to measure the "crisis" response are from 2008 and 2010. The 2008 data may pre-date the trough of the crisis and the 2010 data may post-date the trough. By 2010 stock prices had rebounded dramatically, but housing prices and most labor market indicators were still well below pre-crisis levels. The estimates reveal several noticeable patterns. First, the employment rate for men age 50 to 60 was 3 percentage points lower during the crisis than before the crisis, but the employment rate at retirement ages (61 to 67) was greater during the crisis than in the pre-crisis period. The lower rate at younger ages is likely the result of job loss during the crisis and the higher employment rate at traditional retirement ages was apparently due to delayed retirement.

For men in their fifties, PRA ownership was greater during the crisis than in the pre-crisis period. This may have resulted simply from the secular increase in PRA

ownership – persons at a given age in the pre-crisis period belong to an older birth cohort than persons who reached the same age in the crisis period, and they were less likely to have access to 401(k) plans in the workplace than workers a few years younger. In addition for men 65 and older, PRA balances were noticeably greater during the crisis period that during the pre-crisis years. We do not have good data on contributions and withdrawals that would allow us to determine the source of PRA account growth.

To determine the crisis period effects we estimated the relationship between each outcome and a set of covariates including the *additional* effect of each covariate in the crisis period. Although most of the additional "crisis" effects were not statistically significant, many of the baseline estimates are of particular interest. The most striking findings are the very strong relationships between the level of education and PRA ownership and PRA account balances. Formen, the increase in the probability of PRA ownership associated with having a high school degree is over nine times as great as the increase associated with a $10,000 increment in earnings. The effect of a college degree is over 15 times as large as the increase associated with a $10,000 increment in earnings. Controlling for earnings, the association between education and the PRA balance is also very large. While a $10,000 increment in earnings is associated with about a $6,000 increment in the PRA balance, the effect of education (compared to those without a high school degree) ranges from about $51,000 for those with a high school degree to almost $250,000 for those with a college or post-college degree.

We interpret the relationship between PRA balances and education, controlling for earnings and health status as consistent with education as a proxy for the propensity to save. As an indicator of the propensity to save we calculated the ratio of wealth to lifetime earnings for all sample members who had linked Social Security earnings records. Given any level of lifetime earnings, the ratio of accumulated assets to lifetime earnings is, on average, 0.13 for persons with less than a high school degree, 0.16 for those with a high school education, 0.23 for persons with some college, and 0.47 for persons with a college degree or more. Education is also very strongly related to PRA ownership. The relationship of education of PRA ownership is surely due in large part to the employment of persons with low education in low-paying and high-turnover jobs that tend not to offer 401(k) plans.

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