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## **Aging and Household Stockholdings: Evidence from Japanese Household Survey Data**

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### **Abstract**

Using Japanese household survey data from 2007 to 2010, our analysis examined how household age, income, financial assets, and education affect the tendency to participate in the stock market. Our analysis suggests the probability of stock market participation correlates weakly with age, given other variables such as income, financial assets, education, and a dummy variable for preference for online financial transactions. Of total household financial assets, stocks account for a share that correlates positively with age, given the other variables above. Our results suggest older households tend to have greater stockholdings than younger households, but for reasons involving greater financial assets or higher income, not the effects of age per se.

**Keywords:** stockholding puzzle, participation, online financial transactions

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## I. Introduction

Many developed economies, including Japan, are in the midst of a demographic transition that will profoundly affect national economies, including financial and real estate markets. Some economists argue, for example, that the run-up in asset prices in the 1990s is linked to demographic change. Recent papers making this case include Liu and Spiegel (2011) on stock prices and Takáts (2010) on real estate prices. Such results have drawn the keen interest of policy makers.

While these papers provide interesting empirical evidence based on aggregate data and financial market data, structural interpretations of the evidence pose both theoretical and empirical difficulties. First, establishing clear theoretical links between asset price and aging requires significant assumptions, as pointed out by Poterba (2004). Second, regarding stock prices, empirical evidence based on micro data shows that the majority of households hold neither common stock nor other risky financial securities—a tendency called the “stockholding puzzle” by Mankiw and Zeldes (1991). Based on this evidence, before asserting that the retirement of baby-boomers may lead to massive sales of stocks, one must ask whether older households tend to hold more in stocks than younger households.

This paper also revisits the second difficulty above, based on a body of Japanese individual household data called the Survey of Household Finances (SHF hereafter). We begin by demonstrating the presence of the stockholding puzzle in the Japanese data and by analyzing the relationship between stockholding and age using the SHF. We then move on to test whether household age, financial assets, and education affect stockholding by Japanese households by running regressions, examining whether the results are broadly consistent with studies based on micro data in other economies.<sup>1</sup> Of various financial assets, we restrict our attention to stocks. Nevertheless, this serves as a good approximation, since shares and other equities account for a significant portion of risky financial assets held by Japanese households (Figure 1). We summarize our results below.

We obtained three results regarding the stockholding puzzle and the relationship between stockholding and age.

First, we found evidence for the stockholding puzzles from the SHF. Average

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<sup>1</sup> Cucuru, Heaton, Lucas and Moore (2010) and Campbell (2006) report conditions in the US based on the Survey of Consumer Finance (SCF). Guiso, Haliassos, and Jappelli (2003) provide international comparisons on household stockholdings. Guiso, Haliassos, and Jappelli ed. (2001) collects both theoretical and empirical research by renowned researchers in this field. The volume contains papers on empirical analysis of household portfolios in the US, UK, Italy, Germany, and the Netherlands.

participation rates, defined as the percentage of households holding stock, hovered around 15 percent, based SHF data for 1991 to 2010.

Second, the SHF data for 1991 to 2010 shows that the relationship between participation rate and age is hump-shaped. However, the relationship between age and conditional share—defined as the percentage of stock in financial assets conditional on the fact that the household holds stock—is not hump-shaped.

Third, while participation rates for those in the 20-29, 60-69, and over 70 age groups in the 2000s are higher than in the 1990s, the participation rates for the 30-39, 40-49, and 50-59 age groups are lower than in the 1990s.<sup>2</sup>

We obtained three results from the 2007 to 2010 SHF data for regression analysis in response to the question of whether household age, financial assets, and education affect stockholding behavior.

First, participation rates correlate weakly with age, given other variables such as income, financial assets, education, and a dummy variable for preference for online financial transactions.

Second, conditional shares correlate positively with age, given the other variables discussed above.

Third, a dummy variable for preference for online financial transactions correlates positively with participation rates, given other variables. The result is consistent with observations that the lower fees for online stock trading offered by many Japanese online securities firms significantly boosted online stock trading among Japanese households after the deregulation of Japanese financial markets around 2000.

We draw the following policy implications from our results”.

First, participation rates do not correlate with age, given other variables. If the Japanese government wants to encourage Japanese households to hold more stock, to enhance adequate risk sharing between younger generations and older generations during current demographic transition, such efforts should target all generations, not just older households. In particular, the rise in stock market participation in younger households, perhaps attributable to the prevalence of cheap online stock trading in the early 2000s, may increase the stock market participation of future older households.

Second, given other variables such as income and total financial assets, the conditional share should increase as young generations age. Clearly, this naïve prediction may not hold if income and financial assets decline.

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<sup>2</sup> Based on the Family Income and Expenditure Survey, Iwaisako (2012) reports that the share of stocks in total financial assets increased between 2002 and 2010 and that the share of households whose head is aged 20-29 increased by 5% from 2002 to 2010. However, his study does not provide data on stock market participation for this period.

Before moving on to the details of our analysis, we review the relevant literature based on Japanese household data. Amemiya, Saito, and Shimono (1993), an early study of household portfolios in Japan, analyzed demand for cash, deposits, and risky assets using 1984 data on households in Tokyo. Tanigawa and Tachibanaki (1990) used data for 1985. Fujiki and Shioji (2006) studied the cash and deposits demand of households using the Public Opinion Survey on Household Financial Assets and Liabilities.<sup>3</sup> Iwaisako (2009, 2012) and Kitamura and Uchino (2010) examined Japanese household portfolios using the Nikkei Radar data, which covers just households in the Tokyo metropolitan area.

Of these studies, the closest to ours are Iwaisako (2009, 2012). Regarding the relationship between age and stockholdings, Iwaisako (2009) reports results consistent with ours. In his regression exercises, Iwaisako (2012) also uses a variable that represents household Internet use to control for stock market participation. Our data from the SHF explicitly asked regarding preference for online financial transactions, while the Nikkei Radar data asks about Internet use in general.

The rest of the paper is organized as follows. Section 2 provides a brief overview of household portfolios theories related to our studies. Section 3 explains our data from the SHF data in detail. Section 4 shows the results of regressions for the stock market participation and the conditional share. Section 5 describes robustness checks. Section 6 shows a simulation of how aging affects total household stockholdings. Section 7 concludes the paper.

## **II. Determinants of household stockholdings**

We are interested in the effects of age on stockholding by Japanese households. However, besides age, many other variables may affect stockholdings, such as financial assets or labor income. In this section, we provide a brief theoretical overview of the effects of these variables on the stockholding of household to help grasp the results of our regression analyses in the following sections.

### **A. Financial assets**

We expect stock market participation to increase with the size of total financial assets for the following reasons:

In the absence of entry costs, standard portfolio theory suggests that each investor will hold riskless assets as well as a portfolio of risky securities that yields the maximum expected return for each level of variance of financial assets. This means stock market participation rate should be 100%. If we assume buying and selling stock

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<sup>3</sup> The data set was renamed the SHF in 2007.

entails transaction costs, the poor will not hold risky assets, because the utility loss attributable to abstaining from stock market participation is too small to offset the fixed participation cost. Thus, we would expect a strong positive correlation between stock market participation and the investor's financial assets.

The relationship between the conditional share and financial assets depends on the forms of utility functions. For example, if utility function is of the Constant Relative Risk Aversion (CRRA) type, the conditional share is independent of financial assets. If the utility function is of the Constant Absolute Risk Aversion (CARA) type, as a household accumulates greater wealth, the conditional share will decrease, since the value of the shock holding in his portfolio remains constant, regardless of financial assets.

## **B. Labor income**

We would expect stock market participation and the conditional share to grow with labor income. As future labor income grows more assured and as variations in labor income correlate less with variations in returns from stocks, the conditional share and participation in the stock market grow, as the following example illustrates.

As an extreme example, consider a household with a completely predictable future labor income. Such a household should have a portfolio composed entirely of risky assets. If labor income is risky but uncorrelated with risky financial assets, the portfolio should tilt less toward risky assets. No matter how idiosyncratically risky, all investors with labor income should tilt their portfolios towards risky financial assets. However, as the variance of labor income increases, the tilt towards risky assets diminishes. If labor income is sufficiently positively correlated with risky financial assets, we would expect households to hold more safe financial assets.

Note that the discussions above assume exogenous labor income. However, as Bodie, Merton, and Samuelson (1992) emphasize, the ability to adjust labor supply heightens an investor's willingness to take on financial risk. If an investor can respond to adverse circumstances by increasing work effort as well as by reducing consumption, the investor has two margins of adjustment, not one, and is more tolerant of financial risk.

## **C. Age**

We would expect age to have ambiguous effects on stock market participation and conditional share, given labor income and financial assets, as the following examples show.

Our first example is the case in which the effect of age on stock market

participation and conditional share is negative, given labor income and financial assets. Suppose the amounts of annual labor income are given for all agents up to some predetermined age. Suppose further that agents can purchase either stock or risk-free financial assets. In this situation, compared to older agents, younger agents have a greater amount of safe future income. This means the share of risky assets in the portfolio of financial assets tends to decline with age, up until the point at which labor income is zero.

Our second example is the case in which the effect of age on stock market participation and conditional share is positive, given labor income and financial assets. Assume two households with equal current subsistence levels and equal wealth, but different investment horizons. Given equal current consumption for both investors, the present value of future subsistence levels is higher for the investor with a longer horizon, compelling the long-horizon investor to set aside more wealth in riskless assets to meet subsistence needs and giving the long-horizon investor a more conservative portfolio, as underscored by Samuelson (1989).

#### **D. Entrepreneurial risk**

We would expect lower stock market participation and lower shares of stocks among those with a stake in private businesses, since one can reasonably assume that households operating private businesses face higher and more variable business income than other households. Indeed, Heaton and Lucas (2000) report evidence that private businesses may crowd out ownership of publicly traded equities and that households with more variable proprietary income tend to have smaller equity allocations.

#### **E. Preference for online financial transactions**

We assume that an individual who prefers online financial transactions would have higher stock market participation, given other variables, based on the following development in the Japanese financial markets.

After the “Japanese Financial Big Bang,” Japanese online securities firms dramatically reduced the fees for online stock trading. According to a survey by the Japan securities dealers association in 2005, before the Big Bang, someone purchasing one million yen in stock paid an average of 1.2% in transaction fees. After the Big Bang, someone purchasing one million yen in stock online paid an average of 0.2%. Moreover, online securities firms began providing unique services, including afterhours transactions via proprietary trading systems, the ability to purchase foreign securities, or access to information relevant to personal investment.

Originally offered by online securities firms, these new services eventually spread to other Japanese financial institutions. The new services reduced transaction costs for stocks and the cost of gathering information for investing in stocks. Thus, we would assume that an individual preferring online financial transactions would exhibit higher stock market participation, given other variables.

### **III. Data**

This section first discusses the data from the SHF, then goes on to discuss the trends in key variables.

#### **A. SHF (Survey of Household Finances)**

The SHF is an annual survey of household financial assets undertaken by the Central Council for Financial Services Information (CCFSI). Beginning in 1953, this nationwide survey canvasses households with two or more people. From 2007 to 2010, the survey targeted nationwide 8,000 households of two or more people. For the 2010 survey, 4,032 of 8,000 households responded. The samples are selected each year; the SHF data is not panel data.

The survey asks for the amount of household financial assets and liabilities; selection of financial products, including outstanding amounts (to the nearest ¥10,000) of deposits (both current deposits and time deposits); postal savings (both postal savings current deposits and postal savings time deposits); money trusts and loan trusts; life insurance and postal life insurance; nonlife insurance; personal annuity insurance; bonds; stocks; investment trusts; workers' asset formation savings; and other financial products. In addition, the survey asks for various household characteristics, including annual income, age of household head, household composition, education, and self-employment status.

The CCFSI allows us to use the survey data from 1991 to 2010. Due to discontinuities in sampling designs in 2004 and 2007, we used data from 1991 to 2010 for households with two or more people for this section's analysis and data from 2007 to 2010 for households with at least two members in the regression analysis in Section 4.<sup>4</sup> In the regression analysis in Section 5, we used data from 2007 to 2010 for single-person households. This analysis is possible because the SHF has collected data

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<sup>4</sup> Before 2003, the survey was carried out nationwide and targeted 6,000 households with more than two people; 4,158 households responded to the 2003 survey (response rate: 69.3%). The survey used a stratified two-stage random-sampling method. From 2004 to 2004, the survey was undertaken nationwide, targeting 10,080 individuals; 3,478 households responded to the 2006 survey (response rate: 34.5%). The response rates from 2004 to 2006 are much lower than before 2004.

since 2007 for single-person households from a pool of individuals registered with a survey company through the Internet. The sampling probability is assigned based on the latest Census by age, gender, and region.

## B. Trends in Key Variables

From the 1991 to 2010 SHF data, we computed three annual average variables: unconditional share (US hereafter), participation rate (PR hereafter) and conditional share (CS hereafter). US is the average portfolio share held in stocks across all households. CS is the average portfolio share only for households that have stocks, defined below:

$$\begin{aligned} US &\equiv \frac{\sum_{i=1}^N S_i}{\sum_{i=1}^T W_i}, \\ CS &\equiv \frac{\sum_{i=1}^N S_i}{\sum_{i=1}^N W_i}, \\ PR &\equiv \frac{N}{T}, \end{aligned}$$

where  $S_i$  is amount of stockholding,  $W_i$  the amount of financial assets,  $i = 1, \dots, N$  is the index of households with stocks, and  $i = N + 1, \dots, T$  is the index of households without stockholdings, and  $T$  is sample size.<sup>5</sup>

Figure 2 shows PR. The stock market participation rate is around 15%, which is roughly consistent with direct stock market participation rates in the U.S. and European countries.<sup>6</sup> This indicates the presence of the stockholding puzzle in Japanese data.

Figure 3 shows CS. Conditional share declined from 1991 to 2001, increased from 2001 to 2007, then declined again after 2008. The changes appear consistent with trends in Japanese stock price.

Figure 4 shows US, together with US computed from the aggregate Flow of Funds data, which is the share of equity in financial assets, since the unconditional share by SHF is conceptually comparable to the portfolio share in financial asset by Flow of

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<sup>5</sup> US is decomposed into CS and PR as follows:

$$US = CS \cdot \underbrace{PR}_{<1} \cdot \frac{\overline{W}^N}{\overline{W}^T}, \quad \overline{W}^N \equiv \frac{\sum_{i=1}^N W_i}{N}, \quad \overline{W}^T \equiv \frac{\sum_{i=1}^T W_i}{T}.$$

<sup>6</sup> Guiso, Haliassos, and Jappelli (2003) report stock market participation rates in France, Germany, Italy, the Netherlands, UK, and US of 15%, 17%, 7%, 14%, 27%, and 19% respectively, as of 1998.

Funds. These two series show similar trends, but the equity share by Flow of Funds is more volatile than unconditional share by SHF. Note that one source of discrepancy between these two CSs are reporting errors in the SHF. For example, it is unclear to what extent stockholding in the SHF data is reported in terms of the market price consistent with the SHF's request to respondents. It is also unclear to what extent households having ETF on stock indices report their outstanding amounts as stock or as investment trusts. Moreover, it is unclear to what extent stockholdings in SHF data overlaps with the stockholdings through employee stockholdings or defined contribution plans.

While the conditional share shown by Figure 3 varies with stock price, the participation rate in Figure 2 is near-constant, except during the period from 2004 to 2006. This indicates that time series changes in unconditional share are mainly caused by fluctuations in conditional share, specifically stock price, not by fluctuations in participation rate.

Figure 5 shows the relationship between age and CS, US, and PR using pooled from 1991 to 2010. US shows a hump-shaped profile, resulting from the combination of a concave age profile for PR and a flat profile for CS. PR increases with age, peaking with the 60-69 age group. In contrast, CS is fairly constant across age groups (around 22 percent).

Figure 6 show developments in PR by age groups, estimated by residuals from regressions of participation rates on time dummies and age dummies. PRs for the 20-29, 60-69, and over 70 age groups in the 2000s are higher than in the 1990s. PRs for 30-39, 40-49, and 50-59 age groups in the 2000s are lower than in the 1990s.<sup>7</sup>

Figure 7 shows PR increases with the scale of financial assets held by households, a result consistent with the theoretical prediction based on participation cost explained in Section 2. A. At low levels of wealth, very few investors hold stock directly, while this fraction increases rapidly with greater wealth. This pattern is also reported in previous studies of other countries.

Figure 8 shows CS decreases with the scale of financial assets held by households. However, the negative correlation between CS and the scale of financial assets appears weak compared to the negative correlation between PR and scale of financial assets.<sup>8</sup> The results are consistent with the findings of Guiso, Haliassos, and Jappelli (2001), whose summary conclusion is that the relationship in certain countries between wealth

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<sup>7</sup> The results are consistent with Iwaisako (2012).

<sup>8</sup> The findings below are consistent with findings reported in previous studies in Japan and other countries. See Iwaisako (2012) for Japanese findings. Guiso, Haliassos, and Jappelli (2003) report conditions in the U.S. and European countries.

and conditional share of stock is relatively modest.<sup>9</sup>

#### **IV. Estimation**

In this section, we used annual micro data from SHF 2007 to 2010 and estimated a statistical model of the share of stocks in household financial assets and stock market participation as a function of age, financial assets, income, and several household characteristics that may affect portfolio decisions.

##### **A. Statistical model**

In the following analysis, we use the simplified model of household choice of financial assets used by Fujiki and Shioji (2006).

Suppose a household has a certain wealth. We assume that every household will allocate some of their wealth to currency, which is consistent with the SHF report that nearly all household have currency. We further assume that the household will choose one of two combinations of financial assets. The first combination consists of currency, stocks, and other financial products, such as bank deposits. The second combination consists of currency and financial products other than stocks. The theoretical background for separating stocks from other financial products is that stocks pose high price fluctuation risks compared to deposits, which are highly liquid. Stocks also differ qualitatively from products like insurance, which have very long-term contract periods compared to deposits.

##### **B. Empirical model**

Armed with the statistical model above, using 2007 to 2010 SHF data, we estimated an individual's stock market participation and conditional share based on the sample selection model set forth by Heckman (1979).

In participation and share of stocks regressions, we controlled for household income and wealth, household characteristics (family size, number of children, and region of residence), and variables related to the household head (age, gender, occupation).

To estimate Heckman's model, we must include certain variables that may affect the decision to participate in stock market, but not the equity share. In the participation equations, assuming that variations in information and entry costs are important in this regard, we included an education and dummy variable for preference for online financial transactions that affects the cost of gathering information and learning about stock markets.

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<sup>9</sup> See Table I.7 in Guiso, Haliassos, and Jappelli (2001) for details.

### **C. Variables for regression**

We explain the explanatory variables used in the estimation in detail.

#### **(1) Age**

We included dummy variables for the age range of the household head: under 29 (omitted), 30-39, 40-49, 50-59, 60-69, 70-79, and 80 and over. We set time dummies to indicate the survey year (omitting 2007).

In Section 2, we noted that the effects of age on stock market participation and conditional share are ambiguous, given labor income and financial assets. These age dummies should capture two unobserved variables that evolve with age and affect stockholdings: the present value of remaining labor income for a household and the present value of future subsistence level for a household.

As Ameriks and Zeldes (2004) have pointed out, it is impossible to separately identify age effects, time effects, and cohort effects on portfolio choice. Even if one has complete panel data on portfolios of households over time, any pattern in the data can be made to fit equally well by age and time effects, age and cohort effects, or time and cohort effects. Accordingly, we follow most other studies in setting cohort effects to zero. Based on this assumption, age effects can be estimated in any cross-section.<sup>10</sup>

#### **(2) Financial assets and income**

For financial assets and income, we use dummies of financial assets and income percentiles: below 5% (omitted), 5-10%, 10-25%, 50-75%, 75-90%, 90-95%, top 5%.<sup>11</sup>

#### **(3) Other household characteristics**

We included the following household characteristics as conditioning variables: household type (household headed by men or not, household size); whether a household head is self-employed; the education of the household head (higher than college degree or not). We also included a dummy variable for occupation to capture possible differences in income variability, whether the head is self-employed or not and whether a household head is employed as a regular worker or not and in what

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<sup>10</sup> Identifying cohort effects requires additional assumptions or variables. For example, Malmendier and Nagel (2011) find that individuals who have experienced low stock-market returns throughout their lives so far report lower willingness to assume financial risk, are less likely to participate in the stock market, invest a lower fraction of their liquid assets in stocks if they participate, and are more pessimistic about future stock returns.

<sup>11</sup> We adopt a dummy variable to capture nonlinearities. For robustness checks, we also estimate specifications that adopt polynomials for age, financial asset. The results are nearly identical to the benchmark results.

industry the household head works (agriculture, construction, manufacturing, transportation, wholesale and retail, service, medical service, public sector, other).

#### **(4) Preference for online financial transactions**

Many studies include Internet use as a conditioning variable for stock market participation. Thanks to the SHF, we can construct a dummy variable for preference for online financial transactions, rather than Internet use. The distinction is important because Internet use does not necessarily mean stock market participation.<sup>12</sup>

We construct a dummy variable for preference of online financial transactions as follows. In the SHF 2010, respondents were asked “What features are important for you when you choose financial institutions?” and instructed to choose up to three of 13 possible answers. These 13 answers include: (1) Branch or ATMs located in the neighborhood (79% of respondents picked this answer); (2) financial status is sound and trustworthy (32% of respondents picked this answer); (3) a nationwide branch network (28% of respondents picked this answer); and so forth. Of these 13 answers, 7% of respondents picked the answer “Provides a wide range of online services and transactions.” We constructed a dummy variable to assume the value of one if a household picked this answer and used a dummy variable as a proxy for the household’s preference for online financial transactions.

Note that even if a household indicates a preference for online financial transactions, it is possible the household limits their activities to online banking, rather than engaging in online stock transactions as well. However, households preferring online financial transactions are more likely to take advantage of the benefits of cheap and quick online stock transactions and are thus more likely to participate in the stock market in this way.

#### **D. Results of regression**

Table 1 gives the results of the participation and the conditional share equations for stocks.

The coefficients on age dummy are positive and significant in the conditional share equation. However, the coefficients for the age dummy are negative but not statistically different from zero in five percentage points of statistical significance in the participation equation.

The coefficients of financial asset and income are positive and statistically significant in the participation equation, while they are negative and significant in the

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<sup>12</sup> Iwaisako (2012) uses a variable representing household Internet use but does not discuss its effects on stock market participation and estimation results.

conditional share equation. These results oppose the average results summarized in Figure 5, which do not control for the other variables that could affect stockholding. Our regression supports the idea that old households tend to hold more stock than young households. However, this is likely due to greater financial assets or higher income, not the effects of age per se.

We offer one interpretation of the different signs for the estimated coefficients of financial asset and income between participation and share equation below. In the presence of entry costs for stockholdings, households with higher financial assets are likely to hold stocks. This implies that if households with lesser financial assets hold stocks, they are less risk averse. Households that are less risk averse hold large shares of stocks in financial assets. So, conditioning on participation, financial assets and share are negatively correlated.

The regression coefficients of the participation equation indicate that the self-employed and farmers are less likely to hold stocks. These coefficients of the participation equation are negative and statistically significant, which is consistent with the entrepreneurial risk hypothesis discussed in Section 2.

As for quantitative impact, at the sample means, increasing financial assets from 3 million yen (25th percentile) to 20 million yen (75th percentile) raises the predicted probability by 25 percentage points. Increasing education from less than high school graduate to university degree raises the predicted probability by 4 percentage points.

The coefficient for a dummy variable for a household's preference for online financial transactions in the participation equation is positive and statistically significant. The result supports our hypothesis that the emergence of online stock transactions reduced the cost of gathering and processing information and the fees associated with acquiring household stockholdings.<sup>13</sup>

One may argue that the effects of online stock transactions on stock market participation differ with household age. This is because holding other conditions constant, younger households, who tend to be more comfortable with and more adept at handling computers or cell phones than older households, have readier access to the benefits of online financial transactions and other technological innovations in finance. Figure 9 shows the evidence for our argument. The age-participation profile of

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<sup>13</sup> One might wonder if households wishing to purchase stock for the first time would actually start with online stock transactions. If so, our analysis would suffer from an endogeneity bias due to this reverse causality. To counter this problem, we estimated probit models to obtain predicted values for the dummy variable for preference for the online financial transaction, using the same variable used in the benchmark estimation as explanatory variables. Next, we substituted the predicted values for the observed values of the dummy variable in the benchmark estimation. The results are nearly identical to the benchmark results.

households that picked the answer “Provides wide range of online services and transactions” appears above the age-participation profiles of households that do not select this answer. Figure 10 shows more younger households choose the “Provides wide range of online services and transactions” response than older households.

## **V. Robustness check: Analysis based on single-person household data**

For this section, we used data from single-person households from 2007 to 2010 from a pool of individuals registered through the Internet with a survey company. The sampling probability is assigned based on the latest Census, by age, gender, and region.

It is reasonable to assume that single-person households in the sample would tend to be more accustomed to adopting new technologies like the Internet than the average single-person household. Based on this reasoning, we proposed the three following hypotheses:

First, we would expect single-person households to be more likely to hold stock than households of two or more people. Second, even if we control for Internet use by restricting our attention to our single-person household data, we would still expect higher participation rates among those preferring online financial transactions. Third, once we control for Internet use, we would not expect that younger people prefer online financial transactions than those older. We will examine whether our hypotheses prove true.

Figure 11 supports our first hypothesis. The figure illustrates the age-participation profiles of single-person households and households of two or more people. We would like to note three key items. First, both age-participation profiles increase with age.<sup>14</sup> Second, participation rates for all age groups are greater in single person households than in households with two or more people. Third, the slope of the profile of the single person households is steeper than that of households of two or more people.

Figure 12 supports our second hypothesis. Figure 12 illustrates the age-participation profiles for households who picked the answer “Provides wide range of online services and transactions” on the one hand and who did not pick the answer “Provides wide range of online services and transactions” on the other. First, as with households of two or more people, single-person households choosing this answer are more likely to hold stocks. Second, in contrast to households of two or more people,

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<sup>14</sup> Single-person households who are older than 70 years old are excluded from the sample, due to the difficulty of surveying older households through Internet. This means we cannot confirm whether the age-participation profile of single-person households is hump-shaped, like the profile for households consisting of two or more people.

the two profiles have nearly identical slopes.

Figure 13 supports our third hypothesis, illustrating the relationship between the proportion of households picking the answer “Provides wide range of online services and transactions” and age group. Unlike the sample of households with two or more people, we see no correlation between age group and fraction of households picking the answer “Provides wide range of online services and transactions.” This suggests that once a young person is accustomed to online financial transactions, he or she is likely to remain more likely to hold stocks at some point.

Table 2 shows the estimation results for the single-person households’ sample. As we would expect, the coefficient for a dummy variable for a person’s preference for online financial transactions in the participation equation is positive and statistically significant. Once again, these results support our hypothesis that the emergence of online stock transactions reduced the cost of gathering and processing information and fees associated with household stockholdings. Table 2 shows positive and significant coefficients for both participation and conditional share for age dummies for 50-59 and 60-69 years old.

## **VI. Simulation of how aging affects household stockholdings**

This section discusses a simulation of how aging affects household stockholdings. Figure 14 illustrates the latest official projections for the Japanese population (over age 20) by age groups published in January 2012 by the National Institute of Population and Social Security Research. These projections point to two changes that would affect household stockholdings. First, the population over age 20 at 2010 is 105.125 million and may fall by 2050 to 84.106 million. Second, the ratio of the population over the age of 60 appears likely to continue to rise over time.

Based on these projections, aging will affect household stockholdings through two channels. First, the decrease in population and the number of households will reduce household stockholdings. Second, the increase in the ratio of the population over age 60 will increase household stockholdings due to the two positive effects of financial asset accumulation on participation and of aging on stockholding share.

The overall quantitative effects of aging on household stockholding depend on the relative size of the two channels. We undertook a simulation to gauge the overall effect.

Figure 15 shows two projected paths for household stockholdings based on the projected population shown in Figure 14 and the SHF 2010. We will discuss the two paths in turn.

First, assume that conditional shares, participation rates, and financial assets per household remain constant at 2010 levels over the projection period from 2020 to 2060. Based on this assumption, we calculate the stockholdings path reflecting the future age structure of Japanese population (Figure 14). The blue line with marks indicates the results of this simulation; we call this path the baseline projection. The baseline indicates household stockholdings in 2020 and 2030 will be higher than in 2010 (around 80 trillion yen) since the second channel, the increase in the ratio of old households dominates the first channel, due to a declining total population. However, household stockholdings in 2050 and 2060 are lower than in 2010. Within these timeframes, the first channel dominates the second channel.

Second, we assume that participation rates for all age groups will rise by 1.4 percentage points from 2010 to 2060. The red line corresponds to the household stockholdings based on this assumption. The red line shows that the household stockholding in 2050 will be close to that in 2010. Namely, if one wishes to offset the decrease in household stockholdings due to aging, given the current income and asset profile, one measure would be to raise the participation rate of all age groups by 1.4 percentage points. Is this within our grasp?

One way to achieve this change would be to expand online stock transactions, thereby increasing participation rates for the current young age group, who will in turn be succeeded by younger generations. We can examine how such a mechanism works.

Figure 16 illustrates the impact of the increase in preference for online financial transactions on stock market participation by age groups. The impact is attributable to the marginal effects obtained from the coefficients on household's online financial transactions (Table 1), evaluated at current levels of stock market participation and other conditioning variables. The numbers in the figure are normalized to the deviations from the participation rate at age 80 or over. In passing, the figure shows that the spread of online stock transactions puts the participation rate of younger households (age 20-29) above that of older households (age 80 or over) by about 1.4%.

Suppose that younger generations, born ten, twenty, thirty, and forty years later exhibit the same preference levels for online financial transactions. Suppose further that the level of preference for online financial transactions for each age group will not decline forever. In the year 2050, the participation rates for all age groups would then rise by 1.4 percentage points compared to levels for current age groups.

These projections make numerous restrictive assumptions. Nevertheless, taken at face value and assuming that other variables such as income and financial asset profiles remain constant, they suggest sustaining the current growth in preference for

online transactions for younger generations will maintain current levels of Japanese household stockholdings, despite the progress of an aging society.

## **VII. Conclusion**

This paper investigated how household age, wealth, and education affect stockholding of Japanese households by running regressions using 2007 to 2010 SHF data. We obtained three results.

First, participation rates correlate weakly with age, given other variables such as income, financial assets, education, and a dummy variable for preference for online financial transactions. Older households do tend to hold more stock than younger households, but for reasons involving greater financial assets or higher income, not the effects of age per se.

Second, the conditional share correlates positively with age, given the other variables discussed above.

Third, a dummy variable for preference for online financial transactions correlates positively with participation rates, given other variables. The result is consistent with the observation that the lower fees for online stock trading offered by many Japanese online securities firms significantly boosted online stock trading by Japanese households following the deregulation of Japanese financial markets around 2000.

Our estimates suggest two policy implications.

First, participation rates do not correlate with age, given other variables. To expand stockholding by Japanese households, rather than inducing old households to hold more stock, one should encourage all generations to buy stocks. In particular, the growth in the stock market participation of younger households at this point, potentially attributable to the prevalence of cheap online stock trading after the early 2000s, may increase the stock market participation of future older households.

Second, given other variables such as income and total financial assets, the conditional share should increase as aging proceeds. Declining income and financial assets would clearly affect this projection.

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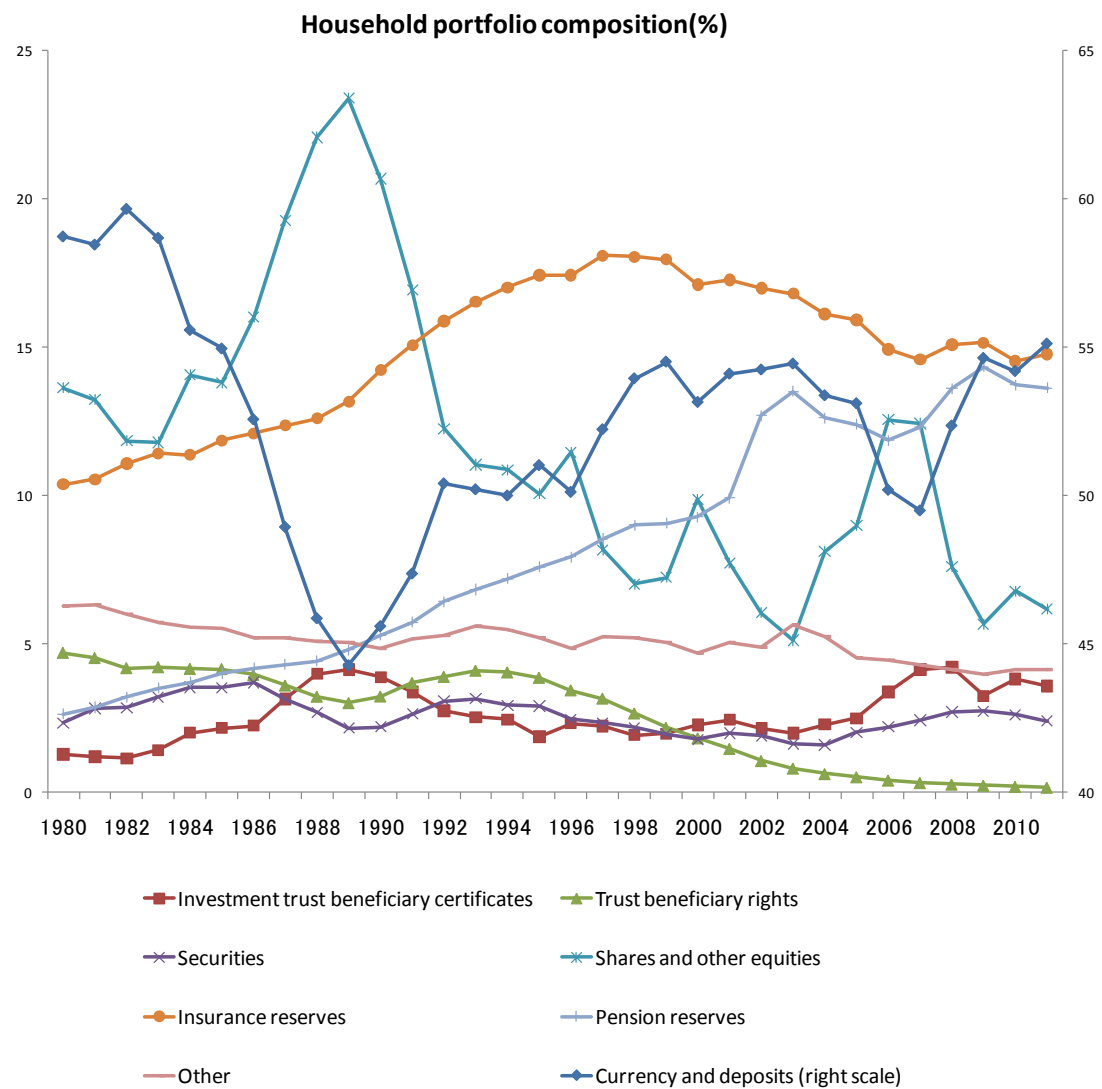


Figure 1: Household portfolio composition in Japan

Source: Flow of Funds

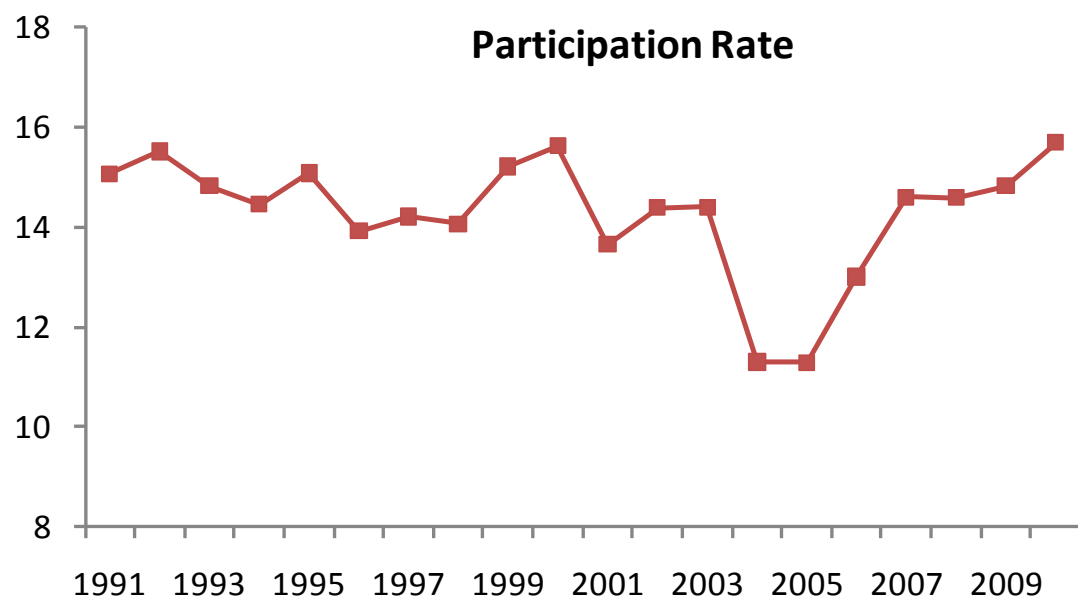


Figure 2. Participation rate

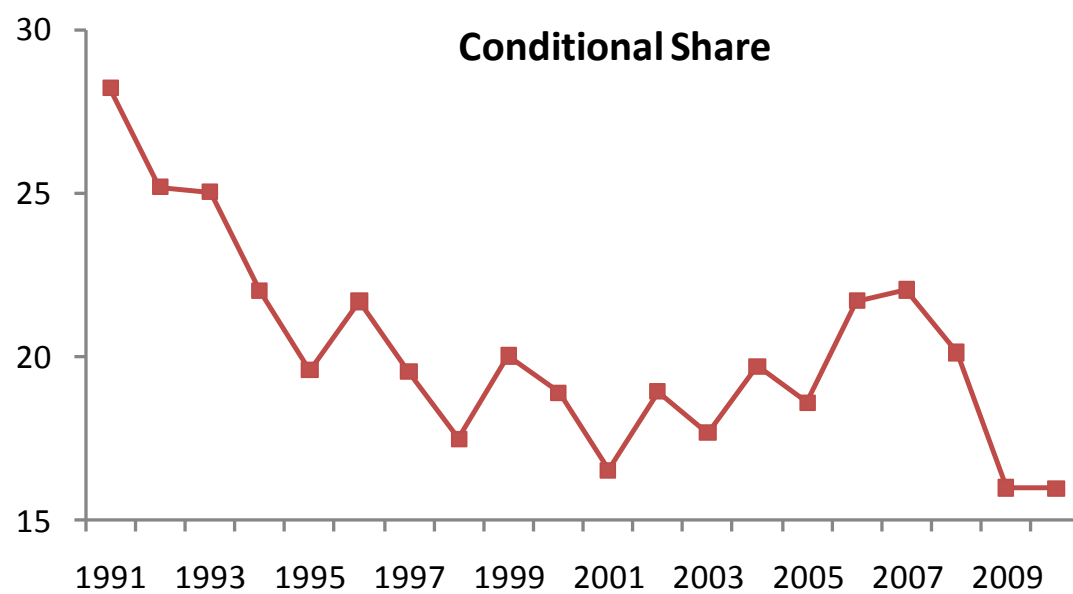


Figure 3: Conditional share of stock

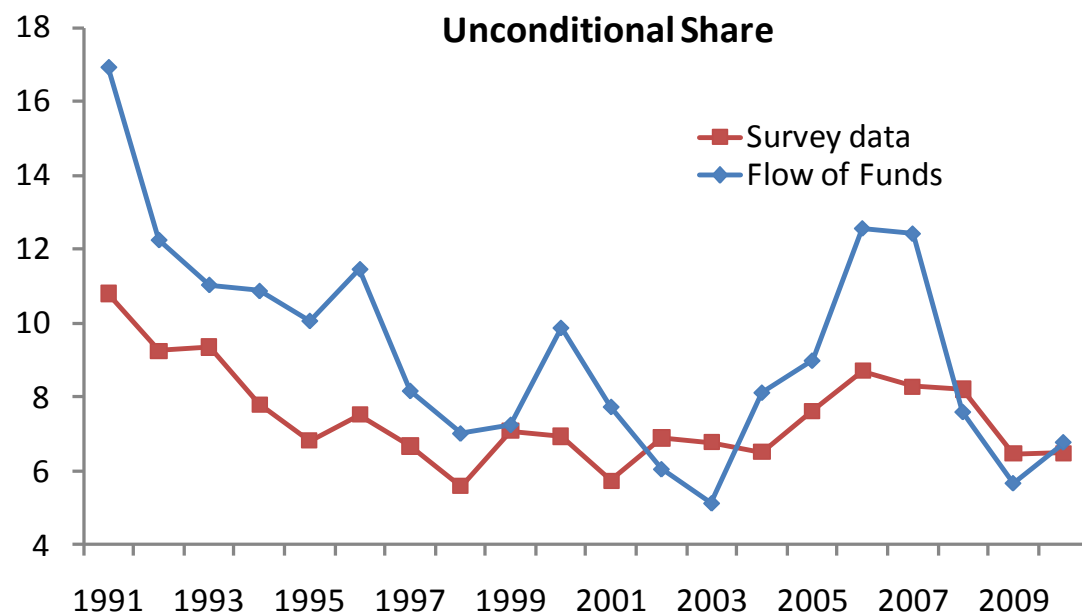


Figure 4: Unconditional share of stock by SHF and unconditional share from Flow of Funds data.

Source: Survey of Household Finances, Flow of Funds

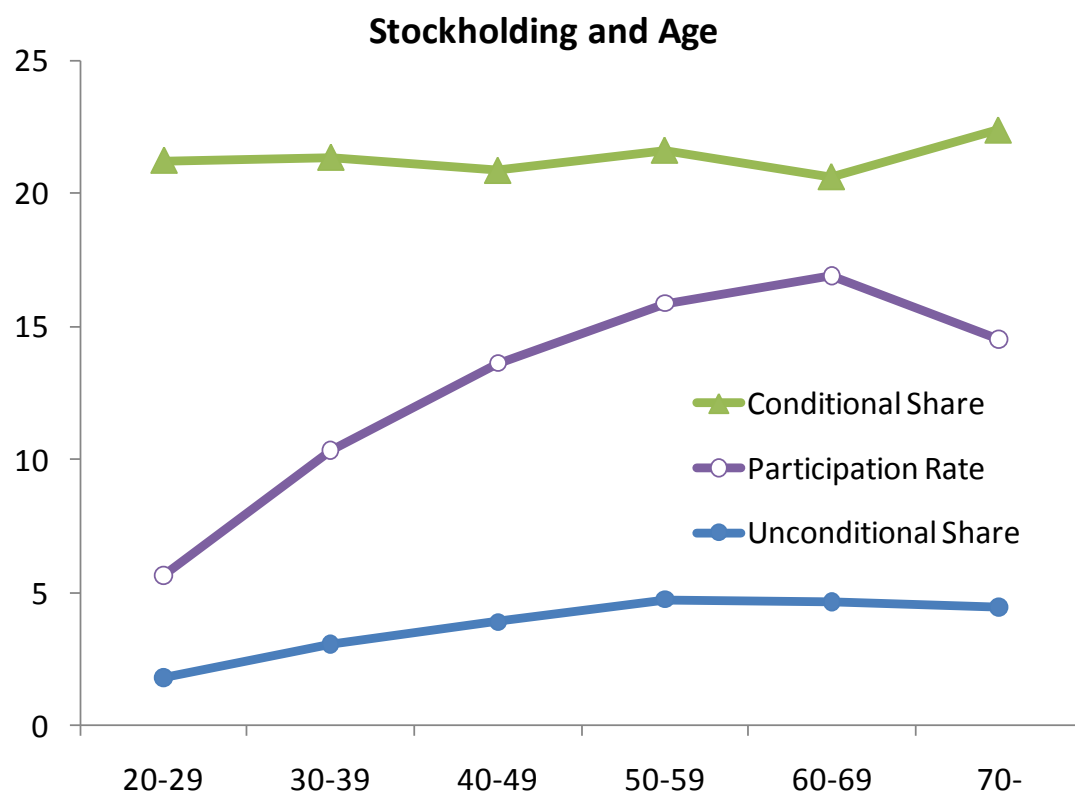


Figure 5: Stockholding and age

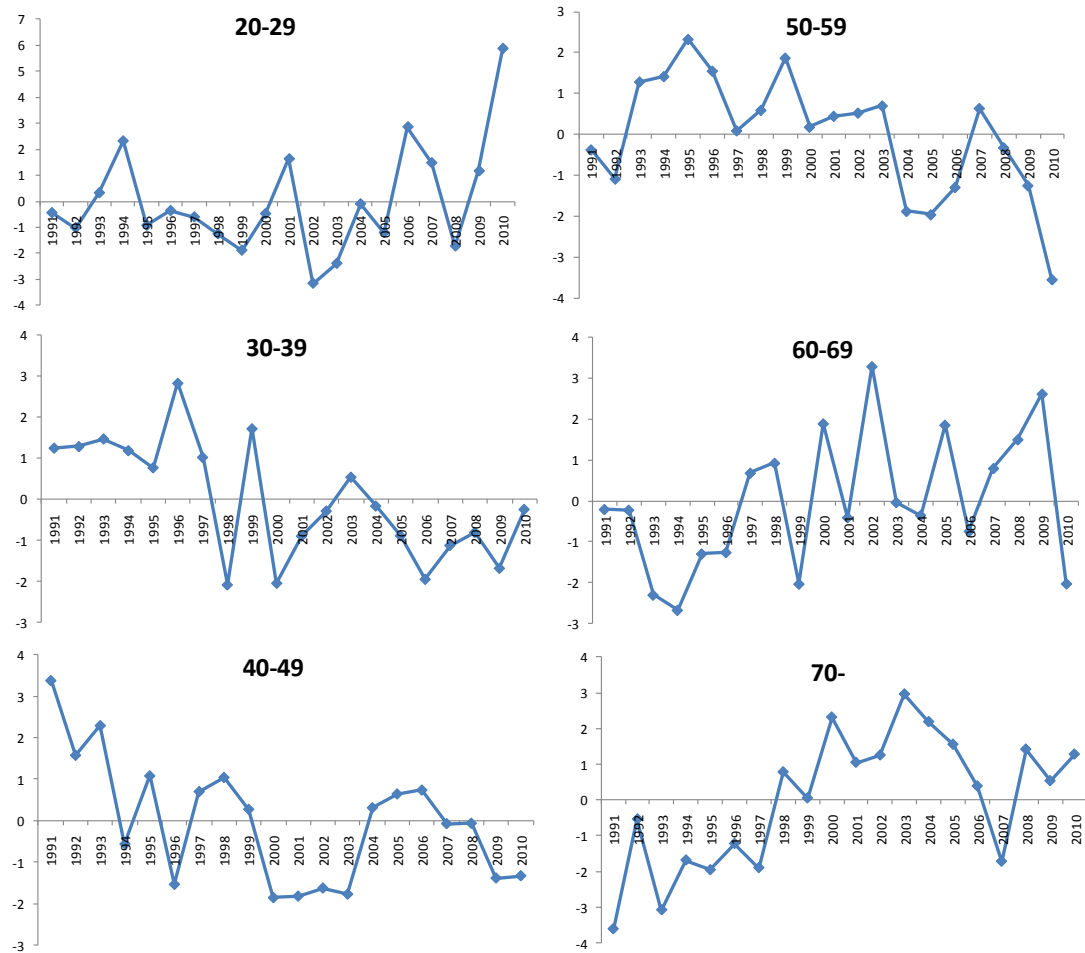


Figure 6: Participation rates by age groups

Note: The participation rates shown in the figure are residuals of regression of participation rates on time dummies and age dummies.

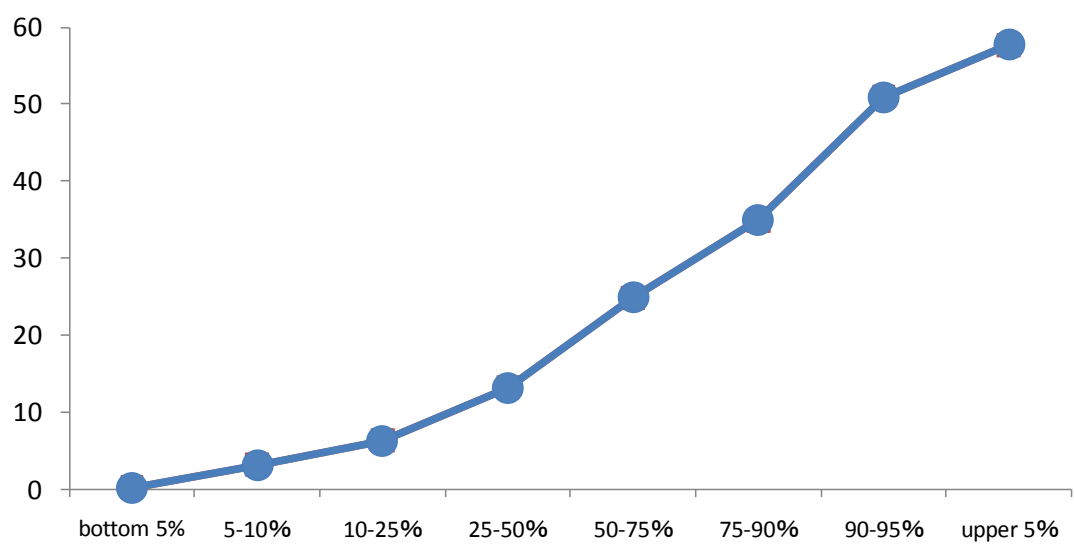


Figure 7: Participation rate and financial asset

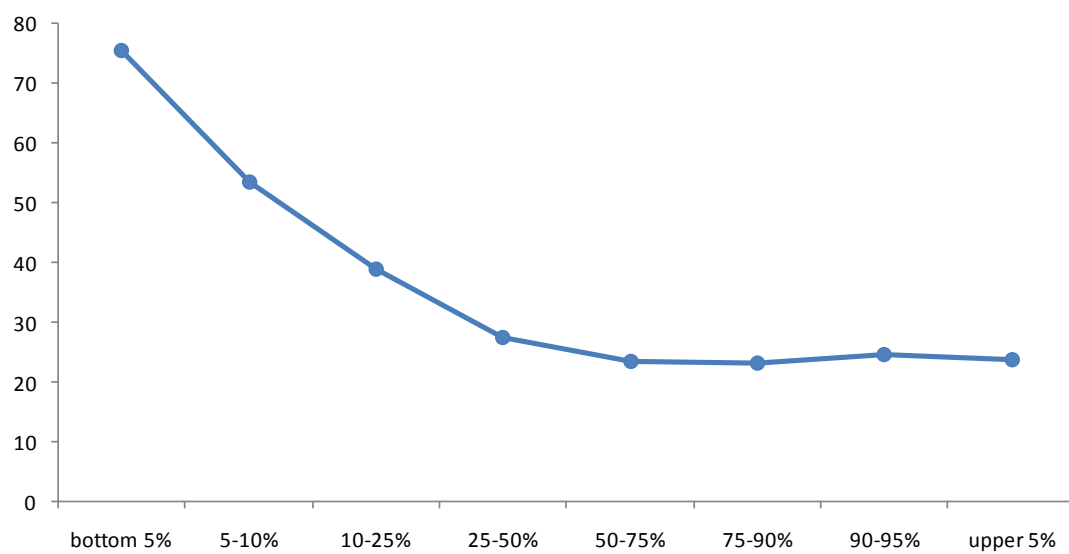


Figure 8: Conditional share and financial asset

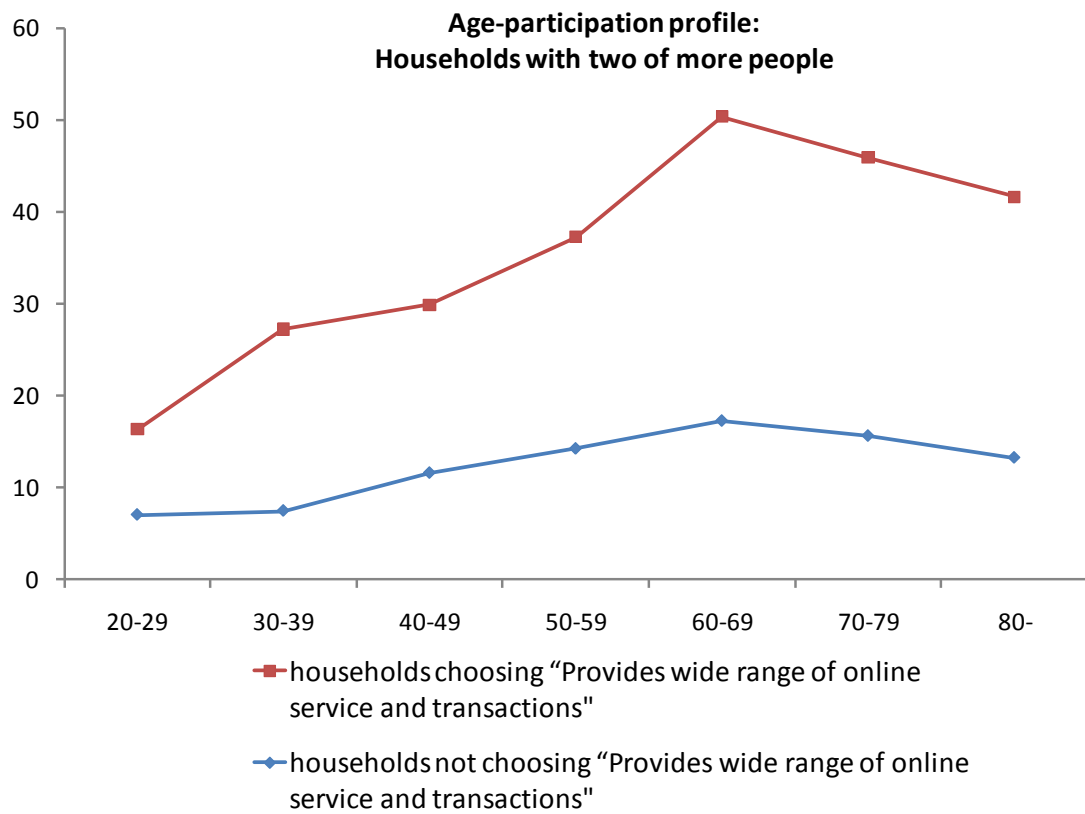


Figure 9: Age participation profiles of households by choice of "Provides wide range of online services and transactions"

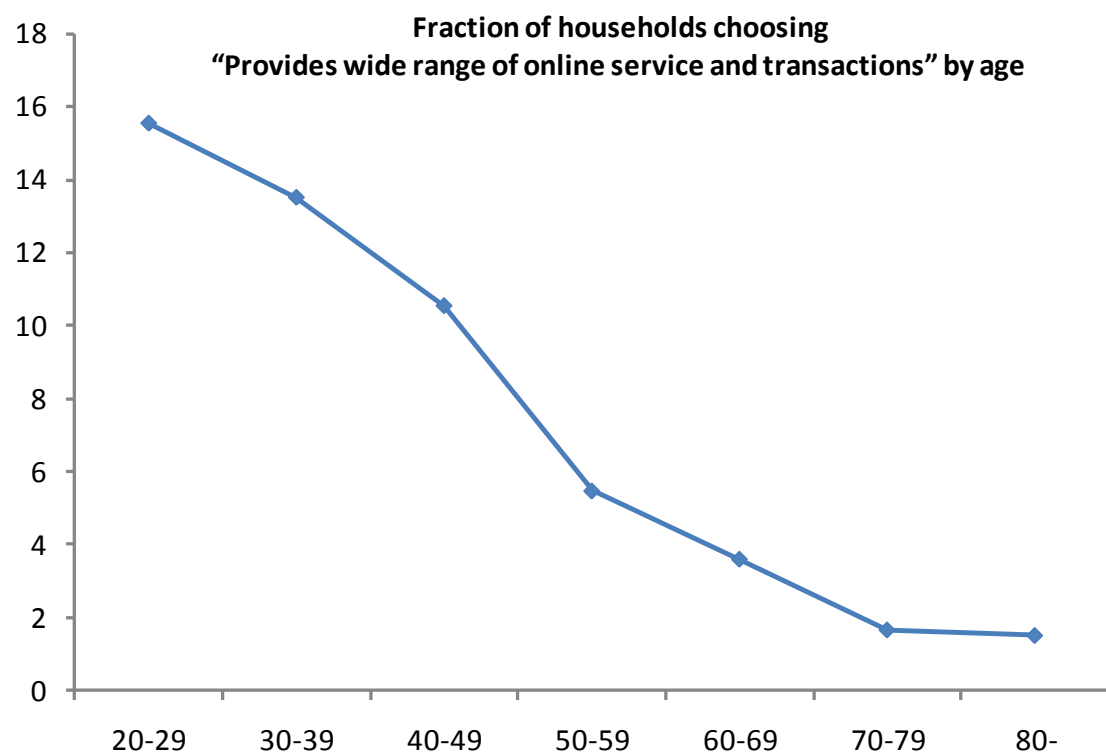


Figure 10: Fraction of the households choosing “Provides wide range of online services and transactions” by age

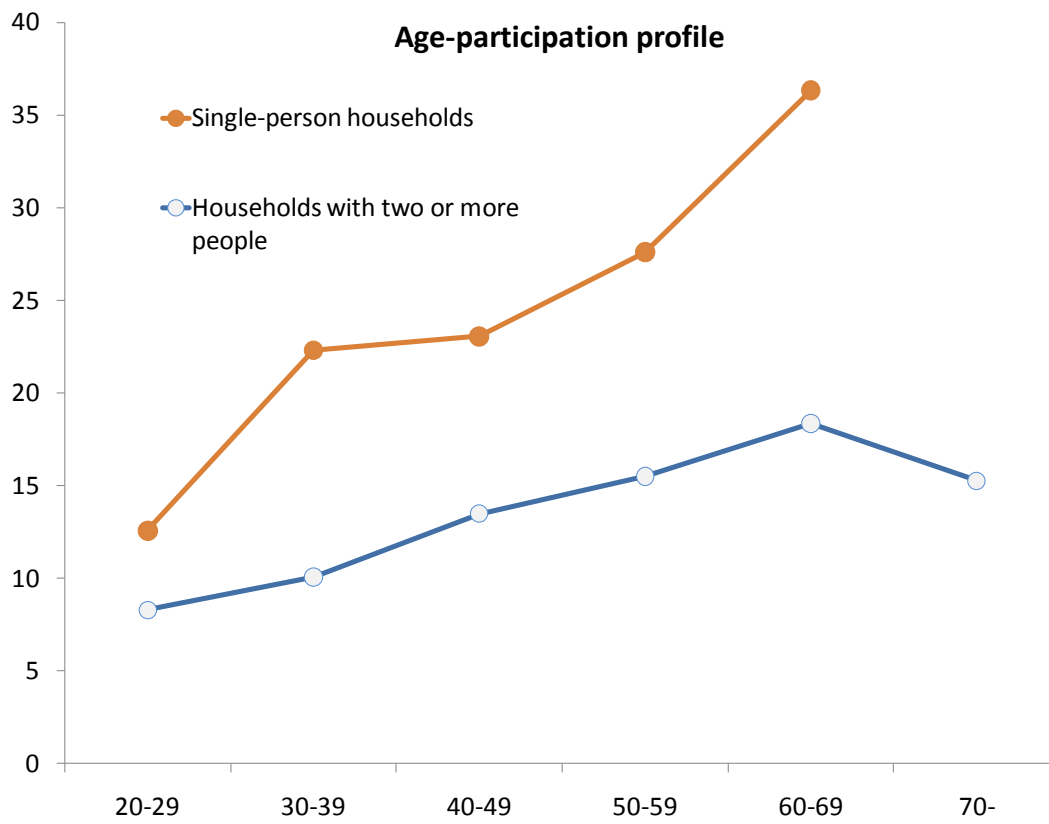


Figure 11: Age participation profiles of single-person households and households of two or more people.

### Age-participation profile: Single-person households

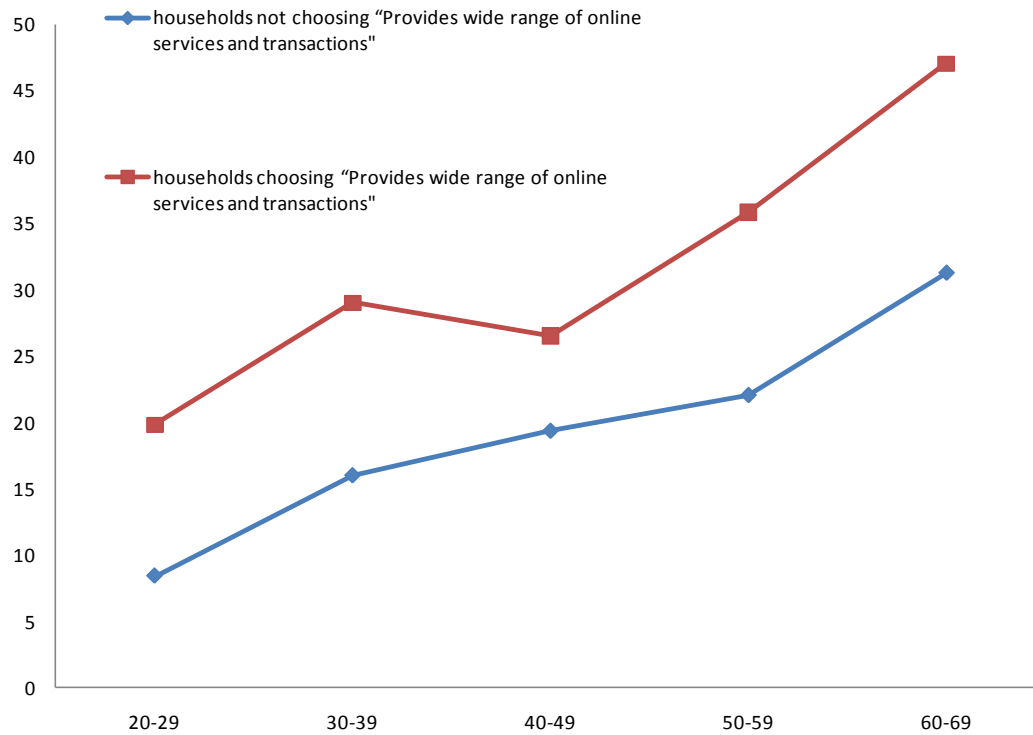


Figure 12: Age-participation profile of single-person households.

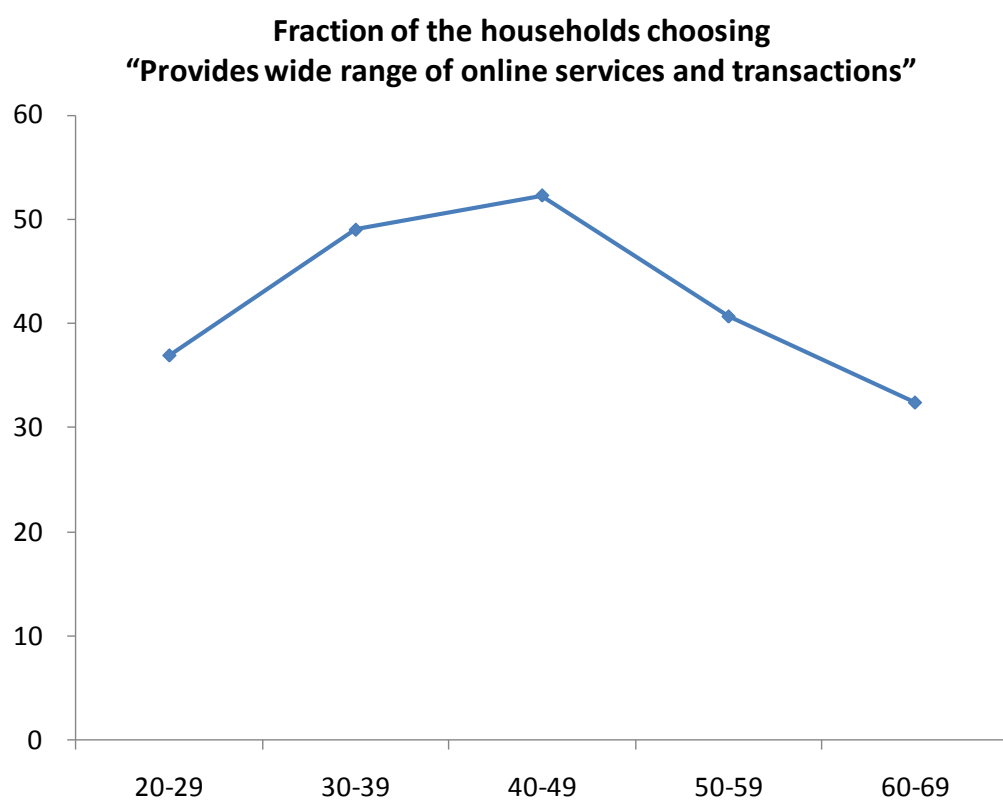


Figure 13: Fraction of households choosing “Provides wide range of online services and transactions” by age

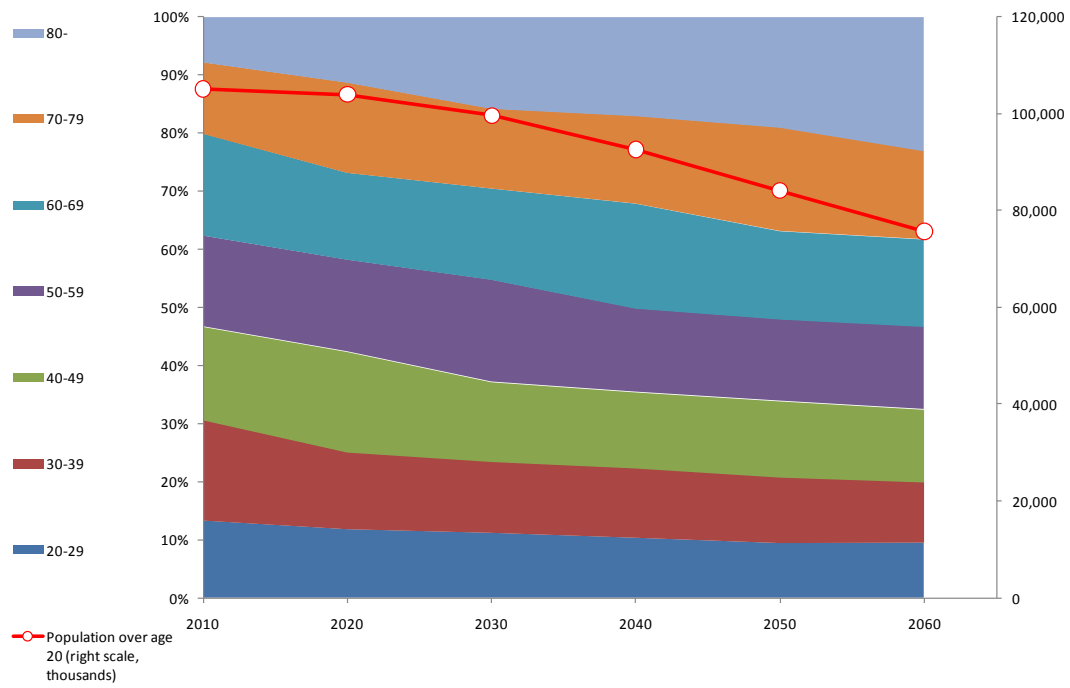


Figure 14: Projection of Japanese age structure and population

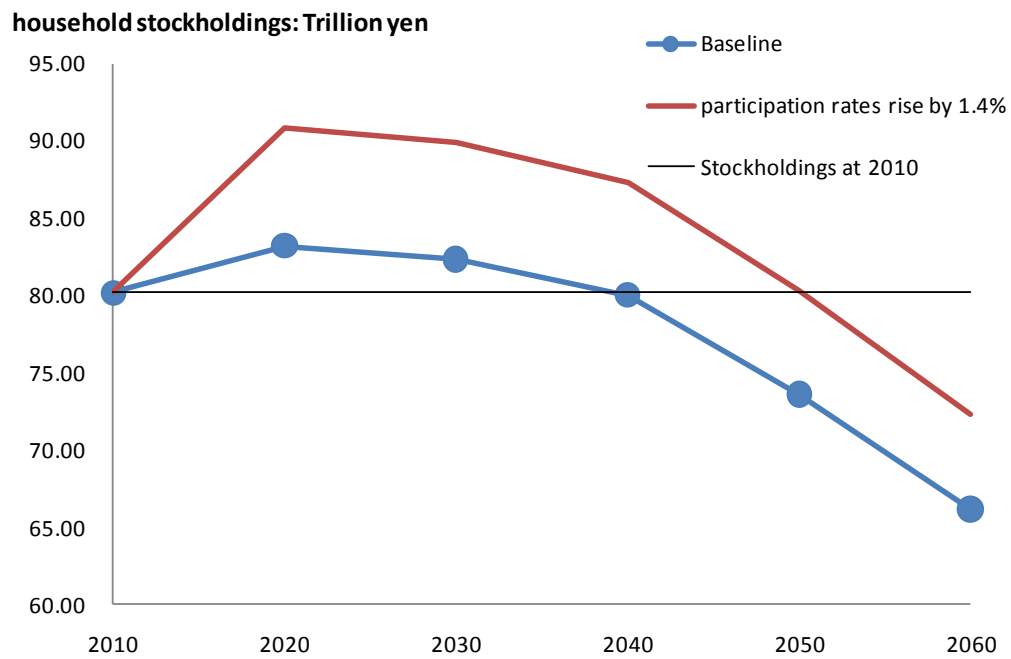


Figure 15: Projections of household stockholdings.

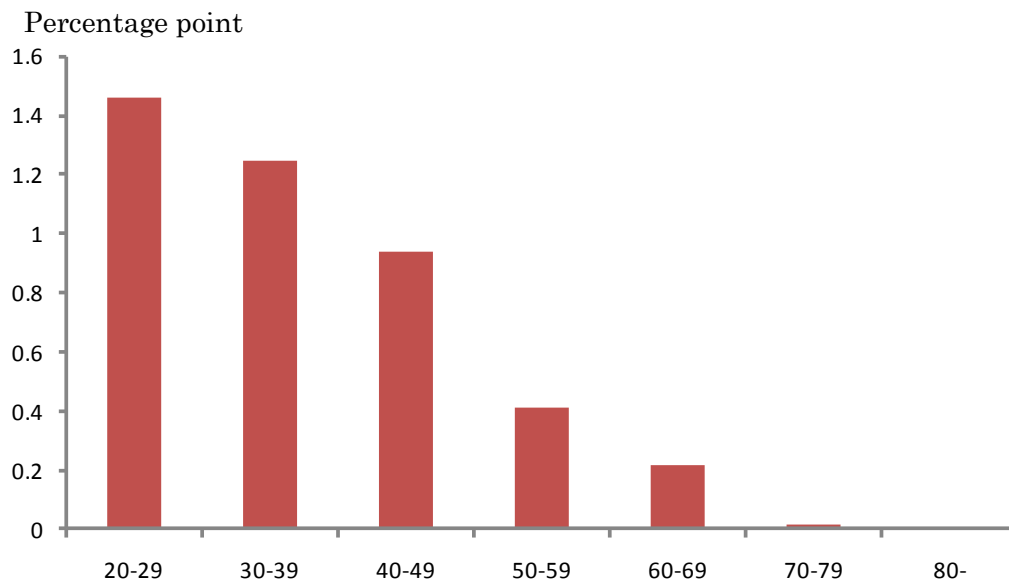


Figure 16: Impact of preference for online financial transactions on stock market participation.

Note: The impact is attributable to marginal effects obtained from estimated coefficients of the preference for online transactions shown in Table 1, evaluated at the current level of stock market participation and other conditioning variables. The numbers in the figure are normalized to deviations from the participation rate at age 80 or over.

		Share				Participation			
		Coef.	Std. Err.	z		Coef.	Std. Err.	z	
Financial asset	5-10%	-0.1982	0.0804	-2.46	**	0.9026	0.1546	5.84	***
percentile dummy	10-25%	-0.3362	0.0722	-4.66	***	1.1947	0.1221	9.78	***
bottom 5% is omitted	25-50%	-0.4970	0.0747	-6.65	***	1.5920	0.1158	13.74	***
	50-75%	-0.5800	0.0796	-7.29	***	2.0025	0.1149	17.43	***
	75-90%	-0.6286	0.0834	-7.53	***	2.2714	0.1171	19.40	***
	90-95%	-0.6642	0.0888	-7.48	***	2.6824	0.1256	21.36	***
	Top 5%	-0.6840	0.0905	-7.56	***	2.8059	0.1269	22.12	***
Income	10-25%	-0.0189	0.0294	-0.64		0.0780	0.0924	0.84	
percentile dummy	25-50%	-0.0541	0.0244	-2.22	**	0.2554	0.0758	3.37	***
bottom 10% is omitted	50-75%	-0.0721	0.0250	-2.88	***	0.3814	0.0763	5.00	***
	75-90%	-0.0880	0.0268	-3.29	***	0.5362	0.0800	6.70	***
	90-95%	-0.0817	0.0288	-2.84	***	0.5449	0.0893	6.10	***
	Top 5%	-0.0399	0.0292	-1.37		0.6160	0.0909	6.78	***
	Household size	-0.0021	0.0041	-0.52		-0.0560	0.0134	-4.19	***
	house owner dummy	0.0023	0.0095	0.24		0.1256	0.0323	3.89	***
Education	college graduate or more					0.2629	0.0319	8.25	***
Preference for online financial transactions dummy						0.5266	0.0532	9.90	***
Industry dummies	Agriculture	0.0507	0.0312	1.63		-0.3736	0.0958	-3.90	***
	Construction	-0.0048	0.0188	-0.25		-0.1076	0.0639	-1.68	*
	Manufacturing	-0.0071	0.0130	-0.55		-0.0330	0.0478	-0.69	
	Transportation	-0.0249	0.0239	-1.04		-0.0668	0.0815	-0.82	
	wholesale and retail	-0.0070	0.0168	-0.42		0.0379	0.0618	0.61	
	Services	0.0255	0.0344	0.74		-0.0227	0.1173	-0.19	
	Medical	0.0162	0.0271	0.60		-0.3562	0.0960	-3.71	***
	Public service	0.0297	0.0177	1.67	*	-0.3495	0.0584	-5.99	***
Occupation dummies	Self-employed	0.0051	0.0158	0.32		-0.1385	0.0561	-2.47	**
	non full-time worker	0.0267	0.0139	1.92	*	-0.0875	0.0503	-1.74	*
	household head, male	0.0111	0.0231	0.48		0.1453	0.0774	1.88	*
Age dummies	30-39	0.1034	0.0387	2.67	***	-0.1919	0.1264	-1.52	
age 20-29 is omitted	40-49	0.1308	0.0386	3.39	***	-0.2206	0.1255	-1.76	*
	50-59	0.1381	0.0387	3.57	***	-0.2097	0.1249	-1.68	*
	60-69	0.1558	0.0394	3.96	***	-0.1660	0.1277	-1.30	
	70-79	0.1656	0.0406	4.08	***	-0.1408	0.1327	-1.06	
	80-	0.1723	0.0437	3.95	***	-0.1754	0.1443	-1.22	
Time dummies	year 2008	0.0064	0.0122	0.53		0.0195	0.0442	0.44	
year 2007 is omitted	year 2009	-0.0285	0.0121	-2.36	**	0.0152	0.0438	0.35	
	year 2010	-0.0363	0.0120	-3.01	***	0.0808	0.0434	1.86	*
	constant	0.8106	0.1117	7.26	***	-2.9640	0.1937	-15.30	***

Table 1: Benchmark results of pooled regression for participation and the share of stocks

Note:

\*\*\*Significant at the 1 percent level.

\*\*Significant at the 5 percent level.

\*Significant at the 10 percent level.

		Share				Participation			
		Coef.	Std. Err.	z		Coef.	Std. Err.	z	
Financial asset	5-10%	-0.3832	0.2608	-1.47		1.0102	0.3542	2.85	***
percentile dummy	10-25%	-0.5646	0.2572	-2.20	**	1.6194	0.3340	4.85	***
bottom 5% is omitted	25-50%	-0.5755	0.2600	-2.21	**	2.0095	0.3314	6.06	***
	50-75%	-0.6277	0.2626	-2.39		2.2877	0.3310	6.91	***
	75-90%	-0.6806	0.2655	-2.56	**	2.6123	0.3319	7.87	***
	90-95%	-0.6787	0.2676	-2.54	**	2.7970	0.3373	8.29	***
	Top 5%	-0.7069	0.2550	-2.77	***	1.2419	0.3313	3.75	***
Income	10-25%	0.0283	0.0422	0.67		-0.0041	0.1148	-0.04	
percentile dummy	25-50%	-0.0188	0.0332	-0.57		0.0120	0.0916	0.13	
bottom 10% is omitted	50-75%	-0.0188	0.0324	-0.58		0.0648	0.0903	0.72	
	75-90%	-0.0553	0.0336	-1.65		0.3957	0.0894	4.43	***
	90-95%	-0.0516	0.0360	-1.43		0.4245	0.0983	4.32	***
	Top 5%	-0.0524	0.0392	-1.34		0.4960	0.1093	4.54	***
	house owner dummy	-0.0432	0.0209	-2.07	**	0.2412	0.0629	3.83	***
Education dummy	College education or more					0.1465	0.0358	4.09	***
Preference for online financial transactions dummy						0.3644	0.0327	11.14	***
Industry dummies	Agriculture	0.0281	0.0719	0.39		0.2034	0.2284	0.89	
	Construction	0.0037	0.0340	0.11		-0.3334	0.0905	-3.68	***
	Manufacturing	0.0041	0.0166	0.25		0.1543	0.0496	3.11	***
	Transportation	-0.0309	0.0296	-1.05		0.0335	0.0879	0.38	
	wholesale and retail	0.0176	0.0210	0.84		0.0289	0.0614	0.47	
	Services	0.0340	0.0414	0.82		-0.1764	0.1120	-1.57	
	Medical	-0.0306	0.0296	-1.03		-0.3088	0.0763	-4.05	***
	Public service	-0.0129	0.0230	-0.56		-0.2694	0.0648	-4.16	***
Occupation dummies	Self-employed	-0.0101	0.0215	-0.47		-0.2389	0.0628	-3.80	***
	non full-time worker	0.0193	0.0186	1.04		0.1900	0.0513	3.70	***
	household head, male	0.0835	0.0146	5.70	***	0.2374	0.0359	6.62	***
Age dummies	30-39	0.0335	0.0173	1.94	*	0.0804	0.0487	1.65	*
age 20-29 is omitted	40-49	0.0129	0.0213	0.61		0.0594	0.0616	0.96	
	50-59	0.0451	0.0217	2.07	**	0.2885	0.0587	4.91	***
	60-69	0.0727	0.0251	2.89	***	0.5394	0.0617	8.74	***
Time dummies	year 2008	-0.0369	0.0147	-2.51	**	0.0368	0.0444	0.83	
	year 2009	-0.0555	0.0147	-3.77	***	0.0446	0.0447	1.00	
	year 2010	-0.0531	0.0153	-3.48	***	-0.0352	0.0457	-0.77	
	constant	0.9038	0.2915	3.10	***	-3.6479	0.3459	-10.55	***

Table 2: Results of pooled regression for participation and the share of stocks using single-person

household data

Note:

\*\*\*Significant at the 1 percent level.

\*\*Significant at the 5 percent level.

\*Significant at the 10 percent level.