# Long-term Effects of the Great Recession

# on Household Investment Behavior: a PSID perspective

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Abstract

This paper examines whether households' investment activities changed in response to their personal experiences during the Great Recession using data from PSID. Higher relative wealth in the current year leads to a higher probability that a family will participate in the stock market. Major negative wealth changes or unemployment during the Great Recession reduce the willingness of a household to invest in stocks directly. In contrast, a household's wealth composition in different assets seems not to be influenced by the financial situation of the family during the crisis.

## 1. Introduction

Do personal experiences during a financial crisis change households' investment behavior after the recession? More specifically, are behavioral changes most significant for those who suffered great distress during the Great Recession?

The Great Recession, starting from December 2007 to June 2009[2], witnessed a fall of 3.6 percent in real GDP[3] and an increase of 4.5 percent in the unemployment rate[4] in the US. Among all the postwar recessions starting from 1946, the 2007-09 recession is not only the longest (18 months) but also the deepest one regarding the magnitude of macroeconomic activities.[5] The crisis spread globally through financial markets, resulting in many countries suffering from equity market decline or currency devaluation.

While the steady real GDP growth after 2009 indicates a gradual recovery of macro-economy after the recession, it remains to be answered whether US households recovered from the distress both financially and mentally. According to fundamental utility maximization economic theory, the increase of total wealth has an income effect on an individual's consumption and saving tradeoffs. Moreover, positive expectations about the future economy may also affect the decision for a rational agent to allocate spending in the future. Therefore, this paper compares households' economic activity before and after the Great Recession from an investment perspective, to learn whether the financial and psychological effect of that financial crisis continues to influence households' investment decisions.

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[2] http://www.nber.org/cycles/cyclesmain.html
[3] https://fred.stlouisfed.org/series/GDPC1
[4] https://data.bls.gov/timeseries/LNS14000000
[5] https://www.minneapolisfed.org/publications/special-studies/recession-in-perspective

The paper looks at the changes in households' investment preferences after the Great Recession with 2007-2015 PSID data. The hypothesis is that there are differences in investment behaviors (for example, participation rate, wealth composition, etc.) between families who experienced financial distress during the Great Recession and those who did not in the latest year (2015)[6].

I. The criteria for whether a family has experienced financial distress are (either of the listed):

    (1) The family has suffered a relatively significant wealth loss from 2007 to 2009, that is to say, moving downward by more than 3%[7] in the wealth distribution generated by all the valid[8] observations;

    (2) The head of the family or his/her spouse was unemployed for some time in 2009.

II. The changes in the investment decisions of a household are captured by:

    (1) Changes in market participation: whether there is a direct ownership for each family in stocks, annuities/IRAs, other real estate assets, or family business;

    (2) Changes in asset allocation: whether there is a significant shift in the average share of a particular asset as a result of the portfolio rebalancing[9].

The wealth distributions from 2007 to 2015 depict a family's relative wealth position respectively. Then the change in wealth percentiles between 2007 and 2009 for each family is generated based on the wealth distributions. It is the benchmark to decide whether the family experienced a significant wealth decrease as depicted in I (1). Since the stocks are the most

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[6] Note: 2015 is the most recent year with the published family-level data from PSID.

[7] See explanation in Page 8 for an example of wealth change. The 3% distinction is inspired by the FRS working paper by Bricker et al.

[8] "Valid" means the families have all of the data records in 2007, 2009, 2011, 2013 and 2015 survey.

[9] Note: the average share change could be caused either by change in asset price (capital gain/loss) or change in number of ownership (buy or sell).

representative and noticeably risky asset among all asset types, stock-related investment behaviors are the focuses in this paper.

The paper first tabulates the stock market participation rate and average share of stock based on the wealth distribution groups and wealth change groups over the years. It turns out that households in the top 10% wealth distribution group in 2015 are not only more likely to participate in the stock market but also show a unique bounce-back pattern, whereas families in all the other wealth distribution groups display decreasing trends for investing in stocks. Moreover, the "richest" families are also holding the highest equity share as a crucial component in their asset allocation.

To see the behavioral changes before and after the Great Recession for specific groups, the paper tests whether people who participated in the stock market in 2007 and exited the market in 2009 are more likely to stay out of the market in 2015. The result shows that people who participated before the recession and exited right after the crisis are more likely to reinvest in the stock market, possibly because they stand in higher positions in the relative wealth distribution than their counterparts in 2015. Another test examines whether households who experienced some financial distress (either significant downward shift in their wealth or unemployment as defined in I (1) in Page 3) are less likely to participate in the stock market, or less willing to hold shares in stocks as a part of their total wealth. The result illustrates that distress during the crisis does make a difference in whether the household participates in the market, but does not influence asset allocation choices.

The paper proposes a linear regression model to predict the probability to invest in the stock market. The predictors are the relative position on the 2015 household wealth distribution, the relative position on the 2015 household income distribution, whether a family suffered financial

distress in 2009, and whether the family lost any jobs in 2009. The regression results indicate that relative family wealth and income position perform better than the absolute value of the family wealth and income when predicting whether a family participates in the stock market in the current year. Adding IRA market participation as another explanatory variable, an extended model provides a better explanation of the stock market participation decision.

## 2. Literature Review

To capture the dynamics of aggregate asset markets, Campell and Cochrane (1999) present a consumption-based habit formation model. They assume that risk aversion among consumers is not heterogeneous and it is determined by external habit formation. The model shows the utility of the agents as a function of consumption minus a habit factor:

$$\max \, E \sum_{t=0}^{\infty} \sigma^t \frac{(C_t - X_t)^{1-\gamma} - 1}{1 - \gamma}.$$

where $X_t$ is the level of habit, $\delta$ is the discount factor of time, and the surplus consumption ratio is defined as $S_t = \frac{C_t - X_t}{C_t}$.

The habit-formation model provides a standard way for analyzing whether an agent's risk aversion is time-varying, especially on the macro level. Brunnermier and Nagel (2008) refer to the idea of external habit in the model as Constant Relative Risk Aversion(CRRA) and analyze whether wealth fluctuation changes the risk aversion of individual investors with panel data from Panel Study of Income Dynamics(PSID). They provide the micro level time-varying evidence that "changes in liquid wealth have a significant positive effect on the probability of stock market entry and a negative effect on the probability of exit." (Brunnermier and Nagel 2008, 714) In contrast, changes in wealth do not explain well the changes in asset allocation, where CRRA still prevails. They also propose "inertia"—lack of rebalancing when the capital gain or loss occurs—as an explanation to the lack of time-varying effects of wealth changes on asset

allocation (Brunnermier and Nagel 2008, 714-715). As for determinants of portfolio rebalancing for individuals, economists find out that families that are financially sophisticated are more actively adjusting their portfolios towards their target risky shares and are more likely to enter and less likely to exit the stock market (Calvet et al. 2009, 304). They also show that limited number of trading strategies households use for portfolio rebalancing when they mainly focus on the performances of the risky assets.

Lusardi and Mitchell's (2013) literature review on *financial literacy* offers an explanation for the investment behaviors of the financially sophisticated families. The term, financial literacy, refers to "people's ability to process economic information and make informed decisions about financial planning, wealth accumulation, pensions, and debt" (Lusardi and Mitchell 2013, 2). They find theoretical evidences from different researchers that the more financially literate are "more likely to participate in financial markets and invest in stocks" (Lusardi and Mitchell 2013, 24). When it comes to wealth accumulation, it seems that financial literacy is "positively and significantly associated with wealth outcomes" (Lusardi and Mitchell 2013, 26). Therefore, a positive correlation between participation in stock market and wealth level is built through the financial literacy.

Lots of research on the individual's investment choice comes from the behavioral economists (Collard 2009). They tend to give different interpretations from those theories presented by conventional economists, who treat individual investors as informed agents who act rationally maximizing their interests. For example, Tapia and Yermo (2007) analyze individual's pension accounts using the OECD data, arguing that there are obstacles for individuals to make strategic investment decisions, such as limitations to cognitive abilities to solve the optimizing problem and behavioral challenges like overconfidence. They also find that pension account

participants tend to "change their asset allocation on the basis of recent performance trend and engage on naïve diversification strategies" (Tapia and Yermo 2007, 26).

Researchers also pay attention to the long-term effect of macroeconomic experience on an individual's investment behavior. Malmender and Nagel (2011), interested in the risk-taking preference of the so-called "depression babies", show that households' risk-taking is strongly related to experienced returns. While recent returns far outweigh distant realizations, "Experience many years ago still have some impact on current risk-taking." (Malmender and Nagel 2011, 410) They also provide some insights on the channels of how experiences affect risk-taking, which is partly throughout affecting beliefs about future returns rather than changing risk preferences substantively.

The study of the effect of the most recent financial crisis—the Great Recession—on family finance also draws public attention. Bricker et al. (2011) look directly at the dynamics of the family wealth in the 2007-2009 period. They use the data from Survey of Consumer Finance (SCF), a triennial cross-sectional survey conducted by Federal Reserve Board. They conclude that the significant shifts in net worth of wealth are due to the revaluation of assets rather than the changes in portfolio composition. As for the changes in investor behavior, they find the increasing need for precautionary saving and asymmetric reacting pattern for fluctuations in wealth (i.e., people are more reluctant to spend when asset price rise and more willing to reduce spending when asset price falls). Hoffman et al. (2013) focus more on the direct investment behavior during the financial crisis, finding the individual investors "substantial swings in trading and risk-taking" driven by the investor perceptions, and they did not de-risk their investment portfolios during the crisis.

3. Data & Methodology

The primary data used for this study are the 2007, 2009, 2011, 2013 and 2015(the latest year) Panel Study of Income Dynamics(PSID) main interview data. Directed by the faculty of the University of Michigan, PSID is the longest running longitudinal household survey in the world. [10] The survey started from late March to the end of December, conducted biennially. Till 2015 there were 9048 families in that survey. Facilitated by the assigned family weight on each family and the extended individual weight for each family member, PSID estimates align with the Current Population Survey(CPS) reasonably in most cases.

The survey weight adopted in this panel is the 2007 longitudinal weight allocated to each family by PSID. It is an attrition-adjusted weight which is assigned for better capture of the population characteristics. Although weighted and the unweighted estimates are consistent, the reason for using the longitudinal weights is the weighted estimates of PSID is closer to the Current Population Survey(CPS) estimates than the unweighted estimates (Gouskova et al. 2009). Since there are 5251 observations in the 2007-2015 panel data with complete records in all variables of the interest, using the same longitudinal weight as the survey dataset's weight shows more consistency when this paper defines 2007 as the base year.

The term "wealth" in this study means net worth. It is the sum of the value of seven asset types (farm/home business, checking/saving accounts, other real estate assets, stocks, vehicles, private annuity/IRA and other), adding the value of home equity minus the net debt, excluding balances in employer-based pensions or IRAs. The family wealth in 2009, 2011, 2013 and 2015 are adjusted to the 2007-dollar value by using CPI-U data from Bureau of Labor Statistics (BLS). The position where each family stands in the relative wealth distribution in each year is classified

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[10] Panel Study of Income Dynamics, https://psidonline.isr.umich.edu/default.aspx

into five different groups: less than 25% percentile (group 1), 25% percentile to 50% percentile (group 2), 50% to 75% percentile (group 3), 75% to 90% percentile (group 4), and 90% to 100% percentile (group 5). These groups are referred to as "wealth distribution groups" in the following of the paper[11].

Based on the generated wealth distribution for each year, the "wealth change group" is assigned to each observation by comparing the percentile of the household on the generated wealth distributions in 2007 and 2009. The five groups are categorized based on the level of the change in the relative wealth distribution: downward more than 10% (group 1), downward more than 3% but less than 10% (group 2), upward or downward within 3% (group 3), upward more than 3% but less than 10% (group 4), and upward more than 10% (group 5). For example, if a family stands at the 70th percentile of the wealth distribution in 2007, and it moves to stand at the 50th percentile of the 2009 wealth distribution, the change is -20% and this family is categorized in group 1.

The term "total family income" in this study refers to the sum of taxable income, transfer income and social security income of all the family members in one household. The total family income in 2009, 2011, 2013 and 2015 are also adjusted to the 2007-dollar value using the same method as wealth.

Age groups in this paper are categorized based on the reported age of head as of 2007. There are six groups: people aged less than 35 (group 1), people aged 35-44 (group 2), people aged 45-54 (group 3), people aged 55-64 (group 4), people aged 65-74 (group 5), and people aged 75 or above (group 6).

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[11] Note: the "income groups" appeared in Section 4.5 is calculated in the same way as the process to get "wealth distribution groups".

Whether the family experienced unemployment in 2009 is measured by looking at the value of the head's unemployment week and the value of the spouse's unemployment week. If either the head or the spouse has a non-zero unemployment week during the year, then the family is categorized into the group that has experienced unemployment during the crisis.

## 4. Results

*4.1 Descriptive Information for Stock Market Participation*

The relative wealth level in the current year seems to determine whether households invest in stocks directly at that time. There are notable differences in stock market participation between families who are financially sophisticated (the top 10% group of the 2015 wealth distribution) and all the other families, both in the participation rate and in the trend over the years. The richest group is more willing to invest in stocks in 2015, and their market participation rejuvenates since 2011, whereas other groups are less likely to invest, with decreasing stock market participation rate.

In the top 10% group, a vast majority of the households (72.9%) own stocks in 2007(before the crisis). After decreasing by 9% to 63.9% from 2007 to 2011, the stock market participation rate returns to 70.8% in 2015, rising to the same level before the crisis [See the blue line in Figure 1]. Moreover, the top 10% group is the only one that presents a bounce-back trend, which is consistent with the finding that "financially sophisticated households, with greater income, wealth and education, are more likely to enter and less likely to exit" (Caviet et al. 2009, 304). The result also corresponds to the arguments identified in Lusardi and Michell's financial literacy literature review, in which they find people with higher level of knowledge in financial fields are more likely to participate in the stock market, and wealth are more easily accumulated in people that are more financially literate.

All the other wealth distribution groups, by contrast, maintain relatively conservative attitudes towards investing in stocks [See the yellow, gray, orange and navy-blue line in Figure 1]. The downward sloping trends indicate that these less wealthy families are more reluctant to keep investing in the stock market during the post-crisis period. Take the second richest group (the yellow line in Figure 1) as an example: In 2007, more than a half of the households (51.20%) in the top 10%-25% own stocks as part of their family assets. However, only 41.05% of the families in the same group choose to invest in stock in 2015. Similarly, 28.34% of the 25-50 percentile families (The gray line in Figure 1) participated in the stock market in 2007, whereas only 15.87% of them keep investing in stocks in 2015. The downward sloping trends in the direct stock ownership also indicate, generally speaking, the decreasing interests of American households in the stock market. Therefore, it provides more opportunities for institutional investors and foreign investors to hold more equities in the US.

Figure 1 Percentage of stocks owners from 2007 to 2015, based on 2015 wealth distribution groups
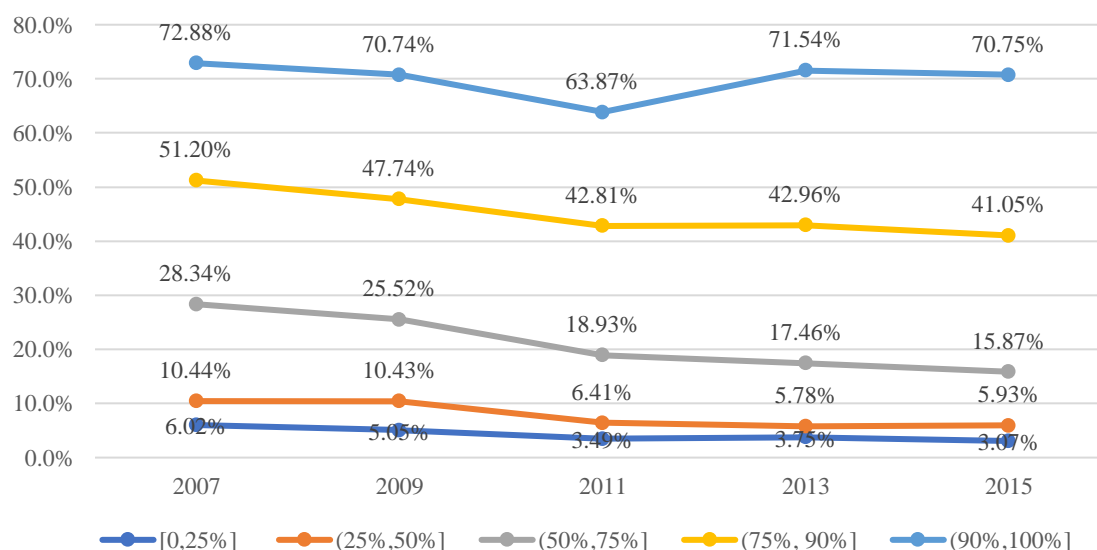


Note: Figure 1 shows changes in the average participation rate in the stock market in 2007, 2009, 2011, 2013 and 2015, based on the five wealth distribution groups [See page 8 for the grouping criteria] in 2015. Data come from PSID. The percentage owning stocks is measured by a dummy variable that records whether the family owns equity as part of its asset. The average participate rates are weighted using the 2007 longitudinal weights [See Page 7-8].

A relatively modest change in wealth distribution during the financial crisis seems to lead to more active participation in the stock market. In the group of households that experience a change of their relative wealth that is within 3%[12] during the crisis, 28.0% of them own stocks in 2015, which is the highest ratio among all the wealth change groups [See the gray line in Figure 2]. The families that moved negatively by more than 3% but less than 10%[13] are also relatively active, with an average 19.6% participation rate [See the orange line in Figure 2]. These two groups are more willing to invest in stocks compared to the others from 2007 to 2015. One possible explanation comes from the relative wealth position: These families are more likely to have higher wealth net worth in 2007. The wealth median of "within 3% group" is 160,000 in 2007 and 111,462 in 2009, and the wealth median of the "-10% to -3% group" is 193,000 in 2007 and 123,707 in 2009[See Table 12], which are higher than the other three groups. As what has been argued, a high wealth level might enable the families to deal with different economic situations and continue investing in different financial assets.

The groups with some capital gains during the crisis (the 10% or more and 3%-10% group, see the blue and yellow lines in Figure 2) seem to be more cautious about investing in the stock (13.8% and 16.1% in 2015). The wealth median of these two groups are 53,800 and 23,000, which are significantly lower than the "within 3%" and "-10% to -3%" group above. However, the group with the most drastic downward shift during the crisis (see the navy-blue line in Figure 2) has a hard time recovering to the pre-crisis participation rate in the stock market (12.5% in 2015 compared to 24.6% in 2007).

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[12] Refer to the group later in this paper as "with 3% group".

[13] Refer to the group later in this paper as "-10% to -3% group".

Figure 2 Percentage of owning stocks from 2007 to 2015, over wealth change groups
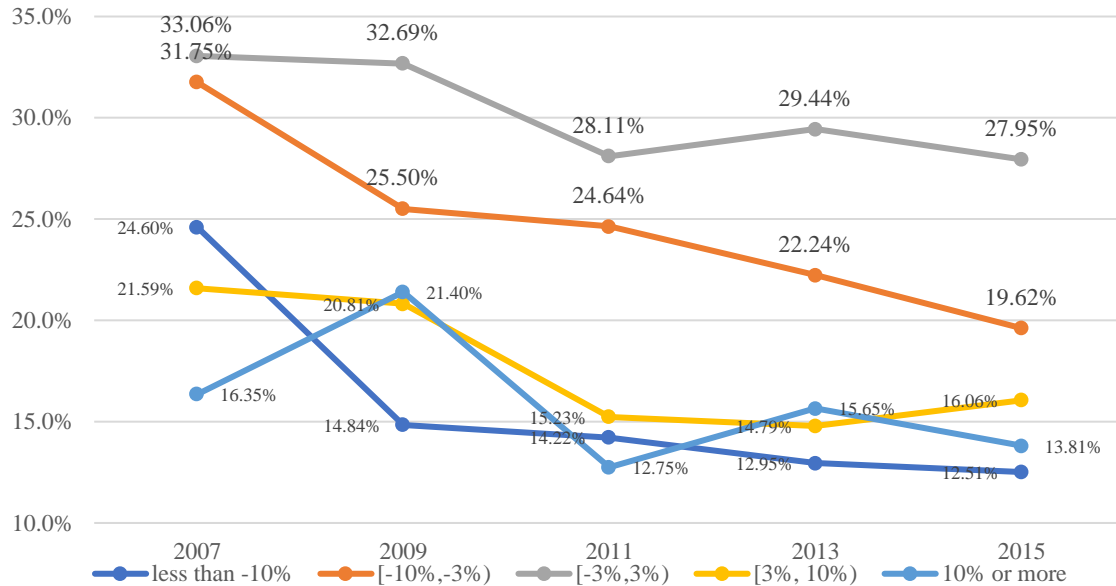


Note: See the note in Figure 1. The grouping criteria in Figure 2 is the wealth change group [See Page 8 for definition]. Figure 2 shows the changes in the stock market participation rate among different wealth change groups.

*4.2 Descriptive Information for Wealth Composition*

PSID surveys record stock, private annuity/IRA, checking/saving, home business, and other real estate assets as the types of households' assets except for employer-based pensions and IRAs. The trends in stock and private annuity/IRA are the most interesting to examine, as they offer more variety in different wealth groups.

Household's relative wealth in the current year plays a significant role in determining the share of a specific asset type on each family's balance sheet. For the top 10% group in 2015, they own 23.1% of their wealth in stocks—which is more than two times the 9.8% average in the 10%-25% group [See Table 1]. Moreover, there is an increasing trend for stocks as part of the family asset in the post-crisis period: the share of stocks rises from 15.3% in 2009 to 23.1% in 2015 in the top 10% group. Nevertheless, it is hard to distinguish whether the increase of the percentage of stock value is caused by pure equity appreciation given that market value of

equities is picking up from 2011 to 2015, or by buying more shares of stocks because PSID only asks about the total estimated stock value for each family in different survey years.

Private Annuity/IRA also makes up a significant portion of the wealth in the top 10% group, representing 21.8% of their total wealth [See Table 2]. Table 2 also shows that private Annuity/IRA takes up 23.33% of the wealth in the top 10%-25% group, and there is an ascending trend in the private Annuity/IRA shares for that group. The relatively high share in IRA points to another conclusion, that the owners of private annuities and IRAs are people with relatively higher wealth position, but not always the richest individuals. However, same as the share of stocks, it is hard to tell whether the increase in the private Annuity/IRA share results from decreasing interest in direct stock ownerships (sell stocks), pure capital gains from Annuity/IRA appreciation, or more active contributions towards the annuity and IRA markets. It could be the case that the interest in investing IRAs are going down throughout the years but the market prices of IRAs are increasing.

For the other three groups with less relative wealth in 2015, the interest in holding stocks is relatively low, which indicates the households with a relatively high wealth level tend to dominate the direct ownership of the stock market. It is also worth noticing that the average share in the private annuity/IRA for those groups is higher than stocks in 2015. One possible explanation is the diversified nature of IRAs makes it more favorable relative to stocks, mainly due to the fact that investors with lower net worth are willing to hold portfolios with lower risks and more stable returns. Another reason might be the entry requirement. Initial capital commitment for buying annuities and IRA could be relatively small compared to direct stock ownership.

Table 1 Average Share of stock in total family wealth, for 2015 wealth distribution groups

| Average share of Stock in Total Wealth from 2007 to 2015, over 2015 wealth distribution groups | | | | | |
|---|---|---|---|---|---|
| | Stock | | | | |
| wealth distribution 2015 | 2007 | 2009 | 2011 | 2013 | 2015 |
| [0,25%] | 2.49% | 0.60% | 0.37% | 0.83% | -1.66% |
| (25%,50%] | 2.35% | 2.62% | 1.85% | 1.41% | 1.72% |
| (50%,75%] | 5.61% | 4.33% | 5.81% | 4.27% | 3.46% |
| (75%,90%] | 9.65% | 9.48% | 8.57% | 10.18% | 9.82% |
| (90%, 100%] | 17.73% | 15.37% | 18.43% | 20.46% | 23.09% |

Note: Each cell in Table 1 reports the average share of stock as part of a family's total wealth composition in 2015, for each of the wealth distribution groups [See Page 8 for definition] in 2015. Data come from PSID. The stock share for each household is calculated using the dollar value of stocks (obtained by a specific variable recording the estimated net worth of stock in 2015) divided by total net wealth (including home equity). All values are adjusted to 2007-dollar values. All the mean values are weighted using the 2007 longitudinal weights.

Table 2 Average Share of the private Annuity/IRA in family wealth, for 2015 wealth distribution groups

| Average Share of the private annuity/IRA in Total Wealth from 2007 to 2015, over 2015 wealth distribution groups | | | | | |
|---|---|---|---|---|---|
| | Private Annuity/IRA | | | | |
| wealth distribution 2015 | 2007 | 2009 | 2011 | 2013 | 2015 |
| [0,25%] | 0.88% | 5.01% | 4.74% | -1.08% | -7.64% |
| (25%,50%] | 2.81% | 6.43% | 5.92% | 5.62% | 5.47% |
| (50%,75%] | 11.61% | 10.02% | 6.68% | 11.72% | 11.45% |
| (75%,90%] | 14.73% | 15.48% | 18.80% | 19.46% | 23.33% |
| (90%, 100%] | 15.53% | 15.71% | 22.33% | 20.42% | 21.79% |

Note: See the note in Table 1. The only difference in Table 2 is the average share is calculated using the dollar value of the private Annuity/IRA divided by total net wealth (including home equity) in 2015.

*4.3 Past Behavior: Households investing in stocks in 2007 and exiting the stock market in 2009*

Families that invested in the stock market in 2007 and then exited the market in 2009 are more likely to invest money in the stock market in 2015 compared to their counterparts (26.5% versus 18.6%). The difference in the 2015 stock market participation rate is statistically

significant. Moreover, the average amount invested in the private annuity/IRA, other real estate assets, and owning a home business in this particular group is also higher than those of their counterparts [See Table 3].

These results may seem to be a little bit surprising. In common sense, people may expect that families exiting the stock market in 2009 are more likely to lose their confidence in making investment decisions, thus more reluctant to reinvest in stocks. One of the explanations would come from changes in relative wealth. According to Table 3, average relative wealth level in 2015 is 3.15[14], which is above the median and higher than 2.54, the average of the control group. The wealthier relative position in the 2015 distribution may facilitate those families to participate more actively in all asset markets, which agrees with the research finding of Calvet, Campell, and Sodini in 2009, and the evidences in the financial literacy review by Lusardi and Mitchell in 2013. From this result, it seems that families making decisions on whether to participate in the stock market are more likely to consider their current wealth situation, rather than their past investment activities.

Meanwhile, for those who used to invest and then quit the stock market, the age makes a difference in whether to participate again. For younger investors (group 1 – group 3) who participated in the 2007 stock market and exited in 2009, they seem to be increasingly attracted to investing in stocks from 2011 to 2015[See blue lines Figure 5 in Appendix]. However, the passion for age group 4 – 6 members (55 years old and above) to stock market investment is diminishing from 2011 to 2015 [See yellow lines Figure 5 in Appendix]. This finding is in tune with the research result in Fagereng, Gottlieb, and Guiso in 2017, who suggest their data tell

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[14] Same as the explanation in the Data section, 0-25% percentile is group 1 and 90-100% percentile is group 5.

"households rebalance their portfolio away from stocks before they reach retirement and exit the stock market after retirement" (Page 708). People seem to be enamored of investing risky assets in their youth, and adjust the wealth composition to a safer portfolio when they get older.

Table 3 Participation rate in different types of assets in 2015, over historical investment experience in 2007

0: other families(control group)
1: families that invest in the stock market and exit the market in 2009

| 2015 Stocks | Mean | Std. Err. | 95% CI | |
| --- | --- | --- | --- | --- |
| 0 | 0.1859038 | 0.0072429 | 0.1717047 | 0.200103 |
| 1 | 0.2650131 | 0.0279305 | 0.2102577 | 0.3197685 |
| | | | | |
| 2015 Home business | | | | |
| 0 | 0.1049433 | 0.0055065 | 0.0941483 | 0.1157383 |
| 1 | 0.14994 | 0.0213138 | 0.1081561 | 0.1917239 |
| | | | | |
| 2015 Private Annuity/IRA | | | | |
| 0 | 0.293813 | 0.0084163 | 0.2773136 | 0.3103124 |
| 1 | 0.5060215 | 0.031374 | 0.4445155 | 0.5675275 |
| | | | | |
| 2015 Other Real Estate | | | | |
| 0 | 0.1661978 | 0.0069471 | 0.1525786 | 0.179817 |
| 1 | 0.2516747 | 0.0263807 | 0.1999576 | 0.3033919 |
| | | | | |
| Wealth Distribution 2015 | | | | |
| 0 | 2.54101 | 0.0235971 | 2.49475 | 2.587271 |
| 1 | 3.145953 | 0.0718169 | 3.005163 | 3.286744 |
| | | | | |
| Change in Wealth Distribution from 2007 to 2009[15] | | | | |
| 0 | 3.202715 | 0.0227242 | 3.158166 | 3.247264 |
| 1 | 2.711886 | 0.0826039 | 2.549948 | 2.873824 |

Test 2015 stocks [0] =2015 stocks [1]

$$F(1, 5250) = 7.52$$
$$\text{Prob} > F = 0.0061$$

Note: Table 3 reports the average participation rate in the stock market, home business, private annuity/IRA market, other real estate assets in 2015, for estimated 2015 wealth distribution

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[15] Note: possible regression to the mean, since the "1" group has higher relative position on the wealth position, it is more likely to move downward rather than upward compared to its counterpart.

group and estimated wealth change group [See Page 8 for the definition for last two terms]. Data come from PSID.

"1" represents the group that had invested in the stock market in 2007 but then exited the market in 2009, and "0" represents all the other families. All the mean values here are weighted using the 2007 longitudinal weights.

The test is an F-test testing whether the mean difference between the stock participation rate in 2015 for the group of interest and its counterpart has statistical significance on 95% significance level.

*4.4 Cohort Effects of the Financial Distress During the Crisis*

The economic distress during the crisis, defined by either a substantial negative shift in relative wealth level or unemployment, seems to have an impact on the stock market participation rate, but not lead to changes in portfolio composition.

Households that have experienced more than a 3% downward shift in the wealth distribution from 2007 to 2009 are less likely to invest in the stock in 2015 (with an average 15.9% participation rate, versus 20.5% of their counterparts) [See Table 4]. The difference is also statistically significant [See Table 5]. Those families possess an average participation rate of 28.0% in 2007, which is higher than 25.1% for the rest of the households. However, after 2009, less than 20% of those households participate directly in the stock market, with the participation rate plummeting to 15.9% in 2015. Contrary to the households with financial distress, the other families remain an average participation rate of 20.5% in stock market in 2015. This result indicates that families that have gone through financial adversity during the Great Recession are more reluctant to invest directly in stocks in 2015.

One of the pitfalls make it hard to support a causal explanation is that the reasons for the negative shift on the relative wealth distribution for each family might be either external or internal. That price of stocks suddenly drops is considered as a surprise, whereas poor portfolio management like selling stocks due to a panic could be avoided with a higher financial knowledge. In fact, from McArdle's research with data from Health and Retirement Study,

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different cognitive abilities like basic math calculation, concept of number series and memory serve as powerful tools to predict total and financial wealth (McArdle et al., 2009). Since there is little information about each family's cognition differences, it would be hard to link the downturn in relative wealth position to past investment activities of families.

Moreover, even if the reasons for the relative wealth change are left undecided, the psychological influence of the change remains hard to measure. Data related to the mental health or emotions are limited in PSID. Luckily, in the 2013 survey, researchers ask six questions[16] related to the psychological health; namely, in past 30 days how often the respondent feels sad, nervous, restless or fidgety, hopeless, that everything was an effect, and worthless. From calculating the average, it seems that people not owning stocks in 2013 have more frequent negative feelings compared to the stockholders. However, there is no evidence to connect the possible reasons for the negative emotions in 2013 with financial conditions of the family in 2009, or in 2013. Furthermore, on the grounds that psychology questions are not asked for all other survey years, the causal relationship between financial distress and psychological concerns are still vague.

Moreover, the result does not support a statistically significant difference in the average share of stocks between the group that suffered financial distress and the group that did not— 4.5% versus 5.0% for the experienced distress group versus the not-experienced distress group [See Table 4 and 5]. From the t-test in Table 5, there is no statistical significance in the difference in these two groups. The findings are consistent with the idea of "inertia" Brunnermier and Nagel discuss in 2008, that investors are less likely to change their portfolio composition when their wealth fluctuates.

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[16] ftp://ftp.isr.umich.edu/pub/src/psid/questionnaires/q2013.pdf, page 171-172, H59A-H59F.

Table 4 Test of the stock market participation, over whether experience wealth collapse during the crisis

0: not experience relatively considerable wealth collapse during the crisis

1: experience relatively considerable wealth collapse during the crisis

| Whether hold Stocks? | Over | Mean | Std. Err. | 95% CI | |
|---|---|---|---|---|---|
| 2007 | 0 | 0.2509516 | 0.0091035 | 0.233105 | 0.2687982 |
| | 1 | 0.2802828 | 0.0149659 | 0.2509434 | 0.3096222 |
| 2009 | | | | | |
| | 0 | 0.2594435 | 0.0092665 | 0.2412773 | 0.2776098 |
| | 1 | 0.1994746 | 0.0132865 | 0.1734274 | 0.2255217 |
| 2011 | | | | | |
| | 0 | 0.2002059 | 0.0083975 | 0.1837433 | 0.2166685 |
| | 1 | 0.19212 | 0.0133144 | 0.1660183 | 0.2182217 |
| 2013 | | | | | |
| | 0 | 0.2115435 | 0.0085525 | 0.194777 | 0.22831 |
| | 1 | 0.1739444 | 0.0128136 | 0.1488244 | 0.1990645 |
| 2015 | | | | | |
| | 0 | 0.2049024 | 0.0084667 | 0.1883041 | 0.2215007 |
| | 1 | 0.1591485 | 0.0125378 | 0.1345693 | 0.1837277 |
| Stock Share 2015 | | | | | |
| | 0 | 0.0497894 | 0.005543 | 0.0389226 | 0.0606561 |
| | 1 | 0.0446155 | 0.0063811 | 0.0321058 | 0.0571253 |

Note: Table 4 reports the average participation rate of the stock market in 2007, 2009, 2011, 2013, 2015, and average stock share in 2015, over whether the family has suffered a relatively significant negative wealth change during the financial crisis. Data come from PSID. "1" represents the group that has suffered more than 3% negative shift on the wealth distribution in 2009 compared to 2007[See Page 3 for criteria], and "0" represents all the other families. All the mean values here are weighted using the 2007 longitudinal weights [See Page 7-8].

Table 5 F-tests based on Table 4

Test participation rate in 2015:
2015[0] =2015[1]

| Coef. | Std. Err. | t | P>t | [95% Conf. | Interval] |
|---|---|---|---|---|---|
| 0.0457539 | 0.0151288 | 3.02 | 0.003 | 0.0160952 | 0.0754127 |

Test average share of stock in 2015:

| Coef. | Std. Err. | t | P>t | [95% Conf. | Interval] |
|---|---|---|---|---|---|
| 0.0051738 | 0.0084524 | 0.61 | 0.54 | -0.0113966 | 0.0217443 |

Note: See the note in Table 4. The tests are two F-tests. The first one is testing whether the mean difference between the stock participation rate in 2015 for the group of interest and its counterpart has statistical significance on 95% significance level. And the second is testing whether the mean difference between the average stock share in 2015 for the group of interest and its counterpart has statistical significance on 95% significance level.

Families that suffer unemployment in 2009 are less willing to participate in the stock market in 2015 (with an average participation rate of 15.0%, versus 19.7% of their counterparts) [See Table 6]. Different from the pattern for the wealth loss in Table 4, the participation rate for the unemployed group is also relatively low before the crisis (17.6% comparing to 27.0% for their counterparts) in 2007[See Table 6]. One possible explanation would be the family that exposed to unemployment in 2009 are less wealthy compared to their counterparts from 2007 to 2015, which leads to the limited financial ability to choose different financial instruments, and a more restricted budget to invest in the asset markets. [See Table 15 in Appendix]. It is also interesting to notice that the difference in participation rate difference between the unemployment group and the control group also shrinks. It further supports the argument discussed before, that US households in general become less attracted to investing in stocks.

The labor market distress also does not change the composition of the investment portfolio statistically significantly as well [See Table 7]. The average share in stocks for those two groups is 1.1% versus 5.2%, which is an about 4% difference in magnitude. However, it would be hard to argue that unemployment in 2009 can make a statistically significant difference in the asset allocation decisions, for the p-value of that F-test is 0.059.

Table 6 Test of the stock market participation, over whether experienced unemployment in 2009

0: no unemployment in 2009

1: experience unemployment in 2009

| | Over | Mean | Std. Err. | 95% CI | |
|---|---|---|---|---|---|
| Whether hold Stocks? | | | | | |
| 2007 | 0 | 0.2694117 | 0.0083688 | 0.2530053 | 0.2858181 |
| | 1 | 0.1759104 | 0.0201644 | 0.1363798 | 0.215441 |
| 2009 | | | | | |
| | 0 | 0.252502 | 0.0082262 | 0.2363752 | 0.2686289 |
| | 1 | 0.1604342 | 0.0193996 | 0.1224029 | 0.1984654 |
| 2011 | | | | | |
| | 0 | 0.2034195 | 0.0076081 | 0.1885045 | 0.2183344 |
| | 1 | 0.1528478 | 0.0192911 | 0.1150293 | 0.1906663 |
| 2013 | | | | | |
| | 0 | 0.2067768 | 0.0076365 | 0.1918061 | 0.2217475 |
| | 1 | 0.1528645 | 0.0192126 | 0.1151998 | 0.1905293 |
| 2015 | | | | | |
| | 0 | 0.1970625 | 0.0075041 | 0.1823514 | 0.2117737 |
| | 1 | 0.1502102 | 0.0199776 | 0.1110459 | 0.1893745 |
| Average Share of stocks in 2015 | | | | | |
| | 0 | 0.0525999 | 0.0041764 | 0.0444123 | 0.0607875 |
| | 1 | 0.0113379 | 0.0214826 | -0.0307775 | 0.0534534 |

Note: Table 6 reports the average participation rate of the stock market in 2007, 2009, 2011, 2013, 2015, and average stock share in 2015, over whether the family has suffered some labor market failure during the financial crisis. Data come from PSID.
"1" represents the group that suffers the unemployment in 2008[See Page 3 for criteria], and "0" represents all the other families. All the mean values here are weighted using the 2007 longitudinal weights [See Page 7-8].

Table 7  F-tests based on Table 9

Test participation rate in 2015: 2015[0] = 2015[1]

| Coef. | Std. Err. | t | P>t | [95% Conf. | Interval] |
|---|---|---|---|---|---|
| 0.0468523 | 0.0213404 | 2.2 | 0.028 | 0.0050162 | 0.0886884 |

Test average share of stock in 2015:

| Coef. | Std. Err. | t | P>t | [95% Conf. | Interval] |
|---|---|---|---|---|---|
| 0.041262 | 0.0218848 | 1.89 | 0.059 | -0.001642 | 0.0841659 |

Note: See the note in table 6. The tests are two F-tests. The first one is testing whether the mean difference between the stock participation rate in 2015 for the group of interest and its counterpart has statistical significance on 95% significance level. And the second is testing whether the mean difference between the average stock share in 2015 for the group of interest and its counterpart has statistical significance on 95% significance level.

*4.5 A Simple Model: Predicting whether a household invests the stock market*

A linear regression model is proposed, consisting of four explanatory variables, to predict whether a family invests in the stock market: the relative position on the wealth distribution, the relative position on the income distribution, whether the family experienced some financial or labor market distress during the Great Recession period.

In the equation form, the model is written as:

$$Whtstock = \beta_0 + \beta_1 wealthgp_{y1} + \beta_2 incomegp_{y1} + \beta_3 wealthchange + \beta_4 unemploy09.$$

Where *Whtstock* stands for whether the family owns the stock in the current year, *wealthgp*$_{y1}$ indicates the relative wealth group it belongs to in year y1, *incomegp*$_{y1}$ denotes the relative income group it belongs to in year y1, *wealthchange* represents whether the family suffered a significant financial distress during the crisis, and *unemploy09* shows if the family lost any jobs in 2009.

Table 8 lists the results when y1 is set to 2015. The slope coefficients on the four variables are all statistically significant, and the R-squared for the sample is 24.7%. The regression results show that a major negative shift in wealth distribution and an experience of unemployment during the crisis do have some long-term effects on the investment decisions of households in the most recent year. However, the dominant factor is the relative wealth level in the current year:

The T-statistic on the slope coefficient is 22.33 and the slope coefficient on this category variable also has the largest absolute value of 14.4%. Although the relative income level and wealth level are positively correlated (correlation 0.5214) [See the correlation matrix], both of the variables are statistically significant for the prediction of stock market participation.

The negative slope coefficient (-0.0293) on the dummy variable of wealth change coincides with the analysis in Section 4.4, stating the probability of a family participating in the stock market decreases if the family suffers financial distress. However, the coefficient on the indicator variable for unemployment is positive with statistical significance, which is inconsistent with the discouraging effect of unemployment on stock market participation rate in Section 4.5.

One explanation comes from the negative correlation between the wealth distribution group in 2015 and the unemployment experience in 2009. Since more than 50% of the families that suffered unemployment in 2009 are from the bottom 25% group, the relative wealth position pushes the probability to own stocks towards zero. Therefore, the coefficient on the unemployment indicator in 2009 may turn positive as a result of least square calculation.

Another interpretation of the positive sign is to think about the bias stability assumption. As stated in Section 4.4, the percentages of those who participated in the stock market in 2007 for the "unemployed in 2009" group and its control group are 17.6% and 26.9%, whereas the percentages both drop in 2015, to 15.0% and 19.7 respectively. Importantly, the difference in the difference between the percentages shrinks. Since the control group seems to plummet more than the unemployed group, the positive coefficient is likely to capture the bias change.

An alternative model is proposed to estimate the probability that a family participates in the stock market with the absolute value of family income and total wealth, while the other two indicator variables stay the same as in the previous model. However, wealth and income are not

better predictors of the probability to participate in the stock market. The absolute value model only explains 11% of the variation. Furthermore, in this model, the indicator variable for unemployment does not have statistical significance, with a t-statistic of -0.35 [See Table 15 in Appendix].

Table 8 Regression results for stock market participation 2015

| Whether own stocks in 2015 | Coef. | Std. Err. | t | P>t | [95% Conf. | Interval] |
|---|---|---|---|---|---|---|
| Wealth group_15 | 0.1444 | 0.0065 | 22.3300 | 0.0000 | 0.1317 | 0.1571 |
| Income group_15 | 0.0190 | 0.0061 | 3.1200 | 0.0020 | 0.0071 | 0.0310 |
| Whether major wealth change | (0.0293) | 0.0135 | (2.1700) | 0.0300 | (0.0557) | (0.0028) |
| Whether unemployment 2009 | 0.0600 | 0.0194 | 3.0900 | 0.0020 | 0.0219 | 0.0981 |
| _cons | (0.2301) | 0.0133 | (17.3400) | 0.0000 | (0.2561) | (0.2041) |

| | income group_15 | wealth group_15 | Whether major wealth change | Whether unemployment 2009 |
|---|---|---|---|---|
| income group_15 | 1 | | | |
| wealth group_15 | 0.5214 | 1 | | |
| Whether major wealth change | 0.0585 | (0.0407) | 1 | |
| Whether unemployment 2009 | (0.1624) | (0.1701) | 0.0139 | 1 |

Note: Table 8 provides an example simple linear regression model to estimate whether a family owns stocks as part of their wealth in 2015. Data come from PSID. The regression is weighted using the 2007 longitudinal weights [See Page 7-8]. The dependent variable is an indicator variable that values one when the family owns stock in 2015. "Wealth group_15" is the 2015 wealth distribution group [See Page 8]. "Income group_15" is the 2015 family income group, a category variable which is calculated using the same method of wealth distribution group's calculation. "Whether major wealth change" is a dummy variable that values one if the family suffered more than 3% negative shift in the wealth distribution during the financial crisis [See criteria on Page 3]. "Whether unemployment" is a dummy variable that values one if the family suffered some unemployment in 2009 [See criteria on Page 3]. The correlation matrix is also attached below for reference.

*4.6 Model Extended: factoring in the IRA*

Recalling the results from Section 4.2 in wealth composition, the private Annuity/IRA

makes up the largest portion in the asset allocation for the top 10-25% group (2015). Since

private IRAs are composed of other financial assets (mainly stocks, bonds or other derivatives),

it could be regarded as an alternative for direct ownership of stocks. One of the reasons

households hold the private IRAs is the potential tax benefits they receive. Thus, whether

investors hold the private annuity/IRA is another independent variable for the stock market

participation, and this information may lead to a better prediction model. Since the IRAs are

always long-term investments, the dummy variable for whether investors hold IRAs in 2007 is

selected as an estimate for IRA investment.

Based on the model given in Section 4.5, an extended model is proposed:

$$Whtstock = \beta_0 + \beta_1 WhtIRA_{07} + \beta_2 wealthgp_{y1} + \beta_3 incomegp_{y1} + \beta_4 wealthchange +$$

$$\beta_5 unemploy09 \,.$$

Where *Whtstock* stands for whether the family owns the stock in the current year, $WhtIRA_{07}$
shows whether the family owns IRA in 2007, *wealthgp_{y1}* indicates the relative wealth group it
belongs to in year y1, *incomegp_{y1}* denotes the relative income group it belongs to in year y1,
*wealthchange* represents whether the family suffered a significant financial distress during the
crisis, and *unemploy09* shows if the family lost any jobs in 2009.

Table 9 interprets the model with 2015 data. Adding private IRAs ownership to the model,

R-squared rises to 26.8% compared to the model in Section 4.5. All of the explanatory variables

show statistical significance. Investing in IRAs in 2007 seems to boost the probability that

households invest in the stock market in 2015, with the magnitude of 0.1412. It might not be

intuitive to accept the higher probability if a family owns an IRA when considering the

substitution effect. One possible explanation is the risk diversification of investment. Households

may choose different assets to invest in order to offset business risks associated with specific firms or industries. Therefore, IRAs and direct stock ownership may serve as a great combination to diversify investment risks.

Compared to the model in Section 4.5[Table 9 vs Table 8], the magnitudes of the coefficient of relative wealth position decreases from 0.1444 to 0.1206, and that of the relative income position increases from 0.0190 to 0.0151. The t-statistics for these two variables also decline when factoring the IRA in. The same direction of the change appears on the 2009 unemployment dummy variable. Nonetheless, the effect on whether relative wealth position had significant changes during the financial crisis in 2008 seems to amplify both in magnitude and statistical significance.

Table 9 Regression results for stock market participation 2015 with IRA

| Whether own stocks in 2015 | Coef. | Std. Err. | t | P>t | [95% Conf. | Interval] |
|---|---|---|---|---|---|---|
| Whether own IRA in 2007 | 0.1412 | 0.0171 | 8.2600 | 0.0000 | 0.1076 | 0.1747 |
| Wealth group_15 | 0.1206 | 0.0069 | 17.4900 | 0.0000 | 0.1071 | 0.1341 |
| Income group_15 | 0.0151 | 0.0060 | 2.5200 | 0.0120 | 0.0033 | 0.0268 |
| Whether major wealth change | (0.0382) | 0.0133 | (2.8600) | 0.0040 | (0.0643) | (0.0120) |
| Whether unemployment 2009 | 0.0590 | 0.0185 | 3.1800 | 0.0010 | 0.0226 | 0.0953 |
| _cons | (0.2048) | 0.0137 | (14.9600) | 0.0000 | (0.2316) | (0.1779) |

| | Whether own IRA in 2007 | Wealth group_15 | Income group_15 | Whether major wealth change | Whether unemployment 2009 |
|---|---|---|---|---|---|
| Whether own IRA in 2007 | 1 | | | | |
| Wealth group_15 | 0.4895 | 1 | | | |
| Income group_15 | 0.3436 | 0.5214 | 1 | | |
| Whether major wealth change | 0.0458 | (0.0407) | 0.0585 | 1 | |
| Whether unemployment 2009 | (0.089) | (0.1701) | (0.1624) | 0.0139 | 1 |

Note: Table 9 provides a simple linear regression model to estimate whether a family owns stocks as part of their wealth in 2015. Data come from PSID. The regression is weighted using the 2007 longitudinal weights [See Page 7-8].

The dependent variable is an indicator variable that values one when the family owns stock in 2015. "Whether own IRA 2007" is the dummy variable that indicates whether the family owns IRA in 2007. See Note for Table 8 for the other for independent variables. The correlation matrix is also attached below for reference.

## 5. Conclusions and Remaining Questions

The research shows that there are longer-term effects of financial distress from the Great Recession on household investment preferences in PSID. People who have experienced a substantial loss of wealth or lost their jobs during the recession tend to show less interest in participating directly in the stock market in the most current year. However, personal experiences during the Great Recession do not significantly affect the asset allocation decisions of individual investors.

It is interesting to see that households with relatively high net worth are more likely to invest in stocks, hold a more significant share in the stock market, and participate more actively in all different financial markets, such as private IRAs, real estate, and home business. The participation rate of the wealthiest group is approximately the same as the level before the crisis, whereas participation rates in all the other groups decline significantly. Therefore, a considerable gap in investing stocks among the wealth distribution groups leads to a higher Gini index for individual investors compared to that in the pre-crisis period. Since the value of the equity market has soared after the crisis, those capital gains are more likely to lead to even higher net worth for the wealthiest families. This might aggravate the inequality between the rich and the poor, leading to the discussion of which groups of families are in reality gaining from the huge equity market appreciation. Moreover, with the declining interest in investing stocks for the US households, institutional investors and foreign investors tend to account for more shares in the US stock market.

The data also show that households that participated in the stock market in 2007 and exited the market in 2009 are more likely to reinvest in the stock market in 2015. A possible reason is that families who once invested and exited the market are initially richer compared to their

counterparts. Financial literacy might also play a role in influencing the individuals' investment activities throughout the years. Nevertheless, the economic growth arouses investing interests—a reviving macroeconomic environment may seem promising for the investment opportunities in the stock market. In that case, the psychological experience from the crisis might not be the dominating power for current investment decisions. Moreover, age matters a lot for stock market participation. People tend to have a stronger incentive to invest when they are relatively young, and their interests for investing seem to decrease around the corner of the retirement age.

To predict whether a family owns stocks as a part of their assets, the relative wealth level in the recent year is the most critical factor. Moreover, the relative level of wealth and family income seems to be more powerful than the absolute value in predicting the participation probability of the households. Most people only have a relatively vague knowledge of their relative wealth position among the population, but it could serve as a better predictor than accurate figures of wealth. Another interesting variable is the investment in alternatives such as IRA. Diversification benefit from holding different assets helps lower the risk of the investment portfolio, which makes the IRA-included prediction model powerful.

Nonetheless, several tasks remain unsolved. First, the paper gives possible explanations on stock market participation rate through the relative wealth level, whereas the proof for a causal relationship is nowhere. Second, the paper mainly focuses on stock-related behavior. A complete analysis on post-crisis investment behaviors should take other assets into full consideration, especially on real estate assets when studying the Great Recession in 2008, considering the great catastrophe the housing market bubble led to during that period. Moreover, the long-term effect of past investment activities is better when putting in a longer time frame. Several studies on the impacts of the Great Depression in 1929-1933 use 30 years or 50 years as the time frame, in

contrast to the relatively short period of 8 years. Additionally, although the paper mentions several quantitative approaches in the literature review section, most of the analysis is descriptive or qualitative. In particular, the prediction model would have been more accurate if the research had added additional explanatory variables with established causal explanations in theories.

REFERENCES

Bricker, Jesse, Brian Bucks, Arthur Kennickell, Traci Mach, and Kevin Moore. 2011.
"Surveying the Aftermath of the Storm: Changes in Family Finances from 2007 to 2009."
*Federal Reserve Board Working Paper*.

Brunnermeier, Markus, and Stefan Nagel. 2008. "Do Wealth Fluctuations Generate Time-
Varying Risk Aversion? Micro-evidence on Individuals' Asset Allocation." *American
Economic Review* 98 (3): 713–36.

Collard, Shanon. 2009. "Individual investment behaviour: A brief review of research." Personal
Finance Research Centre, University of Bristol.

Calvet, Laurent E., John Y. Campell, and Paolo Sodini. 2009. "Fight or Flight? Portfolio
Rebalancing By Individual Investors." *Quarterly Journal of Economics* 124 (1): 301-48.

Campbell, John Y., and John Cochrane. 1999. "By Force of Habit: A Consumption Based
Explanation of Aggregate Stock Market Behavior." *Journal of Political Economy* 107 (2):
205–51.

Fagereng, Andreas, Charles Gottlieb, and Luigi Guiso. 2017. "Asset Market Participation and
Portfolio Choice over the Life-Cycle", *Journal of Finance* 72 (2): 705-50.

Gouskova, Elena, Steven G. Heeringa, Katherine McGonagle, Robert Schoeni, and Frank
Stafford. 2009. "Technical Report, Panel Study of Income Dynamics: Construction and
Evaluation of the Longitudinal Sample Weight 2007". Panel Study of Income Dynamics,
August 2009.

https://psidonline.isr.umich.edu/data/weights/psidweights-2007.pdf

Hoffmann, Arvid O.I., Thomas Post, and Joost M.E. Pennings. 2013. "Individual investor perceptions and behavior during the financial crisis", *Journal of Banking and Finance* 37 (1): 60-74.

Lusardi, Annamaria, and Mitchell, Olivia S. 2013. "The Economic Importance of Financial Literacy: Theory and Evidence." NBER Working Paper 18952, National Bureau of Economic Research, Cambridge, MA.

McArdle, John J., James P. Smith, and Robert Willis. "Cognition and Economic Outcomes in the Health and Retirement Survey." NBER Working Paper 15266, National Bureau of Economic Research, Cambridge, MA.

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

Tapia, Waldo and Juan Yermo. 2007. "Implications of behavioral economics for mandatory individual account pension systems", *OECD Working Papers on Insurance and Private Pensions*, No. 11. http://doi.org/10.1787/103002825851.

Appendix

Table 10

| Changes in Wealth Distribution Groups from 2007 to 2009 | | | | | | |
|---|---|---|---|---|---|---|
| | 2009 | | | | | |
| 2007 | [0,25%] | (25%,50%] | (50%,75%] | (75%,90%] | (90%, 100%] | Total |
| [0,25%] | 18.60% | 5.72% | 0.60% | 0.11% | 0.12% | 25.15% |
| (25%,50%] | 4.26% | 15.31% | 4.81% | 0.31% | 0.21% | 24.90% |
| (50%,75%] | 1.64% | 3.60% | 15.72% | 3.50% | 0.52% | 24.97% |
| (75%,90%] | 0.23% | 0.53% | 3.32% | 8.97% | 1.97% | 15.02% |
| (90%, 100%] | 0.12% | 0.00% | 0.45% | 2.24% | 7.14% | 9.95% |
| Total | 24.86% | 25.16% | 24.89% | 15.14% | 9.95% | 100.00% |

Note: Each cell reports the percentage of the family in the column wealth distribution group in 2009, that were in the row wealth distribution group (defined on page 8) in 2007. Data are from PSID. "2007" refers to imputed wealth including home equity in 2007, and "2009" refers to imputed wealth including home equity in 2009. All percentile computations are done using 2007 longitudinal weights (See Page 7 for notes on weights).

Table 11

| Changes in Wealth Distribution Groups from 2007 to 2015 | | | | | | |
|---|---|---|---|---|---|---|
| | 2015 | | | | | |
| 2007 | [0,25%] | (25%,50%] | (50%,75%] | (75%,90%] | (90%, 100%] | Total |
| [0,25%] | 16.36% | 6.61% | 1.86% | 0.23% | 0.08% | 25.15% |
| (25%,50%] | 6.24% | 12.64% | 5.29% | 0.63% | 0.11% | 24.90% |
| (50%,75%] | 2.06% | 5.06% | 12.57% | 4.60% | 0.69% | 24.97% |
| (75%,90%] | 0.43% | 0.70% | 4.57% | 6.79% | 2.54% | 15.02% |
| (90%, 100%] | 0.06% | 0.20% | 0.73% | 2.80% | 6.16% | 9.95% |
| Total | 25.14% | 25.21% | 25.02% | 15.06% | 9.58% | 100.00% |

Note: See the note in Table 10. The only difference is the column groups are the 2015 wealth distribution groups, and "2015" referring to imputed wealth including home equity in 2015.

Table 12

| | percentage | 2007 Total Wealth | | | 2009 Total Wealth | | |
|---|---|---|---|---|---|---|---|
| | | 25th | 50th | 75th | 25th | 50th | 75th |
| less than -10% | 14.73% | 47,500 | 181,000 | 418,000 | -6,765 | 9,665 | 97,806 |
| [-10%,-3%) | 13.54% | 53,000 | 193,000 | 512,000 | 18,541 | 111,462 | 292,839 |
| [-3%,3%) | 30.11% | 10,650 | 160,000 | 761,000 | 6,379 | 123,707 | 641,422 |
| [3%, 10%) | 23.73% | 2,000 | 53,800 | 224,000 | 2,899 | 63,787 | 245,482 |
| 10% or more | 17.89% | 800 | 28,000 | 125,000 | 24,162 | 101,479 | 291,582 |

**Total Family Wealth Percentile, over wealth change groups from 2007 to 2009**

Note: Table 12 reports the average wealth level of each wealth change group (defined on Page 8). "Percentage" lists the percentage of each wealth distribution group among all the families. Data come from PSID. "2007 Total Wealth" shows the 2007 dollar-value net worth of family wealth in the 25th, 50th and 75th percentile in 2007. "2009 Total wealth" shows the 2007 dollar-value net worth of wealth in the 25th, 50th, and 75th percentile. The centiles are weighted using the 2007 longitudinal weights [See Page 8].

Table 13

| | percentage | 2007 Total Family Income | | | 2009 Total Family Income | | |
|---|---|---|---|---|---|---|---|
| | | 25th | 50th | 75th | 25th | 50th | 75th |
| less than -10% | 14.73% | 33,500 | 60,000 | 98,000 | 31,974 | 58,374 | 96,444 |
| [-10%, -3%) | 13.54% | 32,500 | 59,700 | 100,000 | 31,434 | 54,509 | 97,119 |
| [-3%,3%) | 30.11% | 28,530 | 60,000 | 101,015 | 28,681 | 57,988 | 105,177 |
| [3%, 10%) | 23.73% | 21,284 | 47,700 | 85,000 | 23,815 | 49,208 | 87,958 |
| 10% or more | 17.89% | 25,943 | 50,700 | 84,041 | 28,994 | 55,910 | 89,881 |

**Total Family Income Percentile, over wealth change groups from 2007 to 2009**

Note: See the note in Table 12. The only difference is the value measured here is the total family income in 2007 and 2009 (all in 2007-dollar value).

Table 14 Average Share of Checking/Saving, over wealth distribution 2015

| Average Share of checking/saving accounts in Total wealth, over 2015 wealth distribution, from 2007 to 2015 | | | | | |
|---|---|---|---|---|---|
| | Checking/ Saving | | | | |
| wealth distribution 2015 | 2007 | 2009 | 2011 | 2013 | 2015 |
| [0,25%] | 12.10% | 12.45% | 11.81% | 14.98% | 4.84% |
| (25%,50%] | 7.93% | 13.19% | 7.92% | 15.26% | 15.43% |
| (50%,75%] | 12.46% | 13.03% | 5.52% | 11.85% | 10.65% |
| (75%,90%] | 9.76% | 12.14% | 9.68% | 11.73% | 9.73% |
| (90%, 100%] | 8.49% | 9.70% | 8.82% | 9.59% | 6.99% |

Note: See the note in Table 1. The only difference in Table 14 is the average share is calculated using the dollar value of checking or saving amounts divided by the total net wealth (including home equity) in 2015.

Table 15 family wealth in 2007 and 2009, over unemployment in 2009

| Over | Mean | Std. Err. | [95% Conf. | Interval] |
|---|---|---|---|---|
| Family Wealth 2007 | | | | |
| 0 | 443063.8 | 39568.27 | 365493.5 | 520634.1 |
| 1 | 220924.9 | 52223.74 | 118544.6 | 323305.1 |
| Family Wealth 2009 | | | | |
| 0 | 432527.8 | 67024.03 | 301132.9 | 563922.8 |
| 1 | 149556.2 | 28124.31 | 94420.9 | 204691.6 |

Note: The table displays the mean value of the total family wealth, over whether the family suffered unemployment in 2009. Data come from PSID. All values are adjusted to the 2007-dollar value. The averages are weighted using the 2007 longitudinal weights.
"1" represents the group that has suffered some unemployment in 2008[See Page 3 for criteria], and "0" represents all the other families.

Table 16 Regression: Whether own stocks, absolute value predictors

| Whether own stocks | Coef. | Std. Err. | t | P>t | [95% Conf. | Interval] |
|---|---|---|---|---|---|---|
| Income 2015 | 7.05E-07 | 1.47E-07 | 4.79 | 0 | 4.17E-07 | 9.93E-07 |
| Total Wealth 2015 | 6.17E-08 | 2.73E-08 | 2.26 | 0.024 | 8.24E-09 | 1.15E-07 |
| Whether major wealth change | -0.0324761 | 0.0148805 | -2.18 | 0.029 | -0.061648 | -0.0033041 |
| Whether unemployment 2009 | -0.0071798 | 0.0206733 | -0.35 | 0.728 | -0.0477081 | 0.0333486 |
| _cons | 0.1180196 | 0.0123688 | 9.54 | 0 | 0.0937717 | 0.1422675 |

| | income 2015 | wealth 2015 | Whether major wealth change | Whether unemployment 2009 |
|---|---|---|---|---|
| income 2015 | 1 | | | |
| wealth 2015 | 0.5054 | 1 | | |
| Whether major wealth change | 0.0156 | -0.0575 | 1 | |
| Whether unemployment 2009 | -0.1299 | -0.0632 | 0.0139 | 1 |

Note: See the note in Table 8. The difference in Table 16 is the first two independent variables. "wealth 2015" represents the total family wealth in 2015. "Income 2015" stands for the total family income in 2015. All the values are adjusted to the 2007-dollar value.

Figure 3 Histogram for wealth distribution percentile change from 2007 to 2009
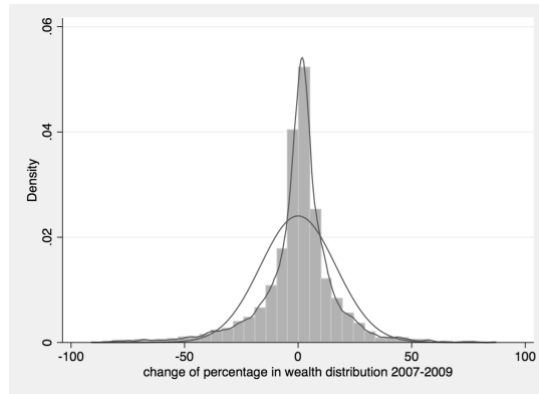


Notes: The graph provides a histogram for the percentage change of the position on the wealth distribution in 2009 compared to 2007 for one family. For example, the family stood on the 60th percentile of the 2007 wealth distribution, and it moved to the 55th percentile of the 2009 wealth distribution, then the change in -5%, which is added to the -5% group on the x-axis.

Figure 4 Histogram for wealth distribution percentile change from 2007-2015
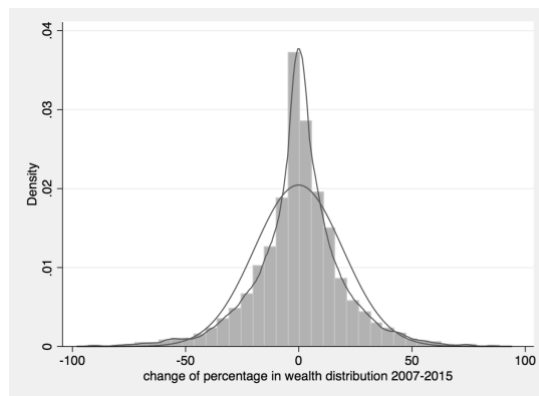


Notes: See the note in Figure 3. All information all the same, except for the percentage change in this graph is compared wealth distribution position in 2015 to that in 2007.

Figure 5 Difference in Ages regarding stock market participation



Stock Market Participation 2011-2015, for families who invested in 2007 and exit in 2009, over agegroup
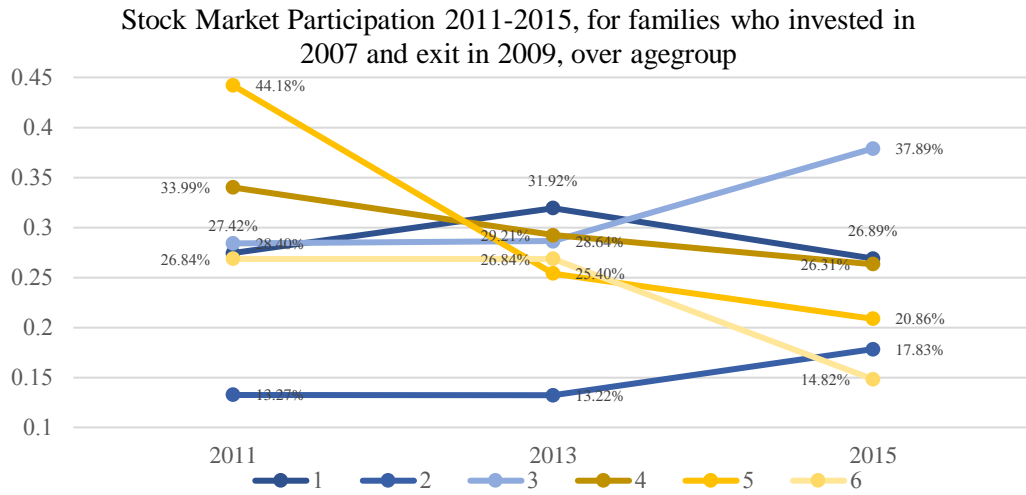
Notes: The line chart provides the average of stock market participation for families who invested in stocks 2007 and exited the stock market in 2009, over the age groups from 1 to 6. See Section 3(Page 9) for the definition of age groups.