After the Financial Crisis: Heterogeneity of Consumer Optimism and Investment in Risky Assets

Daewoung Choi
Department of Economics, Finance and Legal Studies
The University of Alabama

Kyung Tae Kim
Department of Consumer Sciences
The University of Alabama

Abstract

We examined the effects of heterogeneous optimism on risky asset investment in the period following the 2008 financial crisis by distinguishing between the micro and macro levels of individuals' optimism in data provided by the Survey of Consumer Finances (SCF). The baseline logit model showed that the general measure of optimism, which ignores the heterogeneity of one's' beliefs in micro and macro levels of optimism, was associated negatively with stock holdings in the period following the financial crisis. This result is in contrast to the findings of prior studies of household optimism. Using the distinct levels of individuals' optimism, we found that households that are optimistic only about their future income growth are more likely to have directly held stocks in their financial portfolio, and this effect held continuously during the post-crisis period. However, households that are optimistic only about the future economy are less likely to invest directly in stocks during this period. This opposite effect of macro optimism may offset the positive role of individuals' optimism on risky asset investment that has been documented in previous literature. Results of multinomial logit models indeed indicated that households that possessed macro optimism held a lower portion of stocks at most.

Keywords: consumer optimism, stock holdings, 2008 financial crisis, Survey of Consumer Finances

1. Introduction

Recent empirical studies on household portfolio choice have examined a number of determinants of holding risky assets, including human capital risk (Heaton & Lucas, 2000), tax treatment (Shoven & Sialm, 2004), and the individual's health status (Rosen & Wu, 2004). However, relatively little attention has been given to the effects of individuals' psychological traits in the context of the recent financial crisis. Several studies reported that most U.S. families suffered from capital losses during the 2008 financial crisis, which shook their confidence in the economy, and induced considerable fear and uncertainty about their financial behavior (Peek, 2010; Ackerman, Fries & Windle, 2012).

From December 2007 through June 2009, the U.S. economy experienced the worst financial crisis since the Great Depression of the 1930s[1] as a result of simultaneous shocks in the stock, labor, and housing markets. During this period, the real GDP fell nearly 5.1%, and unemployment reached 9.9%.[2] Stock prices also collapsed, with the Standard & Poor (S&P) 500 index losing nearly one third of its value between January 2007 and January 2009[3]. Further, the crisis caused the loss of 38% in median household wealth, while the median household income fell over 8% (Ackerman, Fries & Windle, 2012). This sharp decline in household income and asset value required many households to make adjustments in their risk-taking and portfolio choices. For example, Cooper (2013) found that the collapse in the financial market reduced households' willingness to hold risky assets due to increased concerns about losses of wealth; this led to an increase in the number of households that shifted their wealth from existing risky assets (stocks) into safer assets (cash and bonds).

Since the crisis ended in June 2009, the U.S. economy has recovered slowly. The real GDP has increased by 9% and the unemployment rate declined to 6.7% from the second quarter of 2009 to the fourth quarter of 2013.[4] Following the economic recovery, stock prices also rebounded; between June 2009 and January 2013, the S&P 500 index rose 40%. In response to this economic recovery, households have again adjusted their existing financial portfolios. This paper used household-level datasets from the 2007, 2010, and 2013 Survey of Consumer Finances (SCF) to examine the determinants of U.S. households' stock holding behaviors according to the level of optimism in their expectations of the U.S. economy and income in the periods pre- and post-crisis. The SCF distinguishes between direct-equity holdings and indirect-equity holdings in financial wealth. Investments in private equity (indirectly held stocks) are not included in this analysis in order to reduce the concern about correlations between household optimism and self-employment addressed by Puri and Robinson (2007). Considering directly held stocks as high-risk assets, we investigated how the role of optimism on household stock holdings varied in the period following the 2008 financial crisis.

There have been a number of studies of the determinants of dispositional optimism and its effects on individual decisions and health (Scheier & Carver, 1985). However, little is known about optimism related to stock market participation. Puri and Robinson (2007) conducted one of the

---

[1] Source: http://www.nber.org/cycles/cyclesmain.html.
[2] Source: U.S. Bureau of Labor Statistics at: http://data.bls.gov/timeseries/LNS140000.
[3] Historical prices of S&P index were obtained at https://finance.yahoo.com/q/hp?s=%5EGSPC+Historical+Prices.
[4] Real GDP data were obtained from the U.S. Bureau of Economic Analysis at: http://www.bea.gov/national/index.htm#gdp and unemployment data were obtained from the U.S. Bureau of Labor Statistics.

first studies that examined the relationship between optimism, as measured by self-reported life expectancy, and various economic choices, including stock ownership. They documented the positive role of individuals' optimism on risky asset holdings. However, it is possible that the measure of life expectancy alone cannot capture fully individuals' optimism as it is linked directly to their financial situation. Indeed, we found that the effect of this general measure of optimism varies significantly conditional on one's macro level beliefs during the period following the 2008 financial crisis.

In this paper, we contribute to the portfolio choice theory by examining individuals' optimism as the determinant of household stock holdings. We identified two distinct levels of optimism: micro and macro, which address the ways in which expectations about future income and future economic conditions affect optimism and financial behavior. These two measures capture more fully the heterogeneous perceptions of one's financial status, and allow us to test separately the combined, as well as the isolated effects, of each measure of optimism. We observed that households that possess both forms of optimism increased by approximately 30% after the financial crisis. By parsing optimism into two mutually exclusive measures, we found that the proportion of households that have optimistic views about future economic conditions alone nearly doubled in the period following the crisis, while those with optimistic views about their future income growth alone decreased approximately 50%. Another contribution of our paper is that we investigated whether the influence of optimism on financial asset allocation in the period following the crisis is consistent with the findings of prior studies that used data collected before the crisis. Specifically, Puri and Robinson (2007) found that the micro level of optimism measured by self-reported life expectancy contributed to higher equity holdings in the period before the crisis. Using the 2007, 2010, and 2013 SCF, we documented that households that have only positive beliefs about future income growth, which is categorized as the micro level of optimism, continued to invest in high risk assets regardless of the existing pressure of the 2008 financial shock. In contrast, individuals who have an optimistic view only about future economic conditions, which is classified as the macro level of optimism, are less likely to hold risky assets, and this significantly negative relationship was found only in the post-crisis period. The negative effect from the macro level of optimism may offset the positive role of optimism documented in previous studies. We posited that investigating separately the two different types of optimism would lead to a broader understanding and more detailed picture of the effects of households' psychological traits on their financial portfolio decisions.

2. Literature Review

2.1. Household portfolio choice

There is substantial evidence that household portfolio choice is affected by a number of characteristics, including gender, age, wealth, occupation, and home ownership. For example, Morin and Suarez (1983) found that wealth and educational level were associated positively with the ownership of risky assets. Hinz, McCarthy, and Turner (1997) focused on gender differences in individual investment decisions and found that men exhibited more financial risk-taking behavior than did women. Home ownership was associated negatively with risky asset holdings, and occupation in the financial sectors was associated positively with stock ownership. The effect of health status was not straightforward. There were mixed results with respect to whether or not it has a significant influence on individual portfolio choices (Rosen & Wu, 2004; Love & Smith,

2010). In our study, we included these demographic variables as control variables in the baseline logit and multinomial logit model (MNL), and investigated further the role of household optimism on household financial portfolio choices.

2.2. Optimism

A number of studies on optimism and its effects on individuals' decision-making have been conducted in various disciplines. In the psychology literature, Scheier, Carver, and Bridges (1994) defined optimism as generalized positive expectations about future events; they found that people with optimistic biases have a tendency to believe that they are less likely than are other people to experience negative events (Friedman, Webb, Bruce, Weinberg, & Cooper, 1995). The evidence in the medical literature also suggests that optimistic cancer patients have a lower risk of mortality than do pessimists (Schulz, Bookwala, Knapp, Scheier, & Williamson, 1996).

In finance and economics, optimism is understood to have effects on corporate management financial decisions and entrepreneurial behavior (Odean, 1998; Bernardo, & Welch, 2001). Individuals' optimistic beliefs about future outcomes lead to more risk-taking behavior in investment decision-making. For example, Hackbarth (2008) found that optimistic managers tend to overestimate the probability of assets' growth rates and underestimate the probability of their riskiness; they are also more likely to rely on equity rather than debt when funding investment projects. However, the role of optimism in households' portfolio choices has yet to be documented fully, and there is little evidence to date that optimism has an effect on household expenditures and economic choices (Kacperczyk & Kominek, 2002; Puri & Robinson, 2007). Puri and Robinson (2007) used individuals' life expectancies as a measure of optimism and found that optimistic individuals invest more in individual stocks and that a moderate level of optimism results in better decisions. In this paper, we analyzed the relationship between optimism and household stock holdings, using two different types of optimism: (1) the micro level of optimism proxied by expectations of future income, and (2) the macro level of optimism measured by expectations of future U.S. economic conditions.

2.3 Psychology following the shock

Optimism and overconfidence

In warning against the dangers of extreme optimism, the behavioral finance literature argues that overconfident managers neglect to take basic precautionary measures. They tend to overestimate the likelihood that a favorable outcome will occur, or underestimate the probability of a negative outcome. For example, Weinstein and Klein (1996) found that individuals have wildly miscalculated beliefs about their inherent risk with respect to health or finances. Odean (1998) showed that overconfident individuals believe more strongly in their own skills with regard to the value of financial products, and are less concerned about the beliefs of others.

In our study, we observed that before the financial crisis, approximately 11% of households were extremely optimistic and believed that their wealth would growth. In the period after the crisis, approximately 6% of households still were overly optimistic about their income growth, given a poor belief about future economic conditions. We argue that these extremely overconfident individuals not only underestimate the probability of losing their jobs, but also continue to make risky decisions even when they believe that the economy will remain poor.

O*ptimism and less confidence*

Berkowitz and Qiu (2006) found that a shock could have an asymmetric influence on household financial portfolio decisions; for example, when individuals experience an unexpected shock, they tend to move investment resources into less risky assets, such as a home or public insurance program. Table 1 shows that, after the crisis ended, the number of individuals who believed there would be positive economic growth, but negative growth in their incomes almost doubled. We posited that these households were still under pressure because of the crisis and reduced their investment in high-risk assets, because they were less confident about their ability to earn a higher income.

Research hypotheses

We constructed our main hypotheses based on the theoretical background above, which accounts for the relationship between consumer optimism and stock investment.

Optimism and overconfidence:

H_1: Households that are optimistic about their income growth are more likely to invest in high-risk assets, regardless of their fear of the shock.

Optimism and less overconfidence:

H_2: Households that are optimistic about the future economy, but less confident about their income growth, are less likely to invest in high-risk assets given the fear of the shock.

3 Methods

3.1. Dataset and sample selection

For the empirical analysis, this study uses the SCF dataset, which has been released by the Federal Reserve Board triennially since 1983. The SCF dataset provides detailed household demographic, attitudinal and financial information from a nationally representative sample. We use the pooled dataset from the 2010 and the 2013 SCF. Given the purpose of this study, 2007 SCF is also employed, separately (N=3,137). Following Shum's and Faig's (2006) sample selection procedure, our analytic sample includes only households with: (1) financial net worth (financial assets minus financial debt) greater than or equal to $1000; (2) positive total (financial and physical) net worth, and (3) positive labor income. The total sample size of the 2010 and 2013 SCF is 12,497, and the final sample size is 8,034.

3.2. Measurement of variables

3.2.1. Dependent variable

The individuals choose various pool of stock holdings. For example, they can invest in stocks directly, through mutual funds involving stocks, as well as through defined-contribution pension plans and household retirement accounts. We primarily consider directly-held stocks, which are the riskiest assets among the households' overall financial assets, to measure households' direct stockownership (Christelis, Georgarakos, & Haliassos, 2011).

To reflect the more detailed picture of the individuals' stock ownership, we further categorized the dependent variable into three groups based on the ratio of stocks held in a particular category over total financial assets. If a share of stocks is greater than 66%, the class is coded as "high stock holdings," between 33% and 66% is coded as "middle stock holdings," and anything lower is coded as "low stock holdings." The distribution of each dependent variable is presented in Table 2.

3.2.2. Consumer optimism

The main focus of this research is to analyze the relationship between consumers' optimism and its effect on their stock holdings. We identify two distinct micro and macro level of optimism: expectations about future income and expectations about the future economic conditions. These two measures better capture one's heterogeneous perception of their financial status, and allow us to test combined effect as well as isolated effect of each optimism measure separately. Expectation of future income refers to the expectation with respect to the next year's total income compared to inflation. Households are coded as optimists if they responded that they expected income increases for the following year. Expectations about the economy refer to expectations of trends in the U.S. economy as a whole over the next five years compared to the past five years. Households are coded as optimists if they responded that they expected a better economy over the next five years by comparison to the previous five. In Model 1, we examine the isolate effect of two different optimism variables. Further, we test the combined effect by including 4 possible combinations of two variables such as optimistic for both, optimism only for economy, only for income, and optimism for neither (in Model 2).

3.2.3. Other independent variables

In addition to optimism variables, household demographic (age, education, marital status, race/ethnicity), economic (household normal income, homeownership, employment status), attitudinal (health status, risk tolerance), and a dummy variable for survey year, are included as control variables. Detailed descriptions are presented in Appendix.

4. Empirical model specification

Two methods are used to test research hypotheses. First, a logistic regression is conducted to establish a baseline relationship between the optimism variables and the stock ownership. The dependent variable for this analysis is a binary indicator of holding a directly-held stock in their financial portfolio.

In the next analysis, the portion of households' stock holdings over the total financial assets is used to categorize households into three distinct groups: households holding less than or equal to 33% stocks, 34-66% stocks, and above 66% stocks of the two financial assets measured, total stock holdings and directly-held stocks. The three groups are labeled as follows: group 1 = "low stock holdings", group 2 = "middle stock holdings" and group 3 = "high stock holdings."

The results of a Score test are significant, which indicates that the proportional odds assumption is rejected ($p < 0.0001$). Therefore, the parallel assumption for an ordered logit is inappropriate. Alternatively, classifying households as the three groups with respect to their different levels of

stock holdings, we perform a multinomial logit regression (MNL). The probability that the i^{th} household would choose the j^{th} group is described by:

$$P_{ij} = Pr\,(R_{ij} > R_{ik}), \text{ for } k \neq j, j = 1, 2, 3$$

with R_{ij} being the maximum utility attainable for household *i* if the household holds j^{th} group, and,

$$R_{ij} = X'_{ij}\,\beta_{ij} + \varepsilon_{ij}$$

where β_{ij} is a vector of coefficients of each of the independent variables. Assuming the stochastic term, ε_{ij}, is distributed identically and independently across alternatives, the MNL is expressed by:

$$P_{ij} = \exp\,(X'_{ij}\,\beta_{ij}) / \sum\,(X'_{ij}\,\beta_{ij})$$

The coefficients of explanatory variables are estimated by the maximum likelihood function, and the names and descriptions of the variables are given in Table 1. For hypothesis testing, unweighted results with the Repeated Imputation Inference (RII) technique are used following the recommendation of Lindamood, Hanna and Bi (2007).

5. Results

5.1. Distribution of optimism for micro and macro economy during 2007-2013

Table 1 displays that households holding both optimism increased about 30% across the financial crisis. Decomposing optimism into two mutually exclusive optimisms, we found that the portion of households who had optimistic view only on future economy were almost double in the post period of the crisis, but ones who had optimistic view only on their future income growth decreased by about half.

5.2. Distribution of household stock holdings during 2007-2013

Table 2 shows the distribution of households' stock holdings to the total value of their financial assets using three stockholding categories. In order to observe the periodical shift in the distribution, we use three different survey waves, 2007, 2010 and 2013 SCF. Further, we report the distribution of households' stock holdings at finer levels to see the trend in detail.

As expected, the distribution of households by the fraction of directly-held stock among total financial assets has changed between the before and after the 2008 financial crisis. As shown in the table, households that invested their financial assets heavily in stocks (i.e., over 66%) decreased over the period of financial crisis from 2.12% to 1.35%, but increased again by 2.15% after the crisis.

5.3 Baseline regression

Results from the logistic regression predicting stock ownership are presented in Table 3. This baseline analysis provides evidence of the link between optimism and stock ownership. Optimism about future income was positively related to hold directly-held stocks in both pre- and post-

financial crisis. Specifically, in Model 1, households that expected income would go up had higher odds of holding stocks by 41% (pre) and 42% (post), respectively compared to those who did not have optimism. We found the similar results for those with optimism only for income in Model 2.

On the other hand, households with optimism only about future economy had lower odds of holding stocks by 19% than those without optimism for neither. Further, optimism for both income and US economy is negatively related to hold stocks.

5.4 Multinomial logit regression analyses

Results from the multinomial regression are presented in Tables 4. We conducted pairwise comparisons between low, middle, and high stock holders such as middle vs. low stock holding, high vs. low stock holding, and high vs. middle stock holding.

In Model 1, we tested the isolated effect of optimism (i.e., micro and macro economy separately) on different levels of stock holding. From the 2007 SCF, we found that households with optimism about their future income had higher odds of holding middle stock over holding low stock than those without optimism by 69%. After the financial crisis, results from the 2010 and 2013 SCF showed that households with the micro optimism were more likely to hold middle or high proportion of stock over low stock holding by odds of 50% and 40% respectively compared to those with no optimism.

In Model 2, we tested the similar analysis based on the decomposed effect of optimism with four different combinations. Households with optimism only for their future income had higher odds of holding middle stock over low stock in both pre- and post-financial crisis. By contrast, optimism only for US economy is negatively related to hold middle stock over low stock. Lastly, households with optimism for both income and US economy had lower odds of holding middle stock over low stock by 10% than those with optimism for neither one, which implies that the optimism about future economy led to a decrease in stock ownership more than offsetting the effect of optimism about future income.

6. Robustness check

Several financial portfolio choice studies document that age is the one of the determinants of households' risky asset investments (Bergstresser & Poterba, 2004; Shum & Faig, 2006). Creating distinct age groups, we examine how the effect of optimism varies across different age group in the main specification in Table 4.

We also examine the hypothesis of *optimism and overconfidence* using different measure of optimism proposed by the previous literature. Puri and Robinson (2007) examine the relationship between optimism measured by self-reported life expectancy and individuals' risky asset investment. We use the life expectancy optimism as the alternative micro level of optimism to examine the effect of individual optimism across the 2008 financial crisis.[5]

7. Discussion

[5] The detailed results of robustness checks will be updated.

This study examines individuals' optimism as the determinant of household stock holdings. In our empirical tests, two distinct levels of optimism are implemented: expectations about the U.S. economy and expectations about household future income. These two measures capture more fully the heterogeneous perceptions of one's financial status, and help us test separately the combined, as well as the isolated effects, of each measure of optimism on individual's financial behavior.

We found that households that possess both forms of optimism increased by approximately 30% after the financial crisis. By parsing optimism into two mutually exclusive measures, we found that the proportion of households that have optimistic views about future economic conditions alone nearly doubled in the period following the crisis, while those with optimistic views about their future income growth alone decreased approximately 50%.

We further documented that households that have only positive beliefs about future income growth, which is categorized as the micro level of optimism, continued to invest in high risk assets regardless of the existing pressure of the 2008 financial shock. Consistent with the findings of overconfidence literature, we argue that these extremely overconfident individuals not only underestimate the probability of negative outcome, but also continue to make risky decisions even when they believe that the economy will remain poor.

This finding may also be partly explained by the "wealth effect" often discussed in finance and economics. Standard financial theory proposes that individuals take at least some amount of risk with the expectation of a positive return (Campbell, 2006). This means that wealth is associated with an individual's willingness to take financial risk. Consistent with this theory, households that expect an increase in future wealth may hold more stocks in their financial portfolios.

In contrast, individuals who have an optimistic view only about future economic conditions, which is classified as the macro level of optimism, are less likely to hold risky assets, and this significantly negative relationship was found only in the post-crisis period. These households were still under pressure because of the crisis and reduced their investment in high-risk assets, because they were less confident about their ability to earn a higher income. We posited that the negative effect from the macro level of optimism may offset the positive role of optimism documented in previous studies.

Putting all together, investigating separately the two different types of optimism would lead to a broader understanding and more detailed picture of the effects of households' psychological traits on their financial portfolio decisions.

Reference

Ackerman, R. A., Fries, G., & Windle, R. A. (2012). Changes in US family finances from 2007 to 2010: Evidence from the Survey of Consumer Finances. *Federal Reserve Bulletin*, *100*, 1-80

Bergstresser, D., & Poterba, J. (2004). Asset allocation and asset location: Household evidence from the Survey of Consumer Finances. *Journal of Public Economics*, *88*(9), 1893-1915.

Bernardo, A. E., & Welch, I. (2001). On the evolution of overconfidence and entrepreneurs. *Journal of Economics & Management Strategy*, *10*(3), 301-330.

Campbell, J. Y. (2006). Household finance. *The Journal of Finance*, *61*(4), 1553-1604.

Christelis, D., Georgarakos, D., & Haliassos, M. (2011). Stockholding: Participation, location, and spillovers. *Journal of Banking & Finance*, *35*(8), 1918-1930.

Cooper, D. (2013). Changes in US household balance sheet behavior after the housing bust and Great Recession: Evidence from panel data. *FRB of Boston Public Policy Discussion Paper*, (13-6).

Friedman, L. C., Webb, J. A., Bruce, S., Weinberg, A. D., & Cooper, H. P. (1995). Skin cancer prevention and early detection intentions and behavior. *American Journal of Preventive Medicine*.

Hackbarth, D. (2008). Managerial traits and capital structure decisions. *Journal of Financial and Quantitative Analysis*, *43*(04), 843-881.

Heaton, J., Lucas, D. (2000). Portfolio choice and asset prices: the importance of entrepreneurial risk. *Journal of Finance 55*, 1163−1198.

Hinz, R. P., McCarthy, D. D., & Turner, J. A. (1997). Are women conservative investors? Gender differences in participant-directed pension investments. *Positioning pensions for the twenty-first century*, 91-103.

Kacperczyk, M., & Kominek, Z. (2002). Do optimists grow faster and invest more? *Available at SSRN: http://ssrn.com/abstract=301242 or DOI: 10.2139/ssrn.301242. 2002.*

Lindamood, S., Hanna, S. D. and Bi, L. (2007). Using the Survey of Consumer Finances: Some methodological considerations and issues. *Journal of Consumer Affairs*, 41, 195-222.

Love, D. A., & Smith, P. A. (2010). Does health affect portfolio choice? *Health economics*, *19*(12), 1441-1460.

Berkowitz, M. K., & Qiu, J. (2006). A further look at household portfolio choice and health status. *Journal of Banking & Finance*, *30*(4), 1201-1217.

Morin, R. A., & Suarez, A. F. (1983). Risk aversion revisited. *The Journal of Finance*, *38*(4), 1201-1216.

Odean, T. (1998). Are investors reluctant to realize their losses? *The Journal of finance*, *53*(5), 1775-1798.

Rosen, H. S., & Wu, S. (2004). Portfolio choice and health status. *Journal of Financial Economics*, *72*(3), 457-484.

Peek, J. (2010). Household Reaction to the Financial Crisis: Scared or Scarred?. *Available at SSRN 1605153*.

Pirinsky, C. (2013). Confidence and economic attitudes. *Journal of Economic Behavior & Organization*, *91*, 139-158.

Puri, M., & Robinson, D. T. (2007). Optimism and economic choice. *Journal of Financial Economics*, *86*(1), 71-99.

Shoven, J.B., Sialm, C. (2004). Asset location in tax-deferred and conventional savings accounts, *Journal of Public Economics 88*, 23– 38.

Shum, P., & Faig, M. (2006). What explains household stock holdings? *Journal of Banking & Finance*, *30*(9), 2579-2597.

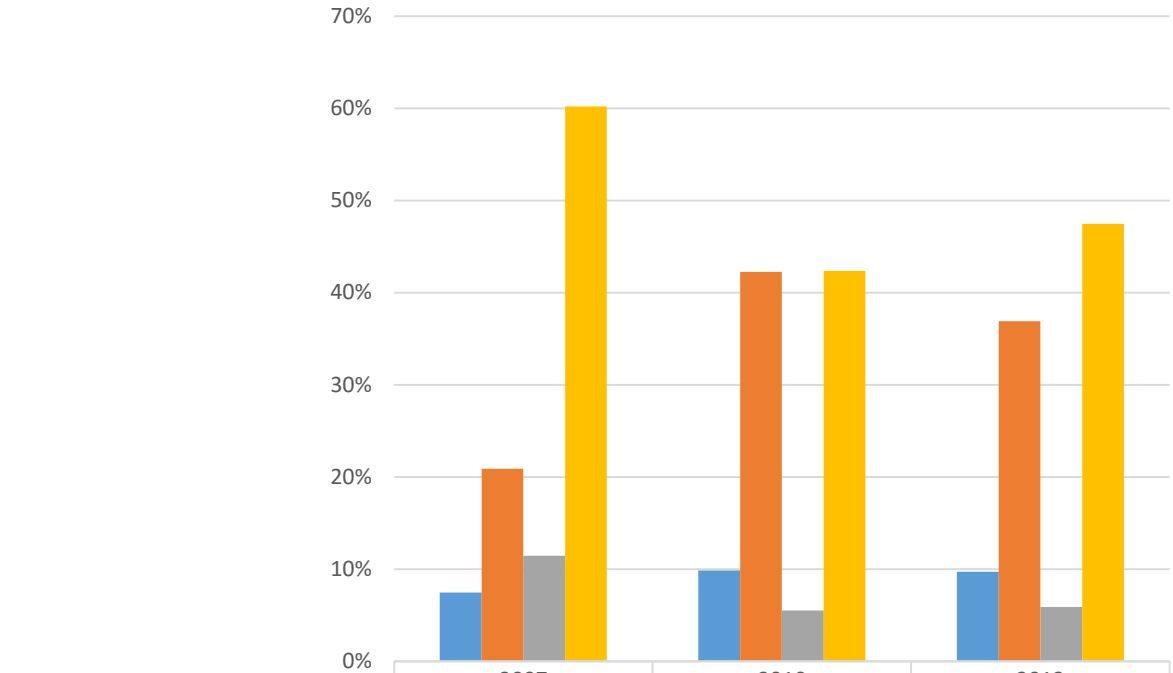
Scheier, M. F., & Carver, C. S. (1985). Optimism, coping, and health: Assessment and implications of generalized outcome expectancies. *Health psychology*, *4*(3), 219.

Scheier, M. F., Carver, C. S., & Bridges, M. W. (1994). Distinguishing optimism from neuroticism (and trait anxiety, self-mastery, and self-esteem): A reevaluation of the life orientation test. *Journal of personality and social psychology*, *67*(6), 1063.

Schulz, R., Bookwala, J., Knapp, J. E., Scheier, M., & Williamson, G. M. (1996). Pessimism, age, and cancer mortality. *Psychology and aging*, *11*(2), 304.

Weinstein, N., Klein, W.M. (1996). Unrealistic optimism: present and future. *Journal of Social and Clinical Psychology 15*, 1–8.

Table 1: Descriptive results of consumer optimism for macro and micro economy, 2007-2013 SCF



	2007	2010	2013
Optimism for both	7.45%	9.87%	9.72%
Optimism only for economy (macro)	20.90%	42.26%	36.91%
Optimism only for income (micro)	11.47%	5.53%	5.91%
Optimism for neither	60.18%	42.34%	47.46%

Table 2 - Trend in Stock asset allocation before and after the financial crisis, 2007-2013 SCF

Ratio of stocks (in each category) over the total value of financial assets	Percentage of households		
	Directly-held stocks		
	2007	2010	2013
Low stock holdings (Stocks≤0.33)	93.79	94.94	93.75
Middle stock holdings (0.33<Stocks≤0.66)	4.09	3.71	4.10
High stock holdings (0.66<Stocks)	2.12	1.35	2.15
Total	100.00	100.00	100.00
	Directly-held stocks		
	2007	2010	2013
Stocks=0	74.52	76.63	78.27
0<Stocks<=0.2	15.89	15.23	12.70
0.2<Stocks<=0.4	4.79	4.29	4.02
0.4<Stocks<=0.6	2.42	1.97	2.37
0.6<Stocks<=0.8	1.35	1.09	1.41
0.8<Stocks<1	1.03	0.74	1.23
Stocks=1	0.00	0.05	0.00
Total	100.00	100.00	100.00
Sample size	3,137	4,106	3,928

Note: Total sample size of the combined dataset is 11,171

Table 3 – Logistic regression results of stock asset ownership, 2007, 2010 and 2013 SCF

	2007 SCF (Before the financial crisis)		**2010 and 2013 SCF (After the financial crisis)**	
	Model 1		Model 1	
	Odds ratio	Wald Chi-Square	Odds ratio	Wald Chi-Square
Optimism for U.S. economy	0.928	0.6121	0.945	1.0566
Optimism for Income	1.414***	12.8897	1.423***	28.7023
	Model 2		Model 2	
	Odds ratio	Wald Chi-Square	Odds ratio	Wald Chi-Square
Optimism for both	1.075	0.7396	0.912***	10.2237
Optimism only for U.S. economy	1.107	0.2544	0.809***	10.0636
Optimism only for income	1.565***	7.0764	1.389***	11.7457
Optimism for neither (Reference category)	-	-	-	-

Note: Control variables are included in both models (see Appendix).
Unweighted RII analysis; *** p<0.01, ** p<0.05, * p<0.1

Table 4 – Multinomial logit regression results, 2007, 2010 and 2013 SCF

	2007 SCF (Before the financial crisis)						2010 and 2013 SCF (After the financial crisis)					
Variables	Middle vs. Low stock holdings		High vs. Low stock holdings		High vs. Middle stock holdings		Middle vs. Low stock holdings		High vs. Low stock holdings		High vs. Middle stock holdings	
	Odds ratio	Wald Chi-Square	Odds ratio	Wald Chi-Square	Odds ratio	Wald Chi-Square	Odds ratio	Wald Chi-Square	Odds ratio	Wald Chi-Square	Odds ratio	Wald Chi-Square
	Model 1						Model 1					
Optimism for U.S. economy (reference: No)	0.927	0.2492	0.826	0.8120	0.891	0.2224	0.929	0.6445	0.880	0.8695	0.943	0.1371
Optimism for income (reference: No)	1.692***	13.7569	1.331	2.2085	0.787	1.1607	1.496***	15.2961	1.398**	4.4870	0.933	0.1454
	Model 2						Model 2					
Optimism for both	0.869	3.4623	0.946	0.3038	0.971	0.0280	0.901**	5.3080	0.934	0.9783	0.988	0.0077
Optimism only for U.S. economy	0.731	1.9666	0.662	1.6139	0.719	0.4538	0.783**	4.8811	0.768	2.4661	0.882	0.1374
Optimism only for income	1.505***	6.9709	1.197	0.7565	0.709	0.9345	1.311***	6.8687	1.442	1.6228	0.860	0.1728
Optimism for neither (reference)	-		-		-		-		-		-	

Note: Control variables are included in both models (see Appendix).
Unweighted RII analysis; *** p<0.01, ** p<0.05, * p<0.1

Appendix: Measurement of control variables

Variables	Description
Demographic variables	
Age	Continuous measure of the age of the respondent
Education	(Reference group = less than high school)
High school diploma	= 1 if households have high school degree
Some college	= 1 if households have some college education without degree
Bachelor degree	= 1 if households have bachelor degree
Post-bachelor degree	= 1 if households have post bachelor education
Marital status	(Reference group = married)
Single male	= 1 if the respondent is single male
Single female	= 1 if the respondent is single female
Partner	= 1 if the respondent is partnered
Race/ethnicity	(Reference group = white)
Black	= 1 if the respondent is Black
Hispanic	= 1 if the respondent is Hispanic
Asian/Others	= 1 if the respondent is Asian or Others
Employment status	(Reference group = salary workers)
Self-employed	= 1 if the respondent is self-employed
Retired	= 1 if the respondent is retired
Not working	= 1 if the respondent is not working
Economics status	
Household Income	Logarithm of household income (= ln(0.01) if income ≤ 0)
Homeownership	= 1 if the respondent owns home
Attitudinal variables	
Health status	(Reference group = poor health)
Excellent health	= 1 if the respondent perceived excellent health
Good health	= 1 if the respondent perceived good health
Fair health	= 1 if the respondent perceived fair health
Risk tolerance	(Reference group = no risk)
Substantial risk	= 1 if the respondent is willing to take substantial risk
Above average risk	= 1 if the respondent is willing to take above average risk
Average risk	= 1 if the respondent is willing to take average risk
Year	= 1 if survey year is 2013