BANK OF CANADA
BANQUE DU CANADA

Working Paper/Document de travail
2015-15

# Household Stockholding Behavior During the Great Financial Crisis

by Jie Zhou

www.bank-banque-canada.ca

Bank of Canada Working Paper 2015-15

May 2015

# Household Stockholding Behavior During the Great Financial Crisis

**by**

**Jie Zhou**

Financial Stability Department
Bank of Canada
Ottawa, Ontario, Canada K1A 0G9
jzhou@bankofcanada.ca



ISSN 1701-9397 

# Acknowledgements

I thank John Campbell, Michael Ehrmann, Jianjian Jin, Katsiaryna Kartashova, Kyre Lahtinen, Fuchun Li, conference participants at the Financial Management Association annual meeting and the Canadian Economics Association annual meeting, and seminar participants at NTU, Saint Mary's University and Statistics Canada for helpful comments.

# Abstract

Using the Panel Study of Income Dynamics, this paper studies household stock market participation and trading behavior in 2007–09, a period that saw a major stock market downswing. The stock market participation rate fell after the market crash. We find evidence that less-educated households, poor households and households with heads belonging to a minority are the ones that dropped out of the market after the market crash. We also find that, of the households that held stocks in non-retirement accounts in 2007, a significant portion reported no stock market activity in non-retirement accounts during the crisis period.



*JEL classification: G01, G11*
*Bank classification: Asset pricing; Financial markets*



# Résumé

À partir des données de panel de l'étude sur la dynamique des revenus (Panel Study of Income Dynamics), nous nous intéressons à la participation des ménages au marché boursier et à leur comportement transactionnel de 2007 à 2009, période où les marchés boursiers ont subi une baisse marquée. À la suite de l'effondrement des marchés, le taux de participation au marché boursier a chuté, et nous constatons que les ménages moins instruits, les ménages pauvres et les ménages dont le chef appartient à une minorité sont ceux qui ont quitté le marché à ce moment-là. Nous observons aussi qu'une proportion importante de ménages qui détenaient des actions dans des comptes autres que des comptes de retraite en 2007 n'ont déclaré aucune activité boursière liée à ces comptes pendant la crise.



*Classification JEL : G01, G11*
*Classification de la Banque : Évaluation des actifs; Marchés financiers*

# Non-Technical Summary

Analyzing households' stock market participation and their trading activities is important for understanding the distribution of wealth and financial risk that households face. The stock market crash of 2008 offers an environment that allows us to analyze household behavior in response to a large negative shock.

In this paper, we examine American households' stockholding behavior during the great financial crisis. We use the 2007 and the 2009 waves of the Panel Study of Income Dynamics to address this issue. We find that the overall stock market participation rate across all accounts dropped 2.6 percentage points during the crisis (from 49.0% in 2007 to 46.4% in 2009). The majority of households exhibited the same participation status in the two surveys. However, many households switched their stockholding status. For example, in non-retirement accounts, 31.3% of stock owners in 2007 became non-stock owners in 2009, while 8.3% of non-stock owners in 2007 became stockholders in 2009. Our estimation suggests that less-educated households, poor households and households with heads belonging to a minority are the ones that dropped out of the market after the market crash.

We also find that for households that held stocks in non-retirement accounts in 2007, a significant portion of them reported no stock market activity during the crisis period. Higher educational attainments, greater financial net worth and a higher initial share of equity in non-retirement accounts in 2007 are closely associated with trading in 2007–09. Moreover, if a household sold real estate in 2007–09, it is more likely that the household also sold stocks during the same period.

# 1 Introduction

The stock market crash in 2008 and the subsequent financial crisis had a significant impact on the balance sheets of many stock market participants. These market participants also reacted to the market shock. Since households' stockholding behavior has wide-ranging implications for understanding both the allocation of risk in financial markets and the distribution of wealth, it is important to study the experiences of households during the crisis period. Moreover, the economic significance of individual households' stockholding behavior rises because of an increasing self-responsibility for building up retirement wealth.

In this paper, we examine American households' stockholding behavior during the great financial crisis. In particular, we are interested in two sets of questions that pertain to the period 2007–09 on (1) stock market participation and (2) trading behavior. The first set of questions includes the following: Were there significant changes in stock ownership during the period? How persistent was the participation status during the period? Which household characteristics were associated with stock ownership? The second set of questions, pertaining to trading behavior, includes the following: How widespread was stock trading/inactivity during the period? Which household characteristics were associated with trading or inactivity?

We use the 2007 and the 2009 waves of the Panel Study of Income Dynamics (PSID) to address these questions. These two consecutive surveys cover the years both before and after the stock market crash in 2008, which provides an opportunity to determine whether this event influenced individual households' stock market participation decisions and to examine their trading patterns during the crisis period.

The various financial accounts owned by households can be classified into two broad categories: retirement accounts and non-retirement accounts. Retirement accounts refer to Individual Retirement Accounts (IRAs) and employer-based pension plans. All other accounts are defined as non-retirement accounts. We find that,

in both survey years, less than half of our sample households participated in the stock market (in either type of account or both). The overall stock market participation rate across all accounts dropped 2.6 percentage points (from 49.0% in 2007 to 46.4% in 2009).[1] This change is statistically different from zero at the 1% level. The majority of households exhibited the same participation status in the two surveys. However, many households switched their stockholding status, and more households exited the stock market than began owning stocks during the period. For example, in non-retirement accounts, 31.3% of stock owners in 2007 became non-stock owners in 2009, while 8.3% of non-stock owners in 2007 became stockholders in 2009.[2]

To gain a better understanding of the determinants of stock ownership during the period under consideration, we first estimate a bivariate probit model of stock ownership using these two surveys. Our results show that education and wealth (both financial and non-financial) have a large and significant impact on the probability of stock ownership. Better-educated households and wealthy households are more likely to own stocks. The probability of holding stocks is also higher for households with heads that are white, and home ownership is associated with stock ownership. These results are consistent with previous research on stock market participation.[3] The crisis has little impact on the relationship between these characteristics and stock ownership.

Next, we pool the 2007 and the 2009 samples together and estimate a probit model to gauge the impact of the financial crisis on stock ownership. We find that after controlling for standard household characteristics, the estimated effect of the year 2009 dummy variable suggests that the stock ownership across all accounts in 2009

[1] If we look only at the stock market participation rate in non-retirement accounts, it dropped from 25.2% in 2007 to 23.5% in 2009.

[2] Across all accounts, 25.7% of stock owners in 2007 became non-stock owners in 2009, while 19.6% of non-stock owners became stock owners during the same period.

[3] See Mankiw and Zeldes (1991), Haliassos and Bertaut (1995), Bertaut (1998), Vissing-Jorgensen (2002), and Calvet, Campbell, and Sodini (2009).

dropped 2.9 percentage points compared to that in 2007. This decline is statistically significant at the 1% level.

We further explore which households dropped out of (entered into) the stock market in the 2009 survey conditional on owning (not owning) stocks in the 2007 survey. We find that less-educated households, poor households and households with heads belonging to a minority are the ones that dropped out of the market after the market crash. Previous studies, such as Malmendier and Nagel (2011) and Ampudia and Ehrmann (2013), have suggested that large shocks in the stock market can have a long-lasting impact on investors' perceptions and risk-taking behavior. We expect that the decision to exit the stock market during the crisis by these households could have a large impact on the long-term performance of their portfolios and wealth accumulation, since these households are likely to remain out of the stock market and miss the potential gains when the market recovers.

The PSID respondents were also asked about their stock transactions (i.e., whether they purchased or sold stocks) that had occurred in non-retirement accounts since the last survey year. However, this information is not available for retirement accounts, such as IRAs and employer-based pension plans. Thus, we use the information on stock transactions in non-retirement accounts to examine households' trading behavior in 2007–09.

Many factors could influence trade. Trade can happen because of rational motivations. Trade can also be stimulated by differences in opinion or behavioral reasons.[4] The PSID data do not allow us to explicitly test the effects of these factors separately. Instead, we document households' trading patterns in 2007–09, and we run a

[4]See Harris and Raviv (1993), Kandel and Pearson (1995), Hong and Stein (2003), and Sarkar and Schwartz (2009). The literature has also documented some significant behavioral patterns, for example, loss aversion and belief in contrarianism or momentum, which might be evidence of investor overconfidence or biased self-attribution (Odean (1998), Daniel, Hirshleifer, and Subrahmanyam (1998), and Berkelaar, Kouwenberg, and Post (2004)).

multinomial logit model to study the role of household characteristics and major life changes in 2007–09 in determining both the inactivity and the trading patterns for stocks held in non-retirement accounts.

For households that held stocks in non-retirement accounts in the 2007 survey, we find that slightly more than half of them reported no stock market activity in non-retirement accounts in 2007–09, when there was a major stock market downswing.[5] We further classify our sample households into four mutually exclusive categories in a multinomial logit model. The first category comprises those households who undertook no trades in stocks in non-retirement accounts during the period 2007–09. The other three categories represent households reporting stock trading in 2007–09 with one of the following three trading types: exclusively buying, exclusively selling, or both buying and selling stocks.

Our results suggest that higher educational attainments, greater financial net worth and a higher initial share of equity in non-retirement accounts in 2007 are closely associated with trading in 2007–09. Whereas these factors significantly reduced the tendency for there to be no trades, they significantly increased the probability of both buying and selling stocks in non-retirement accounts during the period under consideration. Moreover, if a household sold real estate in 2007–09, it is more likely that the household also sold stocks during the same period. We do not find any significant effects of race, gender, number of children, household labor income, private pension coverage or employment status on trading patterns in non-retirement

[5]Unlike current stock ownership, PSID data on past trading practices are known to suffer from systematic under-reporting of trades. Some respondents in the surveys reported moving from being stock owners in 2007 to becoming non-stock owners in 2009 while simultaneously reporting that they did not make any stock transactions in the 2-year period. If we drop all observations with this type of "forgotten" trade, approximately 40% of stockholders in 2007 undertook no trades in stocks in non-retirement accounts during the period 2007–09, but if we count these observations as households with stock trading, about 30% of stockholders in 2007 undertook no trades during the period.

accounts.

This paper is related to the large literature on household finance.[6] In particular, a number of recent studies have examined individual households' behavior during the great financial crisis. Hudomiet, Kezdi, and Willis (2011) use Health and Retirement Study data to study the impact of the stock market crash of 2008 on American households' expectations about the returns on the stock market index. They find that cross-sectional heterogeneity in expected returns, an indicator of the amount of disagreement, increased substantially with the stock market crash. Tang, Mitchell, and Utkus (2011) examine investors' trading behavior in 401(k) plans during the recent financial crisis. Weber, Weber, and Nosic (2013) survey U.K. online-brokerage customers at 3-month intervals between September 2008 and June 2009. They find that risk taking by these investors changed substantially during the period, as did return and risk expectations. Using a Dutch data set, Hoffmann, Post, and Pennings (2013) measure individual investors' perceptions on their expectations for stock-market returns, their risk tolerance, and their risk perceptions during the financial crisis, while Bucher-Koenen and Ziegelmeyer (2014) and Dorn and Weber (2013) examine German data. As a complement to this empirical literature, our paper shows that the crisis has a significant impact on American households' stockholding behavior using PSID data. We find that less-educated households, poor households and households with heads belonging to a minority are the ones that dropped out of the stock market following the market crash. This finding has important implications for better understanding how a major financial market shock affects the allocation of risk among households, and its potential impact on households' wealth accumulation.

The remainder of this paper is organized as follows. Section 2 provides a litera-

[6]See Mankiw and Zeldes (1991), Bertaut (1998), Guiso, Haliassos, and Jappelli (2002), Ameriks and Zeldes (2004), Campbell (2006), Shum and Faig (2006), Calvet, Campbell, and Sodini (2009), Bilias, Georgarakos, and Haliassos (2010), and Christelis, Georgarakos, and Haliassos (2011). Guiso and Sodini (2013) provide an excellent survey.

ture review that motivates our hypotheses on stock market participation. Section 3 describes the data. Section 4 presents results regarding stock market participation and Section 5 studies stock trading behavior. Section 6 concludes.

# 2 Hypotheses

In this section we present related literature and develop our hypotheses about household stock market behavior during the financial crisis.

Classic portfolio theory assumes that investors' individual risk taking depends on investors' risk attitude and their estimates about the expected return and its variance (Markowitz (1952)). Previous evidence suggests that both return and risk expectations can vary substantially over time, as a result of macroeconomic events or individually experienced gains or losses (Shiller, Kon-Ya, and Tsutsui (1996), Glaser and Weber (2005), Hoffmann, Post, and Pennings (2013), and Weber, Weber, and Nosic (2013)). Investors' risk attitude may also change with macroeconomic conditions and large events in the financial market (Sahm (2007), and Guiso, Sapienza, and Zingales (2013)). For example, Guiso, Sapienza, and Zingales (2013) find that the risk aversion of an Italian bank's clients increased substantially after the financial crisis.

The recent financial crisis could be expected to lower investors' return expectations and risk tolerance, increase their risk perceptions, and adversely affect their stock market participation and risk-taking behavior.

Previous studies by Basak and Cuoco (1998), Vissing-Jorgensen (2002), Haliassos and Michaelides (2003), and Alan (2006) have suggested that costs could significantly discourage stock market participation. The stock market participation costs represent a combination of explicit and implicit hurdles such as information acquisition about investment opportunities, more complicated tax filing, and the value of time spent to learn how to trade and rebalance a portfolio. A common finding in the literature, that

wealth and education attainment have a positive and statistically significant impact on stock market participation, is consistent with the argument of participation costs.

During the financial crisis, household wealth was hit hard as households suffered great losses in the stock market. For our PSID sample households, median and mean net worth fell about 15%, respectively, in 2007–09.[7] If there are per-period costs of stock market participation, the participation constraint will become binding for some poor households and less-educated households who are not financially sophisticated. Hence, poor households and less-educated households are more likely to drop out of the stock market during a crisis.

Based on the discussion above, we hypothesize that:

$H_1$. The overall stock market participation rate drops due to a financial crisis.

$H_2$. Poor households and less-educated households are more likely to drop out of the stock market during a financial crisis.

# 3 Data

The data set used in this paper is the Panel Study of Income Dynamics (PSID), a longitudinal study of a representative sample of U.S. individuals and the families in which they reside. It has collected data on demographics, employment, income, wealth and numerous other topics. The PSID is also a good population-wide panel survey on stock market participation and trading. Because we are interested in the changes in household stockholding behavior during the great financial crisis, we use the 2007 and the 2009 PSID.[8] These two consecutive surveys cover the periods both before and after the stock market crash in 2008.

[7] If we focus on those households having retirement accounts in 2007 in the PSID data, we find that the average wealth in retirement accounts fell from \$127,663 in 2007 to \$93,546 in 2009 and the median fell from \$40,000 in 2007 to \$23,000 in 2009. This finding may suggest that many households suffered significant losses in their retirement accounts during the 2-year period in 2007–09.

[8] In each survey year, about 90% of households were interviewed in March–July.

For the purpose of our study, households are included in the sample if they satisfy five criteria. The first criterion is that the household was interviewed in both the 2007 and the 2009 surveys. Second, there was no change in the head of the household. Third, wealth can be observed for the household. To find the wealth of a household, we require that either the value of each asset class is given by the respondent or that it can be estimated using the information provided by the respondent.[9] Fourth, the household had positive financial assets in at least one of the two surveys. Households with zero financial assets in both surveys are excluded so as not to equate stock market non-participation with the decision to hold no assets at all (or the inability to do so). Fifth, the household was not part of the Survey of Economic Opportunity (SEO) sample. The initial PSID sample consists of two independent subsamples of the U.S. population — the Survey Research Center sample, which is a cross-sectional national sample, and the SEO sample, which is a national sample of low-income families. We drop all SEO sample households and focus on the cross-sectional national sample in this study.

The non-SEO PSID sample includes 5,877 households in 2007 and 6,083 households in 2009, respectively. The first four sample selection criteria further reduce the sample size, so that our main sample contains 4,140 households in each survey.

# 4 Stock Market Participation

In this section, we examine stock ownership using the PSID data. By looking at the same households two years apart, in 2007 and 2009, we can observe the stock-

[9]For example, the respondent does not give the exact amount of a certain type of asset but provides a range for the value of the asset. We then replace the missing value with the average of the range. We drop one observation (ER42002=1748) due to the suspicious value of its other real estate. In 2007, the value was $1 million for the household, but it became $100 million in 2009. For more details on household assets and debts, please see the appendix.

holding decisions of those households that held stocks in both 2007 and 2009, those households who abstained from stock market participation in both years, and those households who changed their stockholding status. This period is of particular interest because it covers the years both before and after the stock market crash in 2008. We would like to address several questions, such as the following: Were there significant changes in stock ownership during the period under consideration? How persistent was the participation status of households in the stock market? How did household characteristics and major life changes affect stock ownership?

## 4.1 Stock Market Participation Status in PSID

The various financial accounts owned by households can be classified into two broad categories: retirement accounts and non-retirement accounts. Retirement accounts refer to IRAs and employer-based pension plans. Non-retirement accounts are other financial accounts including checking accounts, savings accounts, brokerage accounts and so on. In non-retirement accounts, households can invest in virtually any asset, including stocks, bonds, mutual funds and other types of asset. Retirement accounts also require active decisions by eligible households. These households need to make decisions about whether to participate, how much to contribute and how to invest their money in retirement accounts. In principle, employer-sponsored defined contribution plans may be invested in a similarly broad way as in non-retirement accounts, but, in practice, employers provide investment menus, which typically include equity funds and other types of funds, to plan participants. Hence, households can hold stocks in both non-retirement accounts and retirement accounts, provided that they have these accounts.

Table 1 reports the stock ownership status of households in the two surveys based on the types of accounts in use. It suggests that stock ownership dropped after the market crash in 2008. When we consider stock ownership across all accounts (i.e.,

in either type of account or both), the percentage of households owning stocks was 49.0% in 2007 and it decreased to 46.4% in 2009. The drop of 2.6 percentage points is statistically different from zero at the 1% level. The stock market participation rate also dropped in non-retirement accounts (from 25.2% in 2007 to 23.5% in 2009).[10] The stock ownership across all accounts is much higher than that in non-retirement accounts. This reflects the fact that many households hold stocks through retirement accounts. Overall, we find that less than half of our sample households participated in the stock market. This finding is in contrast to the prediction of standard models, which suggest that, given an equity premium and conventional preferences (e.g., CRRA preferences), all households with positive savings should participate in the stock market.[11] To resolve this puzzle, previous studies by Basak and Cuoco (1998), Haliassos and Michaelides (2003), and Alan (2006) have suggested that entry costs and/or per-period costs could significantly discourage stock market participation.

[Table 1]

How persistent is stock ownership in the two surveys? Table 2 presents a breakdown of households according to their stock market participation status in non-retirement accounts in both 2007 and 2009. The table suggests that stock ownership is highly persistent, since 85.9% of households exhibited the same participation status in both surveys. The remaining 14.1% of households switched their stockholding status, with more having exited from the stock market (7.9%) than having switched into stock ownership (6.2%). We note that the likelihood of a stock owner becoming a non-stock owner (31.3%) was much higher than the probability of someone who owned no stock in 2007 becoming a stockholder in 2009 (8.3%). Of course, considering

[10]The drop in the participation rate in non-retirement accounts is also statistically significant.

[11]The theoretical result has been confirmed in both infinite-horizon models (Heaton and Lucas (1997), Heaton and Lucas (2000), Koo (1998), Haliassos and Michaelides (2003)) and finite-horizon models (Bertaut and Haliassos (1997), Cocco, Gomes, and Maenhout (2005)).

only the participation status when the surveys were conducted does not necessarily imply that households did not trade within the period under consideration. We will examine their trading behavior in a later section of the paper.

By grouping households according to their stock market participation status across all accounts, Table 3 also shows a tendency of the majority of households (77.4%) to exhibit the same participation status over the period under consideration. Whereas 12.6% of the surveyed households were stockholders in the 2007 survey but not in the 2009 survey, 10.0% had moved in the opposite direction. Again, the likelihood of a stock owner becoming a non-stock owner was higher than the probability of someone who owned no stock in 2007 becoming a stockholder in 2009.

[Table 2]

[Table 3]

## 4.2 Sample Characteristics

Table 4 shows the summary statistics (mean and median) for our sample households. The statistics for age, race, gender, education and marital status refer to the household heads. The other variables are reported at the household level. By grouping households based on their stock market participation status across all accounts, Table 4 shows that households that own stocks are considerably different from non-stock owners in many dimensions.

[Table 4]

Not surprisingly, the data reveal that stockholders are both considerably wealthier and better educated than non-stock owners. The very limited wealth of many non-participants suggests that they may have little incentive to optimize their portfolios, or that they may be discouraged from doing so by fairly small fixed costs. Stock owners

also tend to have higher labor income and they are more likely to be homeowners and to have private pension coverage. These differences between stock owners and non-stock owners are found in both the 2007 and the 2009 surveys. If we consider only non-retirement accounts and we divide households into stock owners and non-stock owners, we obtain very similar results.

## 4.3 What Determines Stock Market Participation?

What determines stock ownership? In this section, we first estimate a bivariate probit model of stock ownership in these two surveys. We then pool the 2007 and the 2009 samples together and examine the effect of the 2009 dummy variable on stock ownership.

Let there be two binary dependent variables $Y_j$, $j = 1, 2$. Each is generated by a probit equation, and the two equations' errors are correlated. Thus, we have the following model:

$$Y_1^* = X_1\beta_1 + \varepsilon_1, \tag{4.1}$$

$$Y_2^* = X_2\beta_2 + \varepsilon_2, \tag{4.2}$$

where the $Y_j^*$ are unobservable, and are related to the binary dependent variables $Y_j$ by the rule

$$Y_j = \begin{cases} 1 & \text{if } Y_j^* > 0 \\ 0 & \text{if } Y_j^* \leq 0 \end{cases} \qquad j = 1, 2. \tag{4.3}$$

We look at stock ownership in non-retirement accounts first. The first equation of the bivariate probit specification models the probability that a household held stocks in non-retirement accounts in the 2007 survey, while the second equation models the probability that a household owned stocks in non-retirement accounts in the 2009 survey. We include the following household characteristics as explanatory variables: age, race, gender, education, marital status, employment status, the number

of children under age 18, labor income, financial net worth, non-financial net worth, home ownership, private business ownership, private pension coverage and location (i.e., whether in rural areas). The variables age, race, gender, education, marital status and employment status refer to household heads. Other variables refer to the households in their entirety. In the second equation, to capture major life changes in 2007–09, we further include a few dummy variables as explanatory variables, for example, a change in marital status in 2007–09 and whether the household bought real estate in 2007–09. The specification allows for potentially different effects of the observable characteristics in the two surveys.

Table 5 presents the marginal effects of our bivariate probit regressions. To begin, we consider the 2007 survey. A number of observations are noteworthy. First, race, gender and education have a significant impact on stock ownership.[12] The probability of holding stocks in non-retirement accounts is two percentage points higher for households with heads that are white or male. Education has an even larger effect: whereas households with heads that have a college (COL) education are 4.5% more likely to own stocks in non-retirement accounts than households with heads having a high school education, households with heads that have less than a high school (LTHS) education are 5.0% less likely to own stocks in non-retirement accounts. Both effects are statistically significant at the 1% level. Second, the probability of stock ownership decreases with the number of children under age 18 and increases with labor income, financial net worth, and non-financial net worth. In particular, the impact of wealth on stock ownership is economically large and statistically significant at the 1% level.[13] Third, the effects of home ownership and private business ownership on stock owner-

[12] Age seems to have little impact on stock ownership in non-retirement accounts.

[13] The regression controls for labor income, financial net worth and non-financial net worth by means of logarithms. According to Table 5, the marginal effect of ln(financial net worth) is 0.0048. This implies that an increase in the financial net worth of $22,000 will increase the probability of stock ownership in non-retirement accounts by 4.8%.

ship in non-retirement accounts are significantly positive.[14] However, marital status does not appear to influence stockholding. Private pension coverage also increases the probability of a household owning stocks, but the magnitude is small and the impact is not very significant.

Overall, our results from the 2007 survey are consistent with previous research on stock market participation (Mankiw and Zeldes (1991), Haliassos and Bertaut (1995), Bertaut (1998), Vissing-Jorgensen (2002), Calvet, Campbell, and Sodini (2009), and Bilias, Georgarakos, and Haliassos (2010)). These studies also find that the effects of income, wealth, education attainment and race (white) on stock market participation are positive and statistically significant.[15]

[Table 5]

The results in the 2007 survey largely hold true in the 2009 survey.[16] This suggests that the crisis has little impact on the main relationship between household characteristics and stock ownership. In 2009, education, wealth and race still had large and significant impacts on the probability of stock ownership in non-retirement accounts.[17]

Next, we examine stock ownership across all accounts. We estimate a similar bivariate probit model, but the first equation now models the probability that a household held stocks across all accounts in the 2007 survey, while the second equation models the probability of a household owning stocks across all accounts in the 2009

[14]Households with private businesses are more likely to hold stocks than those without private businesses. It could be that households of the former type are interested in using stocks to diversify the idiosyncratic risk of their businesses, or that acquiring information about specific firms and their prospects is easier for them.

[15]One caveat is that some relationships can suffer from endogeneity bias. For example, if stock ownership increases wealth, it will lead to an upward bias for the estimated effect of wealth.

[16]The estimated correlation between the error terms in the model, $\rho$, is 0.73 and significant.

[17]However, gender and labor income had a smaller impact and became less significant in 2009 than in 2007.

survey. Table 6 reports the results. We find that most of the results presented in Table 5, where we look at stock ownership in non-retirement accounts, are also valid in Table 6. Perhaps the most dramatic change is the impact of private pension coverage: whereas it has a large, positive and significant impact on stock ownership across all accounts, it has only a small, positive effect on stock ownership in non-retirement accounts. This phenomenon reflects the fact that many households own stocks through employer-based pension plans. Normally, employer-based pension plans provide uniform and simple vehicles for employees to make investment choices, which makes it easier to access the stock market than is the case in non-retirement accounts.

[Table 6]

Finally, we pool the 2007 and the 2009 samples together to examine how stock ownership across all accounts has changed after the financial crisis. We estimate a probit model of stock ownership, in which explanatory variables include standard household characteristics. To gauge the potential changing stock ownership from survey to survey, we also include a 0–1 year dummy variable in the estimation. The year dummy variable takes a value of 1 for the 2009 PSID households. The focus of our interest in this exercise is the impact of the year dummy variable. Table 7 presents the marginal effects of the probit model. We find that education, wealth, race, home ownership, private business ownership and private pension coverage have significant impact on stock ownership. Moreover, the marginal effect of the year 2009 dummy variable is significantly negative. Compared to that in 2007, the stock ownership rate dropped 2.9 percentage points in 2009 for these PSID households after controlling for standard household characteristics. This decline is statistically significant at the 1% level. Combining the results in Table 1 and Table 7, we find evidence in support of hypothesis $H_1$. That is, the overall stock market participation rate drops due to the financial crisis. Next, we examine the entry and exit in the stock market and test

hypothesis $H_2$, which suggests that poor households and less-educated households are more likely to drop out of the stock market during the financial crisis.

[Table 7]

## 4.4 Stock Market Entry and Exit after a Market Crash

Table 2 shows that, in 2007–09, the likelihood of a stock owner becoming a non-stock owner was much higher than the probability of someone who owned no stock in 2007 becoming a stockholder in 2009 (i.e., the conditional probability of a household dropping out of the market was much higher than the conditional probability of a household joining the market). This section tries to explore which households dropped out of (entered into) the market in the 2009 survey conditional on owning (not owning) stocks in the 2007 survey. We examine this issue in non-retirement accounts.[18]

We introduce a probit model, in which the dependent variable measures whether a household dropped out of (entered into) the stock market in non-retirement accounts in 2009 conditional on owning (not owning) stocks in non-retirement accounts in 2007. For stock market exit, the reduced sample now contains only those households that held stocks in non-retirement accounts in the 2007 survey (there are 1,043 such households). As before, we include household characteristics and dummy variables for major life changes in 2007–09 as explanatory variables. Table 8 presents the marginal effects on the estimated probability of a household dropping out of the stock market in non-retirement accounts in the 2009 survey. A household's education and financial net worth had a large and significant impact on the exit decision. For example, compared to households with heads who were high school graduates, households with

[18]Similar results are obtained if we examine stock ownership across all accounts. One major difference is that, when we look at stock ownership across all accounts, private pension coverage has a large, significant, negative impact on the probability of dropping out of the stock market, while the impact is negative but insignificant when we examine stock ownership in non-retirement accounts.

heads having less than a high school education were 23% more likely to drop out of the market, while households with heads having a college education were 11% less likely to exit the market. Households with heads who were white also had a significantly lower probability of dropping out of the market. The effects of other variables are not significant.

To summarize, Table 8 suggests that, for those households that held stocks in non-retirement accounts in the 2007 survey, less-educated households, poor households and households with heads belonging to a minority are the ones that dropped out of the market in non-retirement accounts after the market crash. This supports the hypothesis $H_2$. One explanation of this finding is the stock market participation costs. During the financial crisis, many households suffered great losses in the stock market. If there are per-period costs of stock market participation (e.g., information acquisition about investment opportunities and the value of time spent to trade and rebalance a portfolio), some poor households and less-educated households who are not financially sophisticated will find it too costly to stay in the stock market and may choose to exit the market.

[Table 8]

Similarly, Table 9 presents the marginal effects on the estimated probability of a household entering into the stock market in non-retirement accounts in the 2009 survey conditional on not being a stock owner in the 2007 survey. For non-stock owners in 2007, our results show that better-educated households, households with greater financial net worth and households with heads that are white are more likely to enter into the stock market. The probability of entering into the stock market is also higher for households that received an inheritance in 2007–09 and for homeowners. All these effects are statistically significant at the 1% level.

[Table 9]

# 5 Stock Market Trading Patterns

In this section, we examine households' trading behavior in 2007–09, a period that saw a major stock market downswing.

The PSID respondents were asked about their stock transactions that had taken place since the last survey year, i.e., whether they purchased or sold stocks. However, information on the frequency of trades is not available. Moreover, this information is available only for non-retirement accounts and not for retirement accounts (i.e., IRAs and employer-based pensions).[19] Hence, in this paper we focus exclusively on households' trading behavior in non-retirement accounts.

The implications of theoretical models for trading differ substantially. Many factors could influence trade. Trade can happen because of rational motivations, for example, portfolio rebalancing due to household-specific changes and tax-loss selling. Trade can also be stimulated by differences in opinion or behavioral reasons.[20] The PSID data do not allow us to explicitly test the effects of these factors separately. Instead, we are interested in the following questions: How widespread was stock trading or inactivity during the period? Which household characteristics were associated with trading or inactivity?

## 5.1 Trading Patterns

To separate the stock trading decision from the stock market participation decision, we confine our attention to households that held stocks in non-retirement accounts in the 2007 survey and examine their trading patterns in 2007–09. Using the survey responses recorded by the PSID, we classify these households into four mutually

[19] For stock trading in retirement accounts in other data sets, see Madrian and Shea (2001), Choi, Laibson, and Metrick (2002), Agnew, Balduzzi, and Sundén (2003), and Tang, Mitchell, and Utkus (2011).

[20] See footnote 4.

exclusive categories. The first category comprises those who undertook no trades in stocks in non-retirement accounts during 2007–09. The other three categories represent households reporting stock trading in 2007–09 with one of the following three trading types: exclusively buying ("buy only"), exclusively selling ("sell only"), or both buying and selling stocks ("buy and sell").

In our main sample, there are 1,043 households that held stocks in non-retirement accounts in the 2007 survey. Information on the type of trading in 2007–09 is missing for 13 households. We dropped these 13 households from the subsample of stockholders. For the remaining 1,030 households that held stocks in non-retirement accounts in 2007, 56.1% reported no stock market activity in 2007–09, when there was a major stock market downswing. The proportions of households that reported "buy only," "sell only" and "buy and sell" were 16.9%, 8.2% and 18.8%, respectively. However, unlike current stock ownership, PSID data on past trading practices are known to suffer from systematic under-reporting of trades.[21] Some survey respondents reported moving from being stock owners in 2007 to becoming non-stock owners in 2009 while simultaneously reporting that they did not make any stock transactions in the 2-year period.[22] These "forgotten" trades could have a large impact on the analysis. To address this issue, we drop all observations with the following type of "forgotten" trade: the household held stocks in 2007 but not in 2009, and it did not report any trade in stocks in 2007–09. As a result, we find that 40.8% of stockholders in 2007 reported no stock market activity in 2007–09.[23]

[21] Current stock ownership is less likely to be subject to measurement error.

[22] Most of these observations would represent a contradiction, but there might be cases where households transfer ownership to relatives or donate the stocks to charity.

[23] Instead, if we count the observations with this type of "forgotten" trade as households with stock trading, 30.2% of stockholders in 2007 undertook no trades in stocks during the period 2007–09.

## 5.2 What Determines Trading Practices?

Household characteristics and major life changes in 2007–09 that affect participation status, as discussed in the previous section, can be expected to affect stock trading behavior. In this section, we study the role of these factors in determining both inactivity and trading patterns for stocks held in non-retirement accounts. During a market downturn, a household's initial portfolio composition may also affect its trading behavior. Thus, we include the initial share of equity in non-retirement accounts in 2007 as an additional explanatory variable and we expect that the share of equity at the beginning has a positive effect on trading during a major market downswing. We run a multinomial logit model. Our sample includes households that held stocks in non-retirement accounts in the 2007 survey and that have known trading types. These households are divided into four categories: no trade, buy only, sell only, and both buy and sell.

Table 10 reports the marginal effects of regressors on the estimated probability of being in one of the four categories. We find that higher educational attainments, greater financial net worth and a higher initial share of equity in non-retirement accounts in the 2007 survey are closely associated with trading in the period 2007–09. These factors significantly reduce the tendency of there being no trade, and they significantly increase the probability of both buying and selling stocks in non-retirement accounts during the period under consideration. The effects of these factors on the other trading types ("buy only" and "sell only") are smaller and not very significant.

[Table 10]

Home ownership increases the probability of a household exclusively selling stocks in non-retirement accounts in 2007–09. Moreover, if a household sold real estate during the period, it is more likely that it also sold stocks during the same period. On

the other hand, private business ownership has a negative impact on the probability of exclusively buying stocks in the period under consideration. All these effects are significant at the 5% level.

We do not find any significant effects of race, gender, number of children, household labor income, private pension coverage and employment status of the household head on the trading patterns in non-retirement accounts. Exactly who, then, were trading in non-retirement accounts during the period under consideration? Our results suggest that the traders are likely those households with a higher education attainment or greater financial net worth, households with a higher initial share of equity (i.e., a more risky portfolio) in non-retirement accounts in 2007, and households that sold real estate in 2007–09.

To address the issue of "forgotten" trades, which was mentioned above, we redo the whole analysis by dropping all observations with the potential inconsistency. We are referring to those households that held stocks in 2007 but not in 2009, and that did not report any sales of stocks in the meantime. The results are highly comparable in terms of sign, significance and magnitude, regardless of whether this type of potentially inconsistent response is included.

# 6 Conclusion

Using the PSID data, we document household stockholding behavior during the great financial crisis (2007–09). Many households adjusted their stockholding status during this period. The overall stock market participation rate dropped 2.6 percentage points after the market crash. We find evidence that less-educated households, poor households and households with heads belonging to a minority are the ones that dropped out of the market. We also examine households' trading behavior during the period. For households that held stocks in non-retirement accounts in the 2007 survey, a significant portion of them reported no stock market activity in 2007–09.

We find that household characteristics, including education, financial net worth and initial portfolio composition, are linked to trading behavior. Changes in portfolios made by households during the crisis period will certainly affect their future wealth accumulation and the allocation of risk in financial markets. The impact of these changes is an interesting topic for future research.

# References


Agnew, J., P. Balduzzi, and A. Sundén (2003): "Portfolio Choice and Returns in a Large 401(k) Plan," *American Economic Review*, 93, 193–205.

Alan, S. (2006): "Entry Costs and Stock Market Participation over the Life Cycle," *Review of Economic Dynamics*, 9(4), 588–611.

Ameriks, J., and S. Zeldes (2004): "How Do Household Portfolio Shares Vary with Age?," *Columbia Business School working paper*.

Ampudia, M., and M. Ehrmann (2013): "Macroeconomic Experiences and Risk-Taking of Euro Area Households," Working Paper.

Basak, S., and D. Cuoco (1998): "An Equilibrium Model with Restricted Stock Market Participation," *Review of Financial Studies*, 11(2), 309–341.

Berkelaar, A., B. Kouwenberg, and T. Post (2004): "Optimal Portfolio Choice under Loss Aversion," *Review of Economics and Statistics*, 86(4), 973–987.

Bertaut, C. (1998): "Stockholding Behavior of U.S. Households: Evidence from the 1983–1989 Survey of Consumer Finances," *Review of Economics and Statistics*, 80(2), 263–275.

Bertaut, C., and M. Haliassos (1997): "Precautionary Portfolio Behavior from a Life Cycle Perspective," *Journal of Economic Dynamics and Control*, 21, 1511–1542.

Bilias, Y., D. Georgarakos, and M. Haliassos (2010): "Portfolio Inertia and Stock Market Fluctuations," *Journal of Money, Credit and Banking*, 42(4), 715–742.

Bucher-Koenen, T., and M. Ziegelmeyer (2014): "Once Burned, Twice Shy? Financial Literacy and Wealth Losses during the Financial Crisis," *Review of Finance*, 18(6), 2215–2246.

Calvet, L. E., J. Y. Campbell, and P. Sodini (2009): "Fight or Flight? Portfolio Rebalancing by Individual Investors," *Quarterly Journal of Economics*, 124(1), 301–348.

Campbell, J. (2006): "Household Finance," *Journal of Finance*, 61(4), 1553–1604.

Choi, J., D. Laibson, and A. Metrick (2002): "How Does the Internet Affect Trading? Evidence from Investor Behavior in 401(k) Plans," *Journal of Financial Economics*, 64, 397–421.

Christelis, D., D. Georgarakos, and M. Haliassos (2011): "Stockholding: Participation, Location, and Spillovers," *Journal of Banking and Finance*, 35(8), 1918–1930.

Cocco, J., F. Gomes, and P. Maenhout (2005): "Consumption and Portfolio Choice over the Life-Cycle," *Review of Financial Studies*, 18(2), 491–533.

Daniel, K., D. Hirshleifer, and A. Subrahmanyam (1998): "Investor Psychology and Security Market Under- and Overreactions," *Journal of Finance*, 53(6), 1839–1886.

Dorn, D., and M. Weber (2013): "Individual Investors' Trading in Times of Crisis: Going It Alone or Giving Up?," Working Paper.

Glaser, M., and M. Weber (2005): "September 11 and Stock Return Expectations of Individual Investors," *Review of Finance*, 9(2), 243–279.

Guiso, L., M. Haliassos, and T. Jappelli (eds.) (2002): *Household Portfolios*. MIT Press.

Guiso, L., P. Sapienza, and L. Zingales (2013): "Time Varying Risk Aversion," NBER Working Paper No. 19284.

Guiso, L., and P. Sodini (2013): "Household Finance: An Emerging Field," in *Handbook of the Economics of Finance*, ed. by G. M. Constantinides, M. Harris, and R. M. Stulz, vol. 2, chap. 21, pp. 1397–1532. Elsevier.

Haliassos, M., and C. Bertaut (1995): "Why Do So Few Hold Stocks?," *Economic Journal*, 105, 1110–1129.

Haliassos, M., and A. Michaelides (2003): "Portfolio Choice and Liquidity Constraints," *International Economic Review*, 44(1), 143–177.

Harris, M., and A. Raviv (1993): "Differences of Opinion Make a Horse Race," *Review of Financial Studies*, 6(3), 473–506.

Heaton, J., and D. Lucas (1997): "Market Frictions, Savings Behavior, and Portfolio Choice," *Macroeconomic Dynamics*, 1, 76–101.

——— (2000): "Portfolio Choice in the Presence of Background Risk," *Economic Journal*, 110, 1–26.

Hoffmann, A. O., T. Post, and J. M. Pennings (2013): "Individual Investor Perceptions and Behavior during the Financial Crisis," *Journal of Banking and Finance*, 37(1), 60–74.

Hong, H., and J. Stein (2003): "Differences of Opinion, Short-sales Constraints, and Market Crashes," *Review of Financial Studies*, 16(2), 487–525.

Hudomiet, P., G. Kezdi, and R. Willis (2011): "Stock Market Crash and Expectations of American Households," *Journal of Applied Econometrics*, 26(3), 393–415.

Kandel, E., and N. Pearson (1995): "Differential Interpretation of Public Signals and Trade in Speculative Markets," *Journal of Political Economy*, 103(4), 831–872.

Koo, H. (1998): "Consumption and Portfolio Selection with Labor Income: A Continuous Time Approach," *Mathematical Finance*, 8, 49–65.

Madrian, B., and D. Shea (2001): "The Power of Suggestion: Inertia in 401(k) Participation and Savings Behavior," *Quarterly Journal of Economics*, 116(4), 1149–1525.

Malmendier, U., and S. Nagel (2011): "Depression Babies: Do Macroeconomic Experiences Affect Risk-Taking?," *Quarterly Journal of Economics*, 126(1), 373–416.

Mankiw, G., and S. Zeldes (1991): "The Consumption of Stockholders and Nonstockholders," *Journal of Financial Economics*, 29(1), 97–112.

Markowitz, H. (1952): "Portfolio Selection," *Journal of Finance*, 7(1), 77–91.

Odean, T. (1998): "Are Investors Reluctant to Realize Their Losses?," *Journal of Finance*, 53(5), 1775–1798.

Sahm, C. R. (2007): "How Much Does Risk Tolerance Change?," Finance and Economics Discussion Series 2007-66, Board of Governors of the Federal Reserve System (U.S.).

Sarkar, A., and R. Schwartz (2009): "Market Sidedness: Insights into Motives for Trade Initiation," *Journal of Finance*, 64(1), 375–423.

Shiller, R. J., F. Kon-Ya, and Y. Tsutsui (1996): "Why Did the Nikkei Crash? Expanding the Scope of Expectations Data Collection," *Review of Economics and Statistics*, 78(1), 156–164.

Shum, P., and M. Faig (2006): "What Explains Household Stock Holdings?," *Journal of Banking and Finance*, 30(9), 2579–2597.

Tang, N., O. Mitchell, and S. Utkus (2011): "Trading in 401(k) Plans during the Financial Crisis," *Pension Research Council Working Paper 2011-11*.

Vissing-Jorgensen, A. (2002): "Towards an Explanation of Household Portfolio Choice Heterogeneity: Nonfinancial Income and Participation Cost Structures," *NBER Working Paper No. 8884*.

Weber, M., E. Weber, and A. Nosic (2013): "Who Takes Risks When and Why: Determinants of Changes in Investor Risk Taking," *Review of Finance*, 17(3), 847–883.

# Appendix

Households' wealth data are available from the Panel Study of Income Dynamics (PSID) supplemental wealth file in both the 2007 and the 2009 waves of the study. We examine both financial assets and non-financial assets. Financial assets in the PSID include the following broad categories: (1) W28 (money in checking or savings accounts, money market funds, certificates of deposit, government savings bonds and Treasury bills); (2) W16 (equity in stock, which includes shares of stock in publicly held corporations, mutual funds and investment trusts, but not stocks in employer-based pensions or Individual Retirement Accounts (IRAs)); (3) W22 (equity in private annuities or IRAs); (4) W34 (other assets, including bond funds, cash value in a life insurance policy, a valuable collection for investment purposes, and rights in a trust or estate). Financial net worth is the sum of W28, W16, W22 and W34 net of W39.[24]

Non-financial net worth is the sum of home equity (calculated as the home value minus the remaining mortgage), equity in other real estate (W2), equity in vehicles (W6) and equity in private businesses or farms (W11).

Labor income is defined as the sum of all types of labor income components, including wages and salaries, bonuses, overtime pay, tips, commissions, and the labor part of business income for all members in a household.

We construct measures of stock ownership for each sample household. PSID respondents directly report the total dollar value of their direct stockholdings, their stocks held in mutual funds and investment trusts (W16). Thus, a positive value of W16 implies that the household owns stocks in non-retirement accounts. PSID households can also hold stocks in retirement accounts, such as IRAs and employer-based pension plans. However, the dollar value of stocks in retirement accounts is not directly available. Instead, respondents are asked how the funds in their retirement

[24] W39 measures the value of a household's debt, which includes credit card charges, student loans, medical or legal bills, and loans from relatives, but excludes mortgage or vehicle loans.

accounts are invested. For example, the question on the allocation of defined contribution pension plans for the current main job (for both the household's head and his or her spouse) asks the following question: Are the funds invested mostly in stocks or mostly in bonds and annuities, some of each, or what? Respondents can choose from the following three answers: (1) Mostly (or all) stocks, (2) Some of each, or (3) Mostly (or all) bonds and annuities. Thus, stock ownership in retirement accounts can be inferred from these categorical responses. In practice, we classify a household as a stock owner in retirement accounts if the answer is "(1)" or "(2)."

Table 1: Stock Ownership Based on the Types of Accounts: 2007 and 2009 PSID

| | 2007 | 2009 |
|---|---|---|
| Non-retirement accounts | 25.2% | 23.5% |
| All accounts | 49.0% | 46.4% |

Notes: No. of observations: 4,140. Stock ownership in non-retirement accounts refers to directly held stocks, stocks held in mutual funds and investment trusts. Stock ownership across all accounts refers to stocks in non-retirement accounts and stocks in retirement accounts, which include IRAs and employer-based pensions.

Table 2: Persistency of Stock Ownership in Non-retirement Accounts: 2007 and 2009 PSID

| | 2009 | | |
|---|---|---|---|
| 2007 | Non-stock owner | Stock owner | All |
| Non-stock owner | 68.6% | 6.2% | 74.8% |
| Stock owner | 7.9% | 17.3% | 25.2% |
| All | 76.5% | 23.5% | 100.0% |

Notes: No. of observations: 4,140. Stock ownership refers to directly held stocks, stocks in mutual funds and investment trusts, but not stocks in retirement accounts (i.e., IRAs and employer-based pensions).

Table 3: Persistency of Stock Ownership Across All Accounts: 2007 and 2009 PSID

| | 2009 | | |
|---|---|---|---|
| 2007 | Non-stock owner | Stock owner | All |
| Non-stock owner | 41.0% | 10.0% | 51.0% |
| Stock owner | 12.6% | 36.4% | 49.0% |
| All | 53.6% | 46.4% | 100.0% |

Notes: No. of observations: 4,140. Stock ownership refers to directly held stocks, stocks in mutual funds and investment trusts, as well as stocks in IRAs and employer-based pensions.

Table 4: Sample Statistics

| | 2007 | | | | 2009 | | | |
|---|---|---|---|---|---|---|---|---|
| | Non-stock owner | | Stock owner | | Non-stock owner | | Stock owner | |
| | Mean | Median | Mean | Median | Mean | Median | Mean | Median |
| Age | 44.26 | 41 | 48.00 | 48 | 46.95 | 45 | 49.40 | 49 |
| Race: White | 0.83 | 1 | 0.92 | 1 | 0.83 | 1 | 0.92 | 1 |
| Gender: Male | 0.73 | 1 | 0.87 | 1 | 0.75 | 1 | 0.86 | 1 |
| Grade | 12.69 | 12 | 14.31 | 14 | 12.71 | 12 | 14.39 | 15 |
| Married | 0.56 | 1 | 0.77 | 1 | 0.58 | 1 | 0.76 | 1 |
| No. of children | 0.78 | 0 | 0.67 | 0 | 0.77 | 0 | 0.68 | 0 |
| Labor income | 44318 | 36000 | 90863 | 74500 | 49225 | 40000 | 98818 | 79500 |
| Financial net worth | 13628 | 100 | 224773 | 47500 | 17930 | 150 | 211011 | 53700 |
| Non-financial net worth | 111620 | 27150 | 389713 | 138500 | 106052 | 25000 | 343084 | 117800 |
| Household owns home | 0.54 | 1 | 0.84 | 1 | 0.58 | 1 | 0.85 | 1 |
| Household owns business | 0.09 | 0 | 0.18 | 0 | 0.11 | 0 | 0.17 | 0 |
| Covered by private pension | 0.38 | 0 | 0.72 | 1 | 0.36 | 0 | 0.69 | 1 |
| No. of observations | 2112 | | 2028 | | 2219 | | 1921 | |

Notes: Stock ownership refers to stocks across all accounts (i.e., non-retirement accounts and retirement accounts). The variables age, race, gender, education and married status refer to the household heads. The other variables are reported at the household level. The maximum grade is 17, which represents at least some post-graduate work.

Table 5: Bivariate Probit of Stock Market Participation in Non-retirement Accounts: 2007 and 2009 PSID

| | Own in 2007 | | | Own in 2009 | | |
|---|---|---|---|---|---|---|
| | Marginal Effect | Standard Error | | Marginal Effect | Standard Error | |
| Age < 35 | 0.0045 | 0.0075 | | 0.0005 | 0.0088 | |
| Age 35–44 | 0.0041 | 0.0079 | | -0.0113 | 0.0090 | |
| Age 45–54 | -0.0038 | 0.0068 | | -0.0123 | 0.0078 | |
| Age 65–74 | 0.0082 | 0.0099 | | 0.0000 | 0.0111 | |
| Age 75 and over | 0.0292 | 0.0120 | ** | 0.0311 | 0.0133 | ** |
| Race: White | 0.0226 | 0.0075 | *** | 0.0453 | 0.0092 | *** |
| Gender: Male | 0.0191 | 0.0084 | ** | 0.0013 | 0.0100 | |
| Education: COL | 0.0448 | 0.0043 | *** | 0.0520 | 0.0050 | *** |
| Education: LTHS | -0.0498 | 0.0111 | *** | -0.0831 | 0.0162 | *** |
| No. of children | -0.0081 | 0.0026 | *** | -0.0054 | 0.0029 | * |
| Ln (Labor income) | 0.0022 | 0.0010 | ** | 0.0017 | 0.0011 | |
| Ln (Financial net worth) | 0.0048 | 0.0003 | *** | 0.0044 | 0.0003 | *** |
| Ln (Non-financial net worth) | 0.0036 | 0.0009 | *** | 0.0017 | 0.0006 | *** |
| Household owns home | 0.0189 | 0.0067 | *** | 0.0385 | 0.0073 | *** |
| Household owns business | 0.0169 | 0.0058 | *** | 0.0140 | 0.0075 | * |
| Covered by private pension | 0.0086 | 0.0052 | * | 0.0134 | 0.0060 | ** |
| Location: completely rural | -0.0191 | 0.0131 | | -0.0377 | 0.0156 | ** |
| Unemployed | 0.0072 | 0.0136 | | 0.0192 | 0.0116 | * |
| Retired in 2007 survey | 0.0254 | 0.0101 | ** | | | |
| Married in 2007 survey | 0.0036 | 0.0073 | | | | |
| Remained married to same in 2007–09 | | | | 0.0030 | 0.0092 | |
| Became married in 2007–09 | | | | -0.0134 | 0.0152 | |
| Divorced/widowed/separated 2007–09 | | | | 0.0345 | 0.0184 | * |
| Became retired in 2007–09 | | | | -0.0029 | 0.0118 | |
| Remained retired in 2007–09 | | | | 0.0325 | 0.0120 | *** |
| Bought real estate in 2007–09 | | | | 0.0007 | 0.0086 | |
| Sold real estate in 2007–09 | | | | 0.0036 | 0.0096 | |
| Received inheritance in 2007–09 | | | | 0.0163 | 0.0091 | * |
| Put money into business in 2007–09 | | | | 0.0080 | 0.0106 | |
| Sold part or all of business in 2007–09 | | | | 0.0289 | 0.0233 | |
| No. of observations: 4140 | $\rho$: 0.7298 (s.e. 0.0180) | | | Log likelihood: -3262.0344 | | |

Notes: The first equation of the bivariate probit specification models the probability that a household held stocks in non-retirement accounts in the 2007 survey, while the second equation models the probability that a household owned stocks in non-retirement accounts in the 2009 survey. The specification allows for the common influences of unobservable factors on both decisions, and it also permits potentially different effects of the observable characteristics in the two surveys. Ownership of stocks refers to directly held stocks, stocks in mutual funds and investment trusts — not including stocks held in retirement accounts (IRAs and employer-based pensions). Variables correspond to the year in question. Marginal effects, averaged across households, refer to the changes in the probabilities of owning stocks in each of the two surveys caused by the changes in regressors. The regression controls for labor income, financial net worth, and non-financial net worth by means of logarithms using the transformation $y=\ln(x)$ if $x\geq 1$, $y=-\ln(|x|)$ if $x\leq -1$, and $y=0$ if $-1<x<1$. *** (**, *) stands for statistically significant at the 1 (5, 10) percent level.

Table 6: Bivariate Probit of Stock Market Participation Across All Accounts: 2007 and 2009 PSID

| | Own in 2007 | | | Own in 2009 | | |
|---|---|---|---|---|---|---|
| | Marginal Effect | Standard Error | | Marginal Effect | Standard Error | |
| Age < 35 | -0.0137 | 0.0104 | | 0.0047 | 0.0121 | |
| Age 35–44 | -0.0016 | 0.0113 | | -0.0241 | 0.0124 | * |
| Age 45–54 | -0.0128 | 0.0101 | | -0.0215 | 0.0111 | * |
| Age 65–74 | 0.0133 | 0.0148 | | -0.0025 | 0.0160 | |
| Age 75 and over | 0.0233 | 0.0177 | | 0.0296 | 0.0192 | |
| Race: White | 0.0413 | 0.0093 | *** | 0.0582 | 0.0108 | *** |
| Gender: Male | 0.0248 | 0.0109 | ** | 0.0110 | 0.0128 | |
| Education: COL | 0.0584 | 0.0062 | *** | 0.0727 | 0.0068 | *** |
| Education: LTHS | -0.0867 | 0.0132 | *** | -0.1160 | 0.0182 | *** |
| No. of children | -0.0112 | 0.0033 | *** | -0.0046 | 0.0038 | |
| Ln (Labor income) | 0.0036 | 0.0015 | ** | 0.0040 | 0.0016 | ** |
| Ln (Financial net worth) | 0.0055 | 0.0003 | *** | 0.0060 | 0.0004 | *** |
| Ln (Non-financial net worth) | 0.0034 | 0.0011 | *** | 0.0030 | 0.0008 | *** |
| Household owns home | 0.0446 | 0.0083 | *** | 0.0627 | 0.0090 | *** |
| Household owns business | 0.0402 | 0.0091 | *** | 0.0259 | 0.0114 | ** |
| Covered by private pension | 0.1092 | 0.0070 | *** | 0.1283 | 0.0078 | *** |
| Location: completely rural | -0.0272 | 0.0162 | * | -0.0307 | 0.0185 | * |
| Unemployed | -0.0008 | 0.0192 | | 0.0350 | 0.0150 | ** |
| Retired in 2007 survey | 0.0266 | 0.0150 | * | | | |
| Married in 2007 survey | 0.0124 | 0.0097 | | | | |
| Remained married to same in 2007–09 | | | | 0.0067 | 0.0120 | |
| Became married in 2007–09 | | | | -0.0171 | 0.0199 | |
| Divorced/widowed/separated 2007–09 | | | | 0.0128 | 0.0251 | |
| Became retired in 2007–09 | | | | 0.0224 | 0.0180 | |
| Remained retired in 2007–09 | | | | 0.0464 | 0.0174 | *** |
| Bought real estate in 2007–09 | | | | -0.0161 | 0.0121 | |
| Sold real estate in 2007–09 | | | | 0.0030 | 0.0142 | |
| Received inheritance in 2007–09 | | | | 0.0236 | 0.0152 | |
| Put money into business in 2007–09 | | | | 0.0009 | 0.0165 | |
| Sold part or all of business in 2007–09 | | | | 0.0310 | 0.0430 | |
| No. of observations: 4140 | $\rho$: 0.5529 (s.e. 0.0224) | | | Log likelihood: -4003.4329 | | |

Notes: The first equation of the bivariate probit specification models the probability that a household held stocks across all accounts in the 2007 survey, while the second equation models the probability that a household owned stocks across all accounts in the 2009 survey. The specification allows for the common influences of unobservable factors on both decisions, and it also permits potentially different effects of the observable characteristics in the two surveys. Ownership of stocks regards shares of stocks held in all accounts. Also see the Notes to Table 5.

Table 7: Probit of Stock Market Participation Across All Accounts: Pooled Sample

| | Own stock | | |
|---|---|---|---|
| | Marg. Effect | s.e. | |
| Age < 35 | -0.0029 | 0.0160 | |
| Age 35–44 | -0.0155 | 0.0171 | |
| Age 45–54 | -0.0297 | 0.0154 | * |
| Age 65–74 | 0.0149 | 0.0221 | |
| Age 75 and over | 0.0601 | 0.0259 | ** |
| Race: White | 0.0926 | 0.0141 | *** |
| Gender: Male | 0.0304 | 0.0165 | * |
| Education: COL | 0.1411 | 0.0092 | *** |
| Education: LTHS | -0.1995 | 0.0218 | *** |
| No. of children | -0.0176 | 0.0051 | *** |
| Ln (Labor income) | 0.0064 | 0.0022 | *** |
| Ln (Financial net worth) | 0.0126 | 0.0005 | *** |
| Ln (Non-financial net worth) | 0.0063 | 0.0012 | *** |
| Household owns home | 0.1102 | 0.0120 | *** |
| Household owns business | 0.0789 | 0.0138 | *** |
| Covered by private pension | 0.2478 | 0.0101 | *** |
| Location: completely rural | -0.0537 | 0.0246 | ** |
| Unemployed | 0.0464 | 0.0242 | * |
| Retired | 0.0575 | 0.0210 | *** |
| Married | 0.0223 | 0.0149 | |
| Year dummy: 2009 | -0.0286 | 0.0092 | *** |
| No. of observations: 8280 | Log likelihood: -4225.6555 | | |

Notes: This table shows the results of a probit model of stock ownership when we pool the 2007 and the 2009 PSID sample households together. Ownership of stocks regards shares of stocks held in all accounts. Also see the Notes to Table 5.

Table 8: Stock Market Exit in Non-retirement Accounts: 2009 PSID

| | Exit in 2009: Non-retirement Accounts | | |
|---|---|---|---|
| | Marg. Effect | s.e. | |
| Age < 35 | 0.0387 | 0.0524 | |
| Age 35–44 | 0.0768 | 0.0513 | |
| Age 45–54 | 0.0433 | 0.0434 | |
| Age 65–74 | 0.0571 | 0.0586 | |
| Age 75 and over | 0.0115 | 0.0697 | |
| Race: White | -0.1066 | 0.0521 | ** |
| Gender: Male | -0.0041 | 0.0621 | |
| Education: COL | -0.1085 | 0.0287 | *** |
| Education: LTHS | 0.2302 | 0.1030 | ** |
| No. of children | -0.0062 | 0.0185 | |
| Ln (Labor income) | 0.0052 | 0.0061 | |
| Ln (Financial net worth) | -0.0120 | 0.0019 | *** |
| Ln (Non-financial net worth) | -0.0017 | 0.0038 | |
| Household owns home | -0.0427 | 0.0452 | |
| Household owns business | -0.0228 | 0.0413 | |
| Covered by private pension | -0.0240 | 0.0361 | |
| Location: completely rural | -0.0215 | 0.0866 | |
| Unemployed | -0.1572 | 0.0884 | * |
| Remained married to same in 2007–09 | 0.0505 | 0.0538 | |
| Became married in 2007–09 | 0.0681 | 0.0954 | |
| Divorced/widowed/separated 2007–09 | -0.1145 | 0.1325 | |
| Became retired in 2007–09 | 0.0589 | 0.0654 | |
| Remained retired in 2007–09 | -0.0299 | 0.0642 | |
| Bought real estate in 2007–09 | -0.0415 | 0.0562 | |
| Sold real estate in 2007–09 | -0.0322 | 0.0561 | |
| Received inheritance in 2007–09 | 0.0052 | 0.0534 | |
| Put money into business in 2007–09 | 0.0433 | 0.0582 | |
| Sold part or all of business in 2007–09 | 0.0602 | 0.1231 | |
| No. of observations: 1043 | Log likelihood: -599.4112 | | |

Notes: This table shows the results of a probit model, in which the dependent variable measures whether a household dropped out of the stock market in non-retirement accounts in the 2009 survey conditional on owning stocks in non-retirement accounts in the 2007 survey. Also see the Notes to Table 5.

Table 9: Stock Market Entry in Non-retirement Accounts: 2009 PSID

| | Entry in 2009: Non-retirement Accounts | | |
|---|---|---|---|
| | Marg. Effect | s.e. | |
| Age < 35 | 0.0252 | 0.0165 | |
| Age 35–44 | 0.0026 | 0.0176 | |
| Age 45–54 | -0.0184 | 0.0163 | |
| Age 65–74 | 0.0089 | 0.0236 | |
| Age 75 and over | 0.0496 | 0.0283 | * |
| Race: White | 0.0499 | 0.0174 | *** |
| Gender: Male | -0.0224 | 0.0180 | |
| Education: COL | 0.0471 | 0.0099 | *** |
| Education: LTHS | -0.0901 | 0.0316 | *** |
| No. of children | -0.0047 | 0.0053 | |
| Ln (Labor income) | 0.0036 | 0.0024 | |
| Ln (Financial net worth) | 0.0039 | 0.0006 | *** |
| Ln (Non-financial net worth) | 0.0010 | 0.0011 | |
| Household owns home | 0.0413 | 0.0137 | *** |
| Household owns business | 0.0047 | 0.0162 | |
| Covered by private pension | 0.0242 | 0.0119 | ** |
| Location: completely rural | -0.0880 | 0.0375 | ** |
| Unemployed | 0.0228 | 0.0217 | |
| Remained married to same in 2007–09 | 0.0079 | 0.0177 | |
| Became married in 2007–09 | -0.0100 | 0.0295 | |
| Divorced/widowed/separated 2007–09 | 0.0498 | 0.0340 | |
| Became retired in 2007–09 | 0.0019 | 0.0268 | |
| Remained retired in 2007–09 | 0.0396 | 0.0253 | |
| Bought real estate in 2007–09 | 0.0091 | 0.0163 | |
| Sold real estate in 2007–09 | -0.0037 | 0.0207 | |
| Received inheritance in 2007–09 | 0.0528 | 0.0187 | *** |
| Put money into business in 2007–09 | 0.0461 | 0.0229 | ** |
| Sold part or all of business in 2007–09 | 0.1168 | 0.0518 | ** |
| No. of observations: 3097 | Log likelihood: -777.3681 | | |

Notes: This table shows the results of a probit model, in which the dependent variable measures whether a household entered into the stock market in non-retirement accounts in the 2009 survey conditional on not owning stocks in non-retirement accounts in the 2007 survey. Also see the Notes to Table 5.

Table 10: Multinomial Logit of Trading Practices in 2007–09

| | No trade | | | Buy only | | | Sell only | | | Buy and sell | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Marg. Effect | s.e. | | Marg. Effect | s.e. | | Marg. Effect | s.e. | | Marg. Effect | s.e. | |
| Age < 35 | -0.0223 | 0.0582 | | 0.0042 | 0.0437 | | -0.0440 | 0.0337 | | 0.0621 | 0.0460 | |
| Age 35–44 | 0.0118 | 0.0568 | | -0.0147 | 0.0436 | | -0.0399 | 0.0331 | | 0.0428 | 0.0444 | |
| Age 45–54 | 0.0542 | 0.0469 | | -0.0241 | 0.0362 | | -0.0262 | 0.0259 | | -0.0039 | 0.0361 | |
| Age 65–74 | 0.1347 | 0.0635 | ** | -0.0436 | 0.0493 | | -0.0526 | 0.0358 | | -0.0385 | 0.0483 | |
| Age 75 and over | 0.1481 | 0.0736 | ** | -0.1093 | 0.0607 | * | -0.0095 | 0.0360 | | -0.0293 | 0.0555 | |
| Race: White | -0.0525 | 0.0609 | | 0.0352 | 0.0494 | | 0.0495 | 0.0402 | | -0.0323 | 0.0466 | |
| Gender: Male | -0.0340 | 0.0684 | | -0.0422 | 0.0572 | | 0.0134 | 0.0344 | | 0.0628 | 0.0542 | |
| Education: COL | -0.1448 | 0.0315 | *** | 0.0423 | 0.0254 | * | 0.0020 | 0.0175 | | 0.1004 | 0.0268 | *** |
| Education: LTHS | 1.3288 | 67.7649 | | 0.5015 | 23.6390 | | 0.1612 | 10.6507 | | -1.9914 | 102.054 | |
| No. of children | 0.0202 | 0.0204 | | -0.0045 | 0.0155 | | 0.0015 | 0.0118 | | -0.0172 | 0.0169 | |
| Ln (Labor income) | -0.0019 | 0.0067 | | -0.0016 | 0.0053 | | 0.0023 | 0.0035 | | 0.0012 | 0.0052 | |
| Ln (Financial net worth) | -0.0096 | 0.0026 | *** | 0.0017 | 0.0019 | | -0.0023 | 0.0012 | * | 0.0102 | 0.0028 | *** |
| Ln (Non-financial net worth) | -0.0039 | 0.0048 | | -0.0026 | 0.0032 | | -0.0032 | 0.0020 | | 0.0096 | 0.0052 | * |
| Household owns home | -0.0375 | 0.0528 | | 0.0074 | 0.0404 | | 0.0693 | 0.0344 | ** | -0.0391 | 0.0427 | |
| Household owns business | 0.0239 | 0.0451 | | -0.0789 | 0.0378 | ** | 0.0176 | 0.0232 | | 0.0373 | 0.0330 | |
| Covered by private pension | -0.0162 | 0.0399 | | -0.0004 | 0.0310 | | -0.0275 | 0.0214 | | 0.0441 | 0.0317 | |
| Location: completely rural | 0.6036 | 38.9185 | | 0.2553 | 10.7826 | | -1.0261 | 62.5046 | | 0.1672 | 12.8040 | |
| Unemployed | -0.1178 | 0.0958 | | 0.0872 | 0.0612 | | -0.0681 | 0.0750 | | 0.0986 | 0.0689 | |
| Share of equity in 2007 | -0.1570 | 0.0494 | *** | -0.0289 | 0.0380 | | 0.0439 | 0.0286 | | 0.1420 | 0.0401 | *** |
| Remained married to same in 2007–09 | -0.0222 | 0.0591 | | 0.0864 | 0.0499 | * | -0.0483 | 0.0303 | | -0.0158 | 0.0438 | |
| Became married in 2007–09 | 0.5986 | 39.0115 | | 0.3487 | 10.8085 | | -1.0552 | 62.6539 | | 0.1079 | 12.8347 | |
| Divorced/widowed/separated 2007–09 | -0.0419 | 0.1533 | | -0.0450 | 0.1509 | | 0.0352 | 0.0647 | | 0.0517 | 0.1035 | |
| Became retired in 2007–09 | -0.0854 | 0.0740 | | -0.0317 | 0.0618 | | 0.0383 | 0.0333 | | 0.0789 | 0.0536 | |
| Remained retired in 2007–09 | -0.1455 | 0.0716 | ** | 0.0247 | 0.0557 | | 0.0205 | 0.0371 | | 0.1003 | 0.0538 | * |
| Bought real estate in 2007–09 | -0.0777 | 0.0600 | | -0.0235 | 0.0481 | | 0.0486 | 0.0291 | * | 0.0525 | 0.0439 | |
| Sold real estate in 2007–09 | -0.0110 | 0.0600 | | 0.0271 | 0.0441 | | 0.0659 | 0.0262 | ** | -0.0820 | 0.0511 | |
| Received inheritance in 2007–09 | 0.0388 | 0.0629 | | -0.0069 | 0.0452 | | -0.0922 | 0.0528 | * | 0.0603 | 0.0417 | |
| Put money into business in 2007–09 | 0.0355 | 0.0651 | | 0.0183 | 0.0520 | | -0.0569 | 0.0425 | | 0.0031 | 0.0471 | |
| Sold part or all of business in 2007–09 | -0.1411 | 0.1350 | | 0.0666 | 0.0985 | | 0.0247 | 0.0787 | | 0.0498 | 0.0931 | |
| No. of observations: 1030 | Log likelihood: -1086.6901 | | | | | | | | | | | |

Notes: Trading regards shares of directly held stocks, stocks in mutual funds and investment trusts — not including stocks held in retirement accounts (IRAs and employer-based pensions). Variables correspond to the year of 2009. Also see the Notes to Table 5.