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The impact of digitalization on household asset allocation: evidence from the survey of Bank of Italy.

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Abstract

The purpose of this research is to study the determinants that influence household portfolio asset allocation. In particular, the aim is understanding the contribution of online banking to the final decisions of Italian families on where to allocate their money. Using the cross-sectional surveys of the Survey on Household Income and Wealth (SHIW) conducted by the Bank of Italy in the period 2008-2020, two types of analyses were conducted to answer three hypotheses developed. The initial hypothesis pertains to the potential of financial knowledge to address the stockholding puzzle. The second hypothesis explores whether online banking enhances risk tolerance, while the third hypothesis investigates whether online banking promotes increased investment in risky financial assets. Initially an aggregate analysis of panel data was performed, while in the subsequent examination, two empirical regression models were constructed considering the 2020 survey. The first model is a logistic regression model that captures the probability of using online banking as a tool for financial decisions and investments, while the second is a linear regression model with the aim of understanding what leads a family to choose a specific asset allocation for their portfolio. The data show that only from 2020 onwards, there is a majority in using online banking, while previously, less than 25% of Italians were users. Through the logistic models, it has been shown that financial knowledge, education, town size, and net disposable income are all positively related to the use of online banking. On the contrary, monthly expenses, relational status, and risk aversion negatively affect the use of this service. However, the last variable is not statistically significant, even in the weighted model, to reject the null hypothesis. The linear regression model shows that online banking is positively related to having more allocation in financial assets, particularly in corporate bonds, funds, and ETFs. Regarding stocks and equity, the relationship is positive but was found not to be statistically significant. Overall, these models partially solved the hypotheses, apart from the last one which loses significance. Apart from this, online banking reduces participation costs and as it is adopted by households with a certain level of financial knowledge, education, risk tolerance, these are the features that distinguish having a portfolio oriented towards riskier assets.

Summary

Contents

1. Introduction

The portfolio asset allocation represents one of main fields of Household Finance that researchers have been studying over the course of several years.
Asset allocation is simply the distribution of financial resources among various categories, encompassing both financial assets and tangible assets, including real estate holdings.

There are a lot of literature regarding the asset allocation that households should employ through their life, how adjust them depending on the macroeconomic scenarios which they encounter at different stages of life, which is the best in terms of returns and low risk, along with a multitude of other factors.

Theoretical models don't always reflect the empirical results. For instance, the classical Merton model of consumption and portfolio choice (1969) describe the optimal percentage of risky shares in a portfolio related to the expected risk premium, volatility of the assets and the degree of relative risk aversion.
An inference drawn of the Merton model is that all investors, irrespectively of their financial wealth and risk, should invest in the market portfolio, i.e., the portfolio that replicate the stock markets with stocks weights proportional to the capitalization of the underlying companies.
These implications are not accurate as shown by Guiso and Sodini (2013), regarding both the participation in the stock market and the share of risky assets in the portfolio.
These distinctions highlighted in literature have become renowned under the name of participation puzzle, see chapter 4.2 for an in-depth analysis.

An outstanding contribution over the past two decades to the field of portfolio asset allocation has emerged due to the diffusion of online banking services. With the advent of online banking across various financial institutions, investors could choose and modify their asset allocation without the need of any professional financial advice. Notably, the diffusion of internet access, has further facilitated cost-free and convenient access to economic and financial news.

Furthermore, online brokerage services have become popular, particularly during the COVID-19 pandemic in 2020-2021, offering zero-commission account openings and minimal transactions fees, especially for basic financial products such as ETFs. They are funds that passively replicate the performance of an index comprising securities grouped by regions, theme, or sectors. As they continuously track an index without a fund manager periodically changing positions in the portfolio by selling or buying securities, they exhibit a very low Ter[1], typically ranging from 0.10% to 0.70%, with thematic ETFs being the most expensive.

An illustrative example of this trend can be observed in the case of Directa, one of the oldest and largest brokers in Italy.
Directa experienced a remarkable 40% growth in its client base, exceeding 50,000 accounts and the total assets value under management (comprising cash and financial instruments)

[1] Total expense ratio of the fund that issues that specific ETF.

raised of 58% above three billion between 2020 and 2021, as depicted in Figure 1.1.

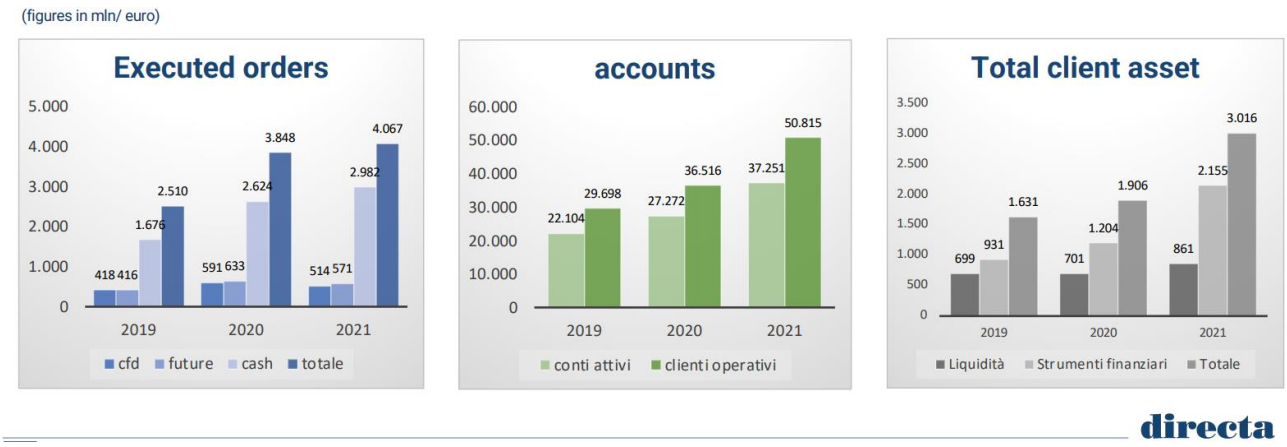


Figure 1.1 Directa balance sheet

As a result of the widespread adoption of online banking and the utilization of online brokers, one could expect a growing tendency among households to hold different asset allocations, due to their different financial knowledge, risk aversion, wealth and other pertinent factors as expounded upon in greater detail in Chapter 4.

The aim of this research is to make a substantive contribution to the existing literature with mainly two principal dimensions:

1) To analyses the characteristics and behaviours of families that invest through online banking platforms, while also investigating if their asset allocation changes and in which measure considering a panel data household. Particular attention will be directed towards those households that, across two consecutive survey waves, start to adopt for the first-time internet banking for investment purposes.
2) To add new findings into the determinants of the household portfolios allocation decisions, with a specific emphasis on the influence of online banking usage on the investment choices made by Italian households.

The study is mainly focus on the SHIW dataset of the Bank of Italy 2020, due to the most updated data and since the main literature is focus on American household it has been decided to improve the Italian case.

The following contents of the study are organized as follows: section 2 will focus reviewing existing literature on the subject, section 3 presents the data considered during the analysis, section 4 provides a descriptive analysis of the macro-level variables, section 5 conducts a multivariate analysis using regression models, and Section 6 discusses the results and implications.

2. Existing literature

In this paragraph, the existing literature on the diffusion of online banking in the Italian context and the theory of asset allocation is analysed, encompassing its optimization, key determinants, and the latest global trends.

2.1. The diffusion of online banking in Italy

The beginnings of online banking in Italy can be followed back to the late 1990s when the web started to obtain widespread popularity. At first, internet banking services were introduced by a select few monetary organizations, cautiously testing the waters of this emerging digital world. These early internet banking offerings were basic compared to today's advanced platforms, mainly providing elementary account information and money transfers.

The first service digitalized was the payment scheme, in fact, today all banks provide digital access to payment services. More interesting is, instead, the digitalization of the asset management service, that basically include both online purchase of financial products and the automated services of robot-advisors. It starts to increase slowly than other banking services but today it reaches almost the totality of Italian banks, as shown in figure 2.

Supply of banking services offered through digital channels in Italy

(percentage shares)

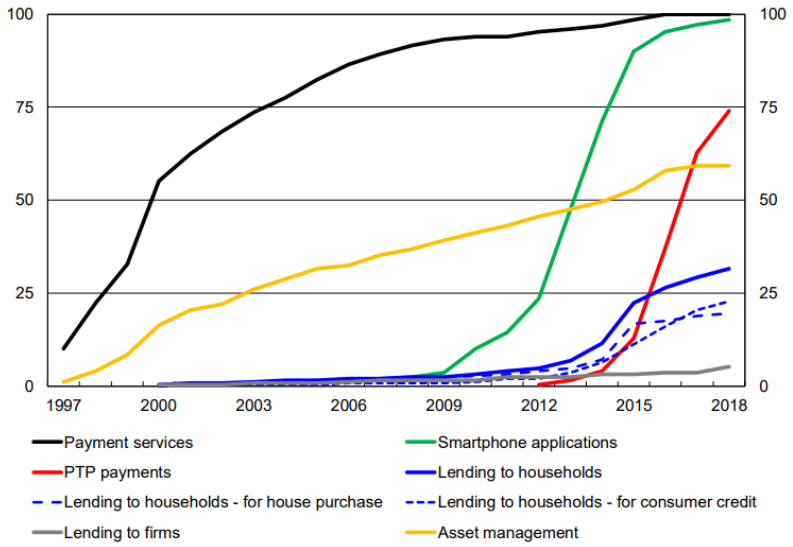


Figure 2.

According to the Eurostat[2] individuals using online banking in Italy was 48% at the end of July 2023 (figure 2.1). These data are consistent with our dataset from SHIW bank of Italy even for the approximation considered when taken the response variables "use of online banking" as will be explained in chapter 3. In fact, in the SHIW of 2014 the user of online banking interviews was around 24%, in 2016 about 25%, while regarding the last available survey of 2020 the data are not very uniform with the aggregate ones where 54% was the percentage of online users.

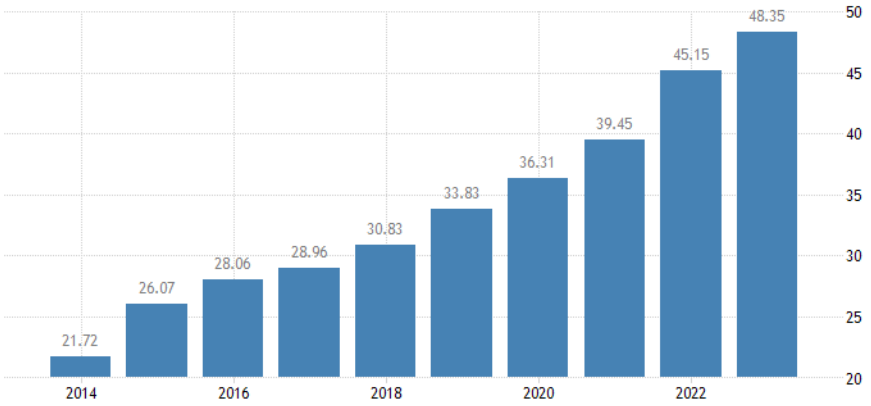


Figure 2.1. Users of online banking in Europe

Banks start to adopt online technologies because:

- Cost-saving opportunities regarding the personnel, physical spaces of local branches, credit and debit card transactions fees, information cost and mantainance fees. Consequently, online banking services from banks reduce number of branches as discussed in Ardizzi et al., 2021 (figure 2.2).

  Michelangeli and Viviano (2021) demonstrate that these cut in costs impacted in a reduction by over 30% between 2002-2016 in fixed fees for opening an online account and in the trading fees for most of the italian banks.

- Implement new sources of revenues stream offering new products and services through digital channels (DeYoung et al., 2007)

- Increase the market segment of clients without opening physical branches (Felici and Paganini, 2008)

[2] is a directorate-general of the European Commission which provide statistical information to the institutions of the European Union

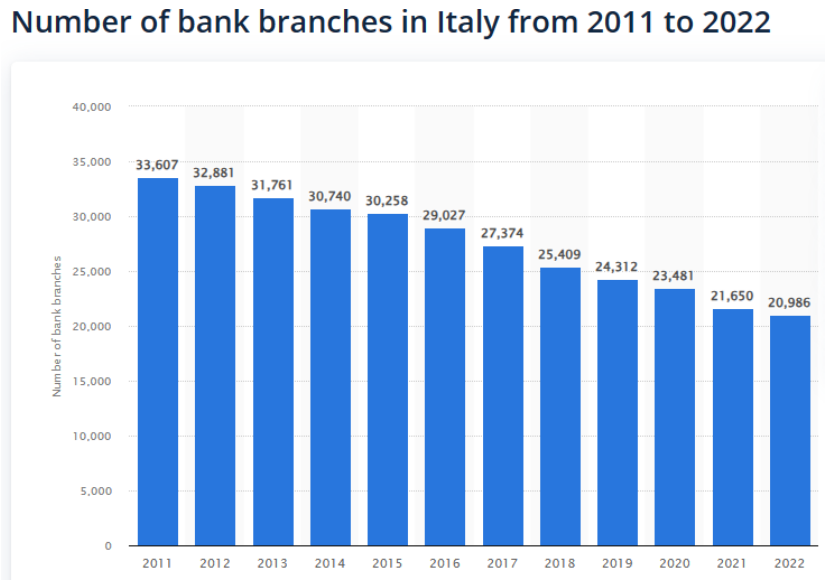


Figure 2.2.

Summing up, Aranudo et al. (2022) in the paper "The digital transformation in the Italian banking sector" from Banca d'Italia demonstrate, with a dataset of 280 italian banks, a positive significant correlation between digital channels and bank profitabiliy, notably with revenues from asset management activities.

Nevertheless, the digitization of financial services open the market to new FinTech players that provide functions and tasks previously reserved excusively to banks, such as investment, payments, lending.
In Italy, the first digital bank, created by Unicredit, was Fineco in 1999. Only in 2008, Mediobanca with CheBanca! creates the first competitors. In the last years, there was an explosion of digital banks, from Hype to Illimity Bank (figure 2.3).
The scope of these E-bank is to provide within an app, all the services for the user from basic payment to sofisticated financial investment.

At the beginning of the Web bank's diffusion, tradional banks have predominantly responded by engaging in strategic partnerships with fintech companies, deferring the decision to modernize their own ICT infrastructure (Brandl and Hornuf, 2017).

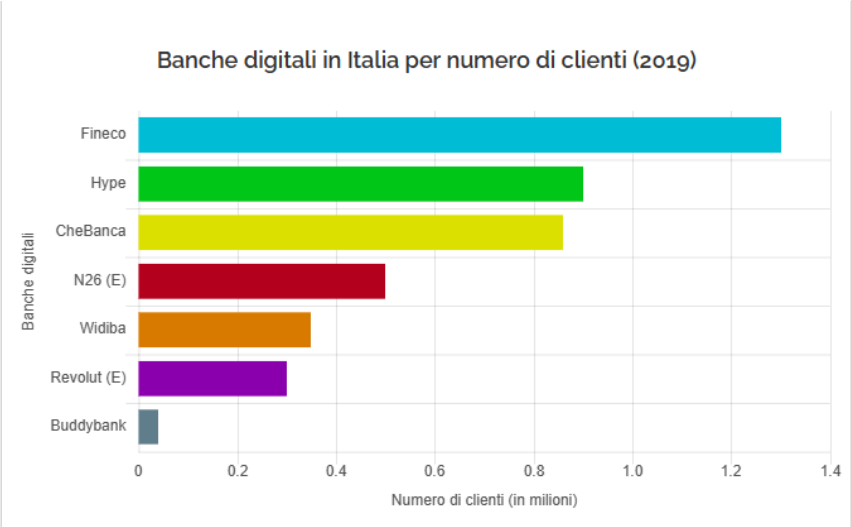


Figure 2.3

2.2. Household asset allocation

The choice of the asset allocation is crucial for any household given that determines the distribution of their current investment and their potential future wealth.
There are few things that an individual can control when it comes to invest, and asset allocation is one of them.
Asset allocation is the exercise of determining how much of each asset class should be allocated in the portfolio.
The main asset classes are stocks, bonds, cash, real estate, and other financial assets. The last one includes commodities, derivatives, cryptocurrencies, and other more sophisticated products that this study don't consider.

There is no optimal asset allocation, the best procedure is looking at the existing literature as also shown by Gerard O'Reilly (2009) that tried to model an optimal asset allocation and concluded that the model was too sensitive to its inputs to define an optimal asset allocation strategy.

The capital asset pricing model (CAPM) was the first model that quantified the relationship between risk[3] and expected return of an asset. Is sees risk and return as being determined by a portfolio's exposure to market beta, i.e., the riskiness of the market as a whole, through a linear relationship.

[3] It refers to the systematic risk, the one that cannot be eliminated through diversification because affects all assets. For example, fluctuations in the stock market, interest rates, or the entire financial system.

Basically, it's represented by the following equation:

$$E[R_i] = R_f + \beta * (E[R_m] - R_f) \qquad (1)$$

Where $E[R_i]$ is the expected return of investment and it's computed as a function of the R_f risk-free rate, β the measure of how much risk the investment will add to the market portfolio and $(E[R_m] - R_f)$ the market risk premium.

The goal of the CAPM formula is to help an investor building a portfolio related to his risk-aversion.
The graph 2.4 shows that, theoretically, any portfolio that fits on the efficient frontier is optimal because it offers the highest expected return for a fixed level of risk or viceversa the lowest risk for a given level of expected return.
Of course, this model relies on different unrealistic assumptions: there are no taxes, inflation or transaction costs, risk and return are linearly related, all investors are risk-averse and have the same time period to evaluate information.
Moreover, futures returns cannot be predicted but the idea under this model is a trade-off between return and risk which the investors should look at.

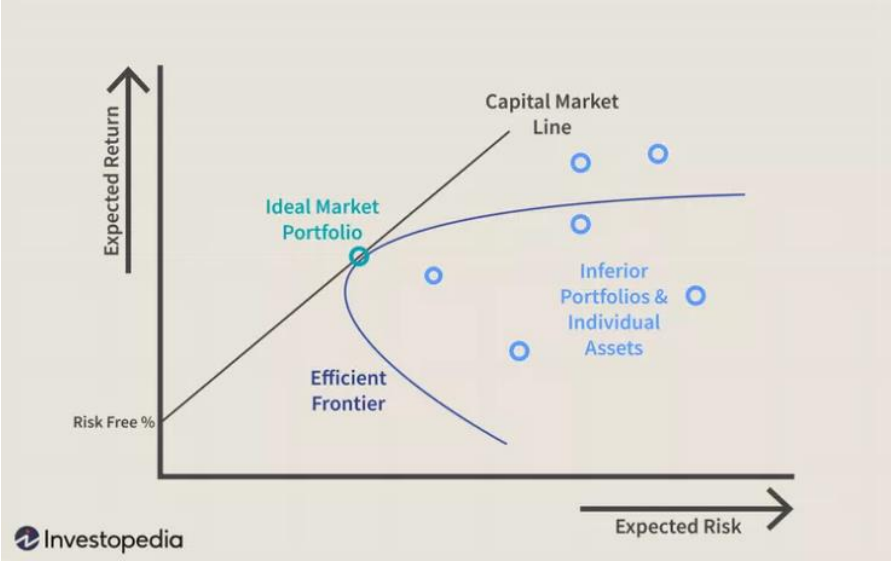


Figure 2.4

As reported above, the risk take into account in the CAPM is the systematic risk.
Instead, another risk is the idiosyncratic or unsystematic risk that comes from when betting on a specific segment of the market and not the whole.
Consequently, to eliminate idiosyncratic risk, the right asset allocation should be the market

portfolio, for instance through an ETF FTSE All World[4], that diversifying reduces the risk exposure.

2.2.1. Determinants of asset allocation

Various factors come into play when a household determines how to allocate its financial resources:

- Risk tolerance

  It refers to how much an individual is willing to lose from their original investment in anticipation of a higher return in the future.
  The risk profile is subjective and not always is related to its financial capacity. If a person cannot handle volatility and risk in his life, even with a huge amount of money tend to be conservative in equity allocation.
  Typically, the literature divided risk-averse people, risk neutral and risk lover. The first one prefers outcomes with low variance to those with high variance even if the return is lower, the middle is indifferent, and the latter take the risk in exchange for a higher expected return.

- Time horizon

  The time horizon is the duration during which an individual is invested. If it is short term, short fixed-income securities like short-term bonds, fixed deposit, liquid funds should be preferred for having access to liquidity and fast returns.
  Instead, for a long-term investor is more advisable to invest in equity since in more than 10-20 years the dynamics of the stock market offer generally long-term growth potential rather than bonds, albeit with a commensurate increase in risk.

- Financial goals

  Depending on the financial goals, an individual chooses different asset allocation. For instance, for households whose goal is to accumulate wealth for their children in the long term or retire early, the so called "FIRE movement", would be better to invest in financial assets, as they generally provide in the long-term high growth potential rather than real assets.
  Instead, if the next nearest goal is to buy a house, it's better to have liquidity in the account to invest in real estate.

- Age

[4] Is a market-capitalization weighted index that tracks the performance of large and mid-cap stocks from developed and emerging markets. It covers more than 95% of the investable market capitalization.

In the literature, a common rule of thumb, is to calculate the equity allocation as 100 minus your age. So, if you are 30 years old, you should have a financial portfolio composed of 70% equity and the remaining 30% in bonds, commodities, and other assets. As age increases, household should reduce his equity allocation. This rule is called "declining equity glide path". Another approach related to age is the "rising equity glide path", where individuals should approach retirement with a high allocation to bonds and spend them first while letting equity allocation grow.
Pfau and Kitces (2013) compared the two approaches, showing that the second approach provided the best outcomes during bear[5] market. Instead, over a bull[6] market both approaches have obtained good results.
A lot of literature, confirm the negative relation between age and equity exposure (see Bodie and Crane (1997), Shum and Faig (2006)). Indeed, young individuals have higher risk tolerance, human capital, and time to invest in risky equity. If markets collapse, they'll still have time to recover from their losses and even grow thereafter. While getting old, human capital tends to zero and the need of stable stream of cash flows require low risk securities exposure.

- Income and expenses

Income and expenses level affect substantially the asset allocation. High income and high percentage in savings allow to a afford aggressive asset allocation. Also matters the expectation of income growth to reallocate the investment.
Further, another determinant is the income uncertainty in the future. Hyun and Tae (2018) found a negative correlation between income uncertainty and allocation in equity.

These represent the primary determinants affecting the decision regarding asset allocation. Further variables will be considered upon the introduction of the regression models analysed within this study (chapter 3).

[5] In a bear market the economy is receding, generally when fall more than 20% from highs.

[6] In a bull market the economy conditions are favorable, and the share prices rises.

2.2.2. Trends in asset allocation

In recent years, trends in household asset allocation have changed significantly. As said in the introduction, the advent of technology simplified the access to financial markets.
Online banking, online brokers, low transaction costs, and access to financial news on the internet have markedly increased the global market capitalization over the past 15 years, as evidenced by the figures. Both the equity market and the fixed income market of the largest markets have increased almost every year since 2008 with, respectively, a 10 years CAGR[7] of 4.3% and 4.0%.

	Australia	Canada	China	EU	HK	Japan	Singapore	UK	US	DM	EM	Total
2008	683.9	1,033.4	1,778.8	5,656.7	1,328.8	3,263.3	265.0	1,868.2	11,590.3	2,124.0	3,457.3	33,049.5
2009	1,261.9	1,676.8	3,573.2	7,664.0	2,305.1	3,444.4	481.2	2,796.4	15,077.3	3,567.2	7,205.1	49,052.7
2010	1,454.5	2,170.4	4,027.8	7,160.9	2,711.3	4,099.6	647.2	3,613.1	17,283.5	4,387.4	9,275.7	56,831.5
2011	1,198.2	1,912.1	3,412.1	5,962.0	2,258.0	3,540.8	598.3	3,266.4	15,640.7	3,798.9	8,001.6	49,589.1
2012	1,386.9	2,058.8	3,697.4	6,847.1	2,831.9	3,681.0	765.1	3,396.5	18,668.3	4,449.1	8,367.1	56,149.1
2013	1,366.0	2,113.8	3,949.1	8,611.6	3,100.8	4,543.2	744.4	4,429.0	24,034.9	5,240.3	8,077.3	66,210.3
2014	1,288.8	2,095.4	6,004.9	7,844.3	3,233.0	4,378.0	752.8	4,012.9	26,330.6	5,292.9	8,415.7	69,649.3
2015	1,187.2	1,593.5	8,188.0	7,580.0	3,184.9	4,894.9	640.0	3,878.8	25,067.5	5,107.2	7,253.0	68,575.0
2016	1,316.9	2,041.5	7,320.7	7,669.6	3,193.2	5,061.5	649.5	3,467.4	27,352.2	5,274.7	8,202.6	71,549.9
2017	1,508.6	2,367.1	8,711.3	9,787.6	4,350.5	6,222.8	787.3	4,455.4	32,120.7	6,436.3	10,919.7	87,667.2
2018	1,262.8	1,937.9	6,324.9	8,136.0	3,819.2	5,296.8	687.3	3,638.0	30,436.3	5,661.4	9,620.9	76,821.6
2019	1,487.6	2,409.1	8,569.5	9,733.6	4,899.2	6,191.1	697.3	4,182.9	34,085.7	8,709.3	8,819.8	89,785.2
2020	1,720.6	2,608.4	12,276.8	11,148.1	6,130.4	6,718.2	652.6	4,045.6	41,569.9	9,756.0	10,089.6	106,716.1
2021	1,887.4	3,264.1	14,437.4	13,811.0	5,434.2	6,544.3	663.4	3,799.5	48,548.5	10,965.0	11,465.1	120,820.0
2022	1,679.2	2,744.7	11,469.3	10,988.4	4,566.8	5,380.5	619.4	3,096.0	40,298.0	9,462.8	10,930.1	101,235.2

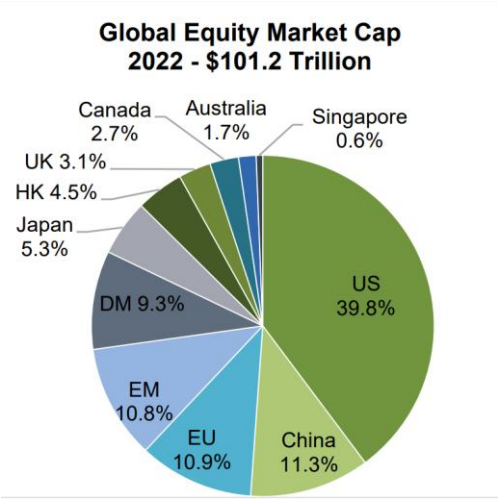
Figure 2.5.. Global Equity markets Capitalization in $ Billions

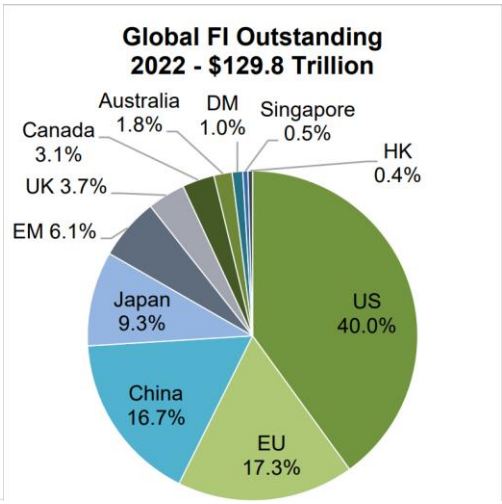
	Australia	Canada	China	EU	HK	Japan	Singapore	UK	US	DM	EM	Total
2008	1,145.3	1,369.7	2,228.0	20,224.8	105.6	12,329.9	167.6	3,991.2	27,890.9	602.5	898.2	70,953.8
2009	1,529.5	1,671.6	2,577.9	24,069.2	154.2	12,268.5	185.0	5,122.8	28,584.3	776.1	1,044.0	77,983.0
2010	1,749.0	1,866.6	3,065.3	23,281.7	186.7	14,604.1	219.0	5,012.3	29,670.8	833.5	1,250.4	81,739.5
2011	1,879.8	1,963.4	3,528.4	23,413.7	214.0	15,809.1	240.9	5,350.9	30,442.8	837.4	1,737.0	85,417.3
2012	2,045.6	2,173.5	4,294.1	24,259.9	253.3	14,247.8	294.8	5,657.8	31,690.2	955.7	2,009.9	87,882.5
2013	1,885.9	2,241.9	4,960.8	24,951.5	306.7	11,900.5	331.4	5,555.1	32,719.7	970.7	1,967.5	87,791.6
2014	1,923.8	2,206.1	5,835.4	22,007.4	345.1	10,548.3	349.3	5,845.7	33,760.7	898.5	2,074.1	85,794.4
2015	1,827.2	2,767.5	7,752.5	19,784.0	374.0	10,631.3	322.3	5,565.1	34,842.7	866.1	2,279.9	87,012.5
2016	1,825.7	2,943.5	9,408.8	19,319.5	405.7	11,241.3	326.4	5,142.2	36,054.8	962.0	2,573.9	90,203.7
2017	1,997.8	3,267.4	11,757.1	22,054.2	474.0	11,913.4	412.2	5,712.9	37,280.3	1,082.4	3,042.2	98,994.0
2018	1,892.2	3,151.0	12,906.9	21,352.9	513.5	12,459.8	441.1	5,434.6	38,778.4	1,063.8	6,375.5	104,369.6
2019	1,943.7	3,371.1	14,725.9	21,690.9	534.0	12,815.4	492.9	5,965.1	40,603.4	1,185.7	6,825.7	110,153.5
2020	2,490.6	3,914.4	18,555.6	27,739.6	558.7	14,669.6	542.8	6,868.5	46,602.2	1,409.9	7,080.4	130,432.2
2021	2,413.8	4,074.6	21,816.4	26,283.9	582.1	13,373.5	612.4	6,821.9	49,287.8	1,421.6	7,386.1	134,074.1
2022	2,311.0	4,085.8	21,660.0	22,494.5	572.6	12,056.2	656.6	4,793.5	51,936.9	1,345.7	7,892.2	129,805.0

Figure 2.6. Global Fixed Income Market Outstanding in $ Billions

[7] Compound annual growth rate

In 2022, the global equity market cap reached $101.2 Trillion and the fixed income market $129.8 Trillion where the US are still the largest capital markets, the most liquid, and most efficient in the world and three times larger than the second-largest market, China. (Report from SIFMA[8] 2023).





According to the report published by Allied Market Research, the global residential real estate market was pegged at $8,567.4 billion in 2019 and is estimated to hit $12,182.1 billion by 2027, registering a CAGR of 9.0% from 2020 to 2027.

[8] Securities Industry and Financial markets association

3. The data

The Bank of Italy has conducted the Household Income and Wealth (SHIW) survey since the 1960s to collect data regarding the income, wealth, and saving patterns of Italian households.

With each passing year, the survey has expanded in its coverage, now encompassing a wide array of aspects related to households' economic and financial behaviors, including methods of payment. The latest surveys have sampled approximately 7,000 households (comprising 16,000 individuals) across roughly 300 municipalities in Italy.

In this study, the analysis was conducted using the most recent 6 cross-sectional surveys spanning from 2008 to 2020. This approach provides insights into the evolution of online banking adoption and asset allocation among Italian households over time.

3.1. Sample Design

The survey sample is designed through a two-stage process, involving municipalities and households as primary and secondary sampling units, respectively. Before the selection of primary units, they undergo stratification based on both region and population size, also known as primary sampling unit stratification.

Within each stratum, municipalities that encompass a population exceeding 40,000 (referred to as self-representing municipalities) are included, while smaller towns are chosen using probability proportional to size sampling (PPS). The households to be surveyed are subsequently and randomly selected from the civic register.

For analysing the evolution of the studied phenomena, a portion of the survey sample has included households previously surveyed in prior waves since 1989, referred to as panel households.
In recent editions, the panel households constitute approximately 50 percent of the total sample. The panel segment comprises households that have participated in at least two previous survey waves and an additional portion randomly selected from those interviewed only in the previous edition. Non-panel households, on the other hand, are randomly chosen from the demographic register.

Starting from the 2020 survey, secondary sampling units have been stratified based on household income and indebtedness, introducing secondary sampling unit stratification. This change marks a structural transition, necessitating the implementation of specific weighting techniques that allow for historical comparisons with earlier editions.

3.2. Sampling Weights

The sampling weight is a critical coefficient assigned to each interviewed household, allowing for unbiased estimates of the phenomena of interest. This weight is determined through a multi-step process:

1. An initial weight is calculated as the inverse of the selection probability (design weight).

2. The design weight is then adjusted to address unit nonresponse by multiplying it by the inverse of the response rate for the respective municipality.

3. Finally, the weight is calibrated to incorporate additional social and demographic data sourced from the Italian National Institute of Statistics (ISTAT). This data comprises population distribution information, including gender, age group, geographical region, and the size of the municipality of residence.

Starting from the 2020 survey, there was a revision in the construction of sampling weights to account for the inclusion of household stratification in the second stage of the survey design. This entailed stratifying non-panel households into ten household income groups within each geographical macro-area (North-East, North-West, Centre, South, and Islands) to enhance sample representativeness across the income distribution.

Additionally, to enhance the survey's suitability for the study of financial vulnerability, a segment of indebted households was incorporated into the selected sample. This segment was stratified based on five debt size categories for each type of debt.

3.3. The variables

According to the existing literature and the objective of this study the variables considered for the multivariate analysis include:

- Response variables:

    1) The use of online banking is represented by the variable 'COLDIS,' which is a binary variable. It takes the value 1 if the reference person of the household answered "yes" to the question: "Did you or a member of the household do business with banks or financial intermediaries by telephone or computer in the last calendar year (home banking, online account...)?" This variable serves as a proxy for online banking usage in the analysis.

    2) In the linear regression analysis, the asset allocation of households is aggregated

into various categories to assess its relationship with the use of online banking. The allocation of asset, given the amount of each form savings reported by the household, is categorized as follows:

i. Liquidity: Includes bank and postal deposits.
ii. Short-Term Assets: Encompasses certificate of deposits and repos.
iii. Short-Term Government Bonds: Comprises BOTs, CTZs, and other short-term government bonds (such as CTEs and CTPs).
iv. Long-Term Government Bonds: Includes BTPs, CCTs, inflation indexed BTPs, and buoni fruttiferi postali.
v. Corporate Bonds: encompasses bonds issued by Italian firms and banks, as well as funds or ETFs in bonds.
vi. Funds and ETFs: Includes funds or ETFs in money market or liquidity, balanced funds or ETFs, funds or ETFs in equities, and funds or ETFs in foreign currencies.
vii. Stocks and Equity: Comprises shares of listed companies, shares of unlisted companies, shares in companies limited by shares (Srl), shares of partnerships, and other forms of equity holdings.
viii. Other Financial Assets: Encompasses various financial instruments like options, futures, royalties, PO savings certificates, and managed savings.
ix. Foreign Assets: Includes foreign government securities, foreign bonds, foreign shares and equities, and other foreign securities.
x. Real Assets: for simplicity only real estate assets were considered, excluding participations in business equity and valuables.

These asset categories are used to study how the allocation of household assets correlates with the use of online banking.

- Predictor variables

3) Sex: dummy variable who value is equal to one if the reference person of household is male and zero for female.

4) Age and Age squared: the latter for taking into account possible hump-shape effect. The age refers to the reference person of the family.

5) Education: categorical variables with values ranging from 0 to 8, with "none education" as the reference category. The highest level of education corresponds to a postgraduate qualification.

6) Household size: an ordinal variable with "at max 4 components" as the highest value considered.

7) Marital status: categorical variables with the reference category "married status." The other category corresponds to "single," "divorced," and "widow/er."

8) Net wealth: It includes the sum for each family of real assets and financial assets, from which financial liabilities are subtracted. Net wealth is considered at the family level, not the individual reference person, since anyone in the family can use online banking, and the entire family can benefit from it.

9) Net disposable income: This represents the sum of a household's consumption and savings.

10) Expenses monthly: this variable is derived from the response to the question, "How much cash do you usually spend per month?" and is provided by the single reference person in the household.

11) Number of bank accounts: the highest value corresponds to 4 or more bank accounts opened by the same household.

12) Employment status: there are 21 categories associated with this variable. These can be grouped into three main categories: employee, self-employed, and not employed.

13) Geographical area: in the data provided by the Bank of Italy, there are two variables related to the geographical area where the interviewed family currently resides, 'area3' and 'area5'. In this study, the first variable has been considered, which assigns the value 1 if the family lives in the North, 2 if they live in the Centre, and 3 if they live in the South and Islands.

14) Town size: this variable corresponds to the demographic size of the municipality. The first range is up to 20,000 inhabitants, the second is between 20,000 and 40,000, the third is between 40,000 and 500,000, and the last one is for municipalities with over 500,000 inhabitants.

15) Risk aversion: an ordinal variable that assigns a value of 1 if the reference person

of the household has a very high risk tolerance, up to a value of 3 if the risk aversion is very high. In detail, the question presented in the survey is: "In managing financial investments, do you consider yourself more oriented towards investments that offer the possibility of...". With the following 4 response options:
- Very high gains, even with a high risk of losing part of the capital.
- Good gains, but at the same time, a moderate degree of capital security.
- Moderate gains, but at the same time, a good degree of capital security.
- Low gains, with no risk of losing the capital.

Regarding the second and third questions, for simplicity, a medium-risk level was assigned if the reference person answered 'yes' to one of the two questions.

16) Financial knowledge: Dummy variables that assign a value of 1 if the reference person answered all 3 financial knowledge questions correctly, and 0 if they answered one or more questions incorrectly.
Specifically, the questions are as follows:

-Imagine that you leave 100 euros in a current account that earns an annual interest rate of 2% and has no fees. After 5 years, how much do you imagine will be available?
-Suppose you leave 1,000 euros in a current account that earns an interest rate of 1% and has no management fees. Also, assume that inflation is 2%. Do you believe that, in one year, when you withdraw the money, you will be able to buy the same amount of goods that you could buy by spending the 1,000 euros today?
-In your opinion, does buying shares of a single company usually provide a safer return than buying shares of multiple companies through a mutual fund? This approach to assessing the financial knowledge of households was inspired by Michelangeli and Viviano (2021).

3.4. Correlation Matrix

To explore potential linear associations between the dependent and independent variables, a correlation matrix was created before estimating the models.
Another valuable aspect of the correlation matrix is its initial utility in ruling out the presence of multicollinearity issues in the models. Except for the high correlation between the two age-related variables, which is inherently expected, no other correlation values indicate potential multicollinearity problems among the independent variables.
The most correlated variables with the dependent variable 'online banking' are Education and Financial knowledge both positively as one could expect.
Surprisingly, Net Wealth has a very low correlation coefficient, precisely $\rho=0.106$. On the other

hand, considering various financial assets as dependent variables, all predictor variables exhibit lower correlation coefficients, except for net disposable income and net wealth with stocks and other financial assets, which have a ρ slightly above 0.19. The remaining variables have a coefficient lower than 0.10. This discrepancy is attributed to the likely lower accuracy of the linear regression model compared to the logistic model.

	onlineбy	age	age2	Educatбn	householбe	Relatiбs	Net_weбh	NetDisбe	Expensбy	numberбt	employбs	geograбa	Townsize	pct_Cash	pct_Sбts	pct_Sбds	pct_loбs	pct_Coбs	pct_Fuбs	pct_Stбy	pct_Otбs	pct_Foбs	pct_Reбe	Risk_aбn	Financбe
onlinebankбy	1.0000																								
age	-0.3750	1.0000																							
age2	-0.3916	0.9897	1.0000																						
Education	0.5031	-0.3091	-0.3199	1.0000																					
householdбe	0.2493	-0.4099	-0.4253	0.1553	1.0000																				
Relationalбs	-0.2241	0.1804	0.2174	-0.2009	-0.5093	1.0000																			
Net_wealth	0.1060	0.0221	0.0148	0.1259	0.0278	-0.0541	1.0000																		
NetDisposабe	0.2794	-0.0417	-0.0572	0.3498	0.1767	-0.1885	0.6350	1.0000																	
Expensesmбy	-0.0191	0.1071	0.1008	0.0950	0.1153	-0.1189	0.2372	0.2845	1.0000																
numberofbaбt	0.3765	-0.1725	-0.1877	0.3223	0.3671	-0.2134	0.2381	0.3903	0.1261	1.0000															
employmentбs	-0.1013	0.4780	0.4778	-0.0151	-0.2138	0.0757	0.1002	0.1267	0.0885	0.0061	1.0000														
geographicбa	-0.1922	0.0066	0.0080	-0.0954	0.0347	0.0033	-0.0382	-0.0853	0.0608	-0.1790	0.0096	1.0000													
Townsize	0.1634	-0.0875	-0.0840	0.3020	0.0244	-0.0482	0.0612	0.1799	0.0736	0.0503	-0.0116	-0.0108	1.0000												
pct_Cash	-0.1025	-0.0394	-0.0265	-0.1486	-0.0736	0.1193	-0.0504	-0.1109	-0.0364	-0.1007	-0.1035	0.0042	0.0003	1.0000											
pct_Shortбts	-0.0047	0.0060	0.0047	-0.0025	-0.0261	0.0020	-0.0123	-0.0199	-0.0088	0.0064	-0.0206	-0.0117	-0.0203	0.0058	1.0000										
pct_Shortбds	-0.0187	0.0741	0.0761	-0.0029	-0.0484	0.0099	-0.0006	0.0013	0.0353	-0.0089	0.0424	-0.0212	-0.0273	-0.0258	-0.0036	1.0000									
pct_long_tбs	0.0475	0.0414	0.0383	0.0461	-0.0161	-0.0253	0.0278	0.0404	0.0185	0.0285	0.0371	-0.0393	0.0093	-0.0416	-0.0044	0.0574	1.0000								
pct_Corporбs	0.0825	0.0364	0.0311	0.0670	-0.0254	-0.0236	0.0867	0.0940	-0.0047	0.0263	0.0441	-0.0322	-0.0047	-0.0583	0.0054	0.0679	0.0616	1.0000							
pct_Funds_бs	0.1284	0.0040	-0.0001	0.1107	-0.0169	-0.0368	0.0415	0.0894	0.0069	0.0971	0.0472	-0.0659	0.0138	-0.0651	-0.0133	-0.0153	0.0282	0.0898	1.0000						
pct_Stocksбy	0.1083	-0.0061	-0.0065	0.1313	0.0073	-0.0371	0.1979	0.2215	0.0706	0.1121	0.0425	-0.0503	0.0519	-0.0391	-0.0136	0.0483	0.0365	0.1524	0.0997	1.0000					
pct_Other_бs	0.1255	0.0489	0.0429	0.1433	-0.0239	-0.0305	0.2394	0.2441	0.0965	0.1409	0.0491	-0.0640	0.0566	-0.0689	-0.0170	0.0070	0.0380	0.0694	0.0595	0.0948	1.0000				
pct_Foreigбs	0.0467	-0.0103	-0.0125	0.0651	0.0130	-0.0167	0.0921	0.1104	0.0250	0.0574	0.0167	-0.0214	0.0190	-0.0109	-0.0060	-0.0049	0.0270	0.0478	0.0773	0.0989	0.0445	1.0000			
pct_RealEsбe	0.0169	0.0096	0.0006	0.0560	0.0896	-0.0900	-0.0548	-0.0132	-0.0028	0.0226	0.0605	0.0413	-0.0179	-0.9001	-0.0995	-0.1116	-0.0690	-0.1326	-0.1759	-0.1508	-0.1989	-0.0946	1.0000		
Risk_aversбn	-0.1414	0.1256	0.1296	-0.2000	-0.0756	0.1057	-0.0998	-0.1445	-0.0853	-0.1184	-0.0184	0.0241	-0.1307	0.0806	0.0377	-0.0060	-0.0375	-0.0531	-0.0973	-0.1411	-0.0976	-0.0384	-0.0101	1.0000	
FinancialKбe	0.3072	-0.0940	-0.1047	0.2930	0.0623	-0.1096	0.0978	0.1986	0.0333	0.2147	0.0126	-0.1087	0.0895	-0.1216	0.0188	-0.0168	0.0574	0.0496	0.1232	0.0969	0.1265	0.0295	0.0387	0.0016	1.0000

Figure 3.1. Correlation matrix

4. Descriptive analysis

In this chapter, a descriptive statistic is performed on the dependent and independent variables among the six consecutive surveys of Bank of Italy spanning from 2008 to 2020.

4.1. Response variables

The table 4.1 shows a rising trend in the adoption of online banking, with the most recent survey 2020 indicating that the percentage has more than doubled. This marks the first instance where a greater number of households use online banking as opposed to not using it.

Use of online banking	2008	2010	2012	2014	2016	2020
Yes	13,76%	15,42%	17,09%	24,34%	25,81%	54,02%
NO	86,24%	84,58%	82,91%	75,66%	74,19%	45,98%

Table 4.1. Online banking users

The table 4.2 presents the mean and standard deviation of the asset allocation within the Italian samples from 2008 to 2020. To simplify matters, the components of household portfolio have been categorized into three main segments: liquidity, financial assets, and real assets.

So, concerning the second response variable of interest, asset allocation, amidst numerous factors, two significant events emerge.
First, the sharp decline in the percentage of financial assets in italian householdìs portfolios, decreasing from 9% to 4,5%, which is a 50% reduction. This phenomenon appears to be explained by the italian sovereign debt crisis of 2011-2012. The crisis erupted in Italy following various simultaneous events, such as the 2008 american financial crisis and the Berlusconi government crisis, which pushed the spread to a peak of 575 points on November 9,2011.
BOT interest rate were rising and rating agencies were downgrading Italy's credit score, causing people to become apprehensive about investing in Italy.
In fact, the category of financial assets that experienced the most significant reduction was italian bonds and stocks.

The second occurrence is the growth of financial assets at the expense of lower liquidity in italian

portfolios from 2016 to 2020. This event is correlated, as demonstrated in the chapter 5, with the substantial increase in online banking as a means of investment.
The percentage of real assets is almost the same in all surveys rappresenting the most significant component of italian's portfolio allocation, accounting for approximately 75% of their wealth.

Asset allocation		2008	2010	2012	2014	2016	2020
%Liquidity	Mean	18,25%	17,37%	19,68%	21,10%	23,14%	19,44%
	Standard Deviation	33,94%	33,07%	34,81%	35,34%	36,79%	31,67%
%Financial assets	Mean	8,10%	8,79%	4,75%	5,64%	4,68%	6,23%
	Standard Deviation	19,75%	20,47%	12,99%	14,9%	13,19%	14,66%
%Real assets	Mean	73,65%	73,84%	75,57%	73,25%	72,21%	74,31%
	Standard Deviation	37,86%	37,40%	36,36%	37,19%	37,74%	33,46%

Table 4.2 Mean and standard deviation of the 3 main assets

To obtain confirmation of the correlation between online banking and stock market participation, an additional macro-level analysis was conducted on the composition of financial assets (table 4.3). Specifically, for the sake of simplicity, only bonds and stocks were taken into consideration, with options, futures, certificate of deposits, and royalties excluded from the analysis.
Within the bond category, there were considered short and long-term government bonds, corporate bonds, and foreign Bonds. As stocks also funds and ETFs were deemed, in addition to Italian stocks, equity participation, and foreign stocks.

The percentage of bonds dominates from 2008 to 2016, accounting for approximately 75% of households' financial portfolios. This data reflects a low risk aversion, prevalent in almost all surveys.

From 2014 onwards, the decline in the yield of 10-year BTPs, reaching levels of 1% from 2016 to 2020 prior to the COVID-19 crisis, contributed to making bonds less attractive to Italian households, leading them to shift towards riskier stocks.

In 2020, once again coupled with an increase in the adoption of online banking, a reversal in the average aggregate portfolio composition occurred for the first time, with stocks accounting for approximately 60% of households' financial wealth.

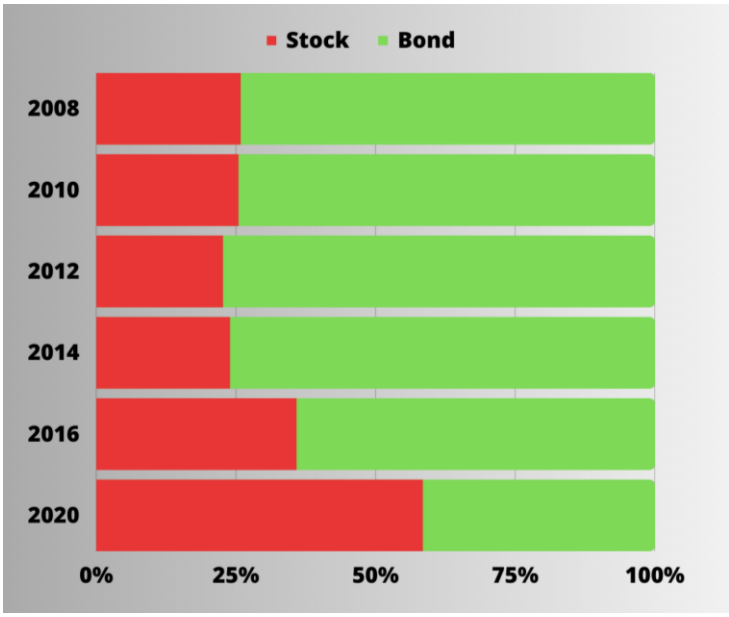


Table 4.3. Composition percentage of Stocks and Bonds

4.2. Stockholding puzzle

The "stockholding puzzle" is the phenomenon according to which households do not invest in risky financial assets.
Household-level data show a tendency of the majority of households in each developed country to hold no stocks despite a historical expected-return premium on equity relative to riskless assets.

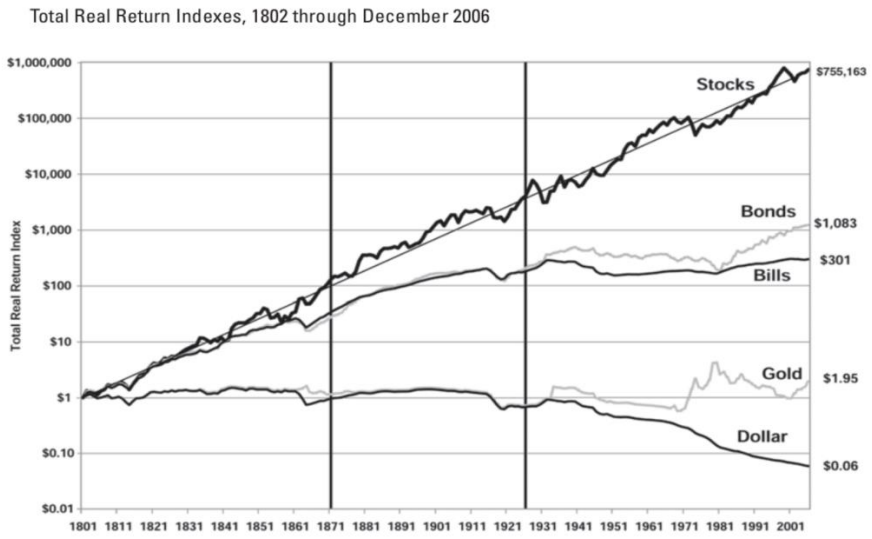


Table 4.4 Returns of indexes over the past 200 years

As shown in table 4.4, investing 1 dollar in stocks in 1801, assuming they represent a hypothetical all-world index for each period, would have yielded more than 750,000 dollars in 2006. So, why do people prefer long-term investments in financial instruments like bonds or commodities that historically have always yielded lower returns? Certainly, we cannot predict the future of markets, so we don't know if the stock market will continue to provide these returns for the next 30 years. However, based on historical returns, we can confidently say that, in terms of maximizing expected returns, investing in stocks is advantageous.

Basically, the existing literature answered this question with three answers: transaction costs, non-standard preferences and beliefs.
Households are presumed to make decisions regarding access to stocks by weighing the costs against their well-being, considering expected lifetime utilities under both scenarios. One option involves gaining access to stocks but incurring associated costs, while the alternative avoids costs but limits access to riskless assets (Haliassos and Bertaut 1995)
Transactions cost, as already mentioned it, could be administrative charges to set up an investment account, information costs, opportunity cost of time, fixed exist costs.
Nevertheless, it is feasible to calculate the minimum level of entry costs necessary to dissuade a household with specific characteristics from participating in the stock market (Haliassos and Michaelides, 1999). Current computational and econometric studies on this matter suggest that such threshold entry costs are generally quite modest.

The underlying rationale for why marginal investors might be deterred by small costs from entering the stock market is that, even if these potential investors were to enter, their planned investment in stocks would be minimal. With limited planned stock investment, the benefits of entry are relatively insignificant, and small entry costs can act as a deterrent to stock market participation.

While risk aversion, income uncertainty, and financial constraints in borrowing cannot individually

account for the prevalence of zero stockholding, they collectively contribute to diminishing the extent of stockholding a household would engage in if it had access to the stock market. Consequently, they also play a role in lowering the threshold entry costs required to discourage households from participating in the stock market.

Overall, this yields to the fact that participation costs are consistent with the positive correlation between participation and wealth as demonstrated by Guiso and Sodini 2013.
The purpose of this research is precisely to understand how the proliferation of online banking, by reducing fixed participation costs, has contributed to diminishing the latter correlation.
The other determinants, non-standard preferences and beliefs are less considered in this study even if they explain a significant portion of the participation puzzle.

Looking at our data, it is evident how this reluctance to not participate in the stock market is also present in Italy. Until 2016, less than 10% of the surveyed sample owned at least one stock in their portfolio. Looking at 2020, the latest available survey, a progressive increase in stockholders is already noticeable, reaching approximately 20% of the sample (table 4.5). As mentioned earlier, most of the sample uses online banking in 2020, and this could already provide an initial conclusion on the impact of digitalization. However, before delving into a detailed analysis of this relationship, let's introduce the socio-demographic characteristics of the analyzed samples.

Stockholding	2008	2010	2012	2014	2016	2020
YES	9,37%	9,76%	7,92%	8,46%	7,78%	18,95%
NO	90,63%	90,24%	92,08%	91,54%	92,22%	81,05%

Table 4.5 Overall percentage of shareholders

4.3. Explanatory variables

This paragraph presents the trend over time of explanatory variables related to the adoption of online banking. Further comparisons are made between independent variables and the respective asset allocation associated for all the six surveys.

These findings provide an initial descriptive insight into how the use of online banking impacts household asset allocation through the analysis of socio-demographic characteristics.
For abbreviations, the terms ‘user’ and ‘not user’ refer to the families that use or do not use online banking.

4.3.1. Age

Table 4.6 shows the mean age of the reference person. It can be observed an increasing trend of the explanatory variable and that the users of online banking are always younger than those who do not use it.

Age	2008	2010	2012	2014	2016	2020
User	49,8	50,6	48,2	52,9	54,1	57,3
Not user	59,6	59,8	48,6	63,4	64,9	67,5

Table 4.6 Average age of household reference person

Now, looking at table 4.7, in general, both users and not user fall within the same age range 46-65, making it challenging to draw a direct comparison.
However, focusing on the 2020 survey where not user have an average age of 67.5 years, it becomes evident that they tend to have slightly more wealth invested in financial assets and less in real assets compared to users.

Turning our attention to age ranges, a positive relationship between age and financial assets becomes apparent, except in the first two surveys.
The same pattern holds true for real assets, while younger individuals tend to have higher liquidity in their portfolios.

More in general, the analysis reveals that younger generations, aged 18-30, exhibited greater volatility in their financial decisions, with significant fluctuations in liquid reserves and a consistent decline in financial assets, although a return to real asset allocation was evident by 2020. In contrast, the more mature age groups, between 31 and 65, displayed a greater stability in their preference for real assets, while the elderly, aged 65 and above, maintained a very low liquidity percentage.

Age		2008	2010	2012	2014	2016	2020
18-30	Liquidity	45,43%	37,48%	19,95%	54,29%	61,38%	32,81%
	Financial assets	8,98%	11,85%	4,83%	4,26%	0,33%	4,48%
	Real assets	45,58%	50,67%	75,21%	41,45%	38,28%	62,70%
31-45	Liquidity	27,33%	26,75%	19,87%	31,61%	39,52%	25,35%
	Financial assets	8,20%	8,23%	4,55%	4,47%	3,40%	3,50%
	Real assets	64,46%	65,01%	75,58%	63,93%	57,08%	71,15%
46-65	Liquidity	16,24%	15,24%	19,26%	18,75%	20,66%	17,47%
	Financial assets	7,47%	7,95%	4,93%	5,63%	4,57%	6,22%
	Real assets	76,28%	76,23%	75,80%	75,62%	74,73%	76,30%
65+	Liquidity	13,09%	13,18%	19,69%	17,96%	18,97%	19,25%
	Financial assets	8,67%	9,83%	4,82%	6,23%	5,33%	7,06%
	Real assets	78,22%	76,99%	75,49%	75,80%	75,80%	73,68%

Table 4.7 Asset allocation by age range

4.3.2. Gender

For reasons of space only the male portion was considered in the computation of user and not user of online baking.
Males are overwhelmingly the predominant users of online banking, accounting for more than 2 out of 3 users (table 4.8). In fact, they typically possess more financial assets and less liquidity compared to females (table 4.9).
However, this percentage gradually declined over the years, reaching a low point of 62.42% in 2014, followed by a moderate rebound to 69.82% in 2020. In contrast, male non-users started at 59.79% in 2008 and steadily decreased. The lowest figure, 48.57%, was recorded in 2014, with a subsequent modest increase to 57.51% in 2020. These observations underscore a persistent gender divide in online banking adoption, with males remaining the majority, albeit with notable fluctuations in usage trends.

Sex (male)	2008	2010	2012	2014	2016	2020
User	74,77%	64,44%	66,62%	62,42%	61,93%	69,82%
Not user	59,79%	52,71%	52,22%	48,57%	48,98%	57,51%

Table 4.8 percentage male user and not user

The data in the table shed light on how individuals of different genders allocated their assets. What stands out is that both men and women favored real assets, though the percentages slightly varied. Men consistently allocated between 73.44% and 76.45% to real assets, and their liquidity allocation remained relatively stable, peaking at 21.55% in 2016. Notably, their allocation to financial assets fluctuated, dipping from 7.78% in 2008 to 4.99% in 2016 but rebounding to 7.35% in 2020. On the other hand, women exhibited a similar preference for real assets, with allocation percentages between 70.69% and 74.46%. Their liquidity allocation remained steady, reaching a high of 24.93% in 2016. Unlike men, women allocated lower wealth to financial assets, with levels ranging from 3.93% in 2012 to 9.42% in 2010, eventually falling to 4.19% in 2020.

Sex		2008	2010	2012	2014	2016	2020
Male	Liquidity	17,20%	16,05%	18,13%	19,75%	21,55%	17,95%
	Financial assets	7,78%	8,28%	5,41%	5,98%	4,99%	7,35%
	Real assets	75,00%	75,66%	76,45%	74,26%	73,44%	74,70%
Female	Liquidity	20,00%	19,02%	21,62%	22,61%	24.93%	22,19%
	Financial assets	8,62%	9,42%	3,93%	5,26%	4,34%	4,19%
	Real assets	71,36%	71,55%	74,46%	72,11%	70,69%	73,62%

Table 4.9 Asset allocation by gender

4.3.3. Education

Regarding the education level of the reference person in the family, it's analyzed the percentages of individuals with educational qualifications equivalent to a high school diploma or a degree.
It can be observed that individuals with higher levels of education tend to use technology much more than those who have not completed their studies (table 4.10).
This results in a riskier asset allocation, with the percentage of financial assets surpassing 10% in many years for those with a master's degree or post-graduate qualification (table 4.11).

Education (>diploma)	2008	2010	2012	2014	2016	2020
User	72,95%	72,68%	73,80%	72,24%	68,30%	80,18%
Not user	27,00%	30,77%	31,02%	26,61%	25,56%	32,87%

Table 4.10 Percentage of user and not user with education higher than high school diploma

Education		2008	2010	2012	2014	2016	2020
None	Liquidity	11,26%	9,19%	22,60%	21,42%	28,51%	38,42%
	Financial assets	11,89%	15,93%	2,30%	1,07%	2,46%	1,23%
	Real assets	76,84%	74,86%	75,09%	77,50%	69,03%	60,35%
Primary school	Liquidity	15,88%	15,96%	20,20%	21,73%	22,40%	25,28%
	Financial assets	7,29%	8,58%	3,23%	5,13%	3,84%	2,63%
	Real assets	76,82%	75,57%	76,58%	73,13%	73,75%	72,08%
Lower secondary	Liquidity	22,23%	20,35%	22,36%	23,24%	25,20%	24,56%
	Financial assets	7,29%	7,96%	3,83%	4,67%	3,43%	3,64%
	Real assets	70,48%	71,69%	73,82%	72,07%	71,37%	71,79%
Vocational secondary	Liquidity	24,40%	23,33%	23,40%	25,01%	27,70%	21,05%
	Financial assets	7,55%	7,02%	4,62%	4,39%	5,45%	4,79%
	Real assets	68,03%	69,65%	71,97%	70,59%	66,85%	74,15%
Upper secondary school	Liquidity	16,93%	16,45%	17,05%	19,09%	21,09%	17,24%
	Financial assets	8,43%	8,46%	5,94%	6,59%	5,45%	6,17%
	Real assets	74,65%	75,09%	77,01%	74,31%	73,40%	76,58%
Bachelor's degree	Liquidity	19,49%	17,46%	25,82%	31,11%	30,41%	24,90%
	Financial assets	11,04%	9,29%	3,78%	4,85%	5,37%	5,86%
	Real assets	69,47%	73,25%	70,39%	64,03%	64,21%	69,34%
Master's degree	Liquidity	15,18%	14,82%	15,14%	15,72%	18,74%	13,74%
	Financial assets	10,23%	10,42%	8,24%	9,11%	7,73%	10,59%
	Real assets	74,58%	74,77%	76,61%	75,16%	73,52%	75,67%
Postgraduate qualification	Liquidity	12,85%	13,31%	14,40%	15,81%	16,81%	13,05%
	Financial assets	9,63%	11,89%	5,31%	8,03%	8,41%	9,97%
	Real assets	77,52%	74,79%	80,28%	76,15%	74,77%	76,98%

Table 4.11 Asset allocation by education levels

4.3.4. Household size

The number of household members seems to be related to the probability of using online banking for almost all years. The higher participation associated with household having more than 3 components is linked with the age; in fact, the average age of the reference person using internet banking falls within the 46-65 range, indicating a higher likelihood that they have children.
Conversely, if the probability of using online banking is correlated with having a higher percentage of wealth allocated to financial assets, this does not appear to be deducible from the aggregate survey data. In fact, as household size increases, families seem to lean towards having real estate of higher value rather than investing in financial assets.

For a clearer and more concise view of the extrapolated results, please refer to appendix 1 for the visualization of tables with precise percentages.

4.3.5. Relational status

The percentages of users are nearly similar among married, single, separated, or divorced individuals (table 4.13). There is no distinct category that stands out significantly among users. This, in turn, results in a very similar asset allocation across the various categories (table 4.14), except for some outliers in 2008 and 2010, as explained in section 4.1.
It can be concluded, therefore, that relational status variables do not appear to have a substantial influence on the final portfolio allocation.

4.3.6. Net disposable income

The table 4.15 displays the average annual net disposable income of users and non-users. It is evident that users have a significantly higher income compared to non-users, and this difference has consistently grown from 2008 onwards until 2020.
In 2020, online banking users had an average income of 80.000 euros while non-users have an income of 30.000 euros.

Comparing this with table 4.16, it is evident that users, being in the higher income bracket, have a higher percentage of financial assets compared to non-users.
Therefore, there is a positive relationship between net disposable income and financial assets, at the expense of lower liquidity in their portfolios.

4.3.7. Net wealth

Now, let's take a look at the evolution of household' net worth over the last 15 years (table 4.17).
In all the years, there has consistently been a significant gap between the net wealth of users and non-users. Indeed, the net wealth of users is approximately twice that of non-users until 2016.
In 2020, however, the ratio is 4:1, still in favor of users. In the computation, households with negative net worth were also take into account.
So, examining the link between net worth and asset allocation (table 4.18), in recent years, households with a net worth exceeding 250.000 euros have the highest percentage invested in financial assets.
However, in 2008 and 2010, this data does not seem to be confirmed, as households with a net worth below 100.000 euros have the highest percentage.

4.3.7. Monthly expenses

Users tend to spend more on a monthly basis compared to non-users (table 4.19). Among users, expenses began at €1,737 in 2008, steadily rising to €1,868 in 2012 before experiencing a notable decline in 2014 (€1,688) and a significant drop in 2016 (€1,515). In contrast, non-users consistently reported lower average expenses, starting at €1,174 in 2008 and increasing slightly to €1,219 in 2010, followed by a decrease in 2012 (€1,184) and 2014 (€1,089). The most remarkable drop occurred in 2016, when expenses hit €962.

In 2020, however , user on average start to spend less than not user and expenses significantly decreased for both categories due to the pandemic COVID-19.

In general, users, who spend more apart from the last survey 2020, indeed fall into the category of households with the highest investment in financial assets compared to others (table 4.20). This data is connected to the net wealth and net disposable income.

4.3.8. Number of bank account

The percentage of users increases with the number of bank accounts held by the family, consistently exceeding 60% when there are at least three bank accounts opened (table 4.21). This data, in line with most of the preceding explanatory variables, is reflected in the user's asset allocation with a significant portion of their liquidity invested in financial assets. Table 4.22 shows that this positive relationship between financial assets and the number of bank accounts is present in all years.

4.3.9. Geographical area

The table 4.23 reveals a consistent trend where most users are located in the northern regions of Italy. Furthermore, upon closer examination of average asset allocation, it becomes evident that individuals who are more frequent users of online banking and reside in northern regions tend to allocate a larger proportion of their portfolios to financial assets. In terms of the detailed breakdown of the average allocation, it typically aligns around the ratio of 20% in liquidity, 10% in financial assets, and 70% in real assets, respectively. Additionally, a notable observation is that residents in the northern regions also exhibit the lowest valuation of real assets. This can be attributed to a significant population of students and workers hailing from southern regions who, in many cases, opt for rental accommodation and do not own property.

4.3.10. Town size

Generally, the highest proportion of users tends to be located in cities with a population of at least 500,000, and this proportion increases with the size of the population. In the case of the year 2020, where there was a significant surge in the percentage of users compared to previous years, it appears that there exists a positive relationship between the adoption of online banking and financial investments, as evident from the data presented in the table. In contrast, in preceding years, this correlation does not seem to hold true. In fact, individuals residing in smaller cities tend to allocate a larger portion of their savings to financial investments.

4.3.11. Risk attitude

Individuals exhibiting a greater risk tolerance, implying their willingness to embrace risk in pursuit of the equity premium, tend to display a heightened likelihood of adopting online banking services (table 4.27). This digital tool encourages them to allocate considerably larger portions of their wealth into financial markets, in stark contrast to those individuals who exhibit a preference for lower or minimal risk in preserving their capital. Prevailing literature underscores that a broader inclination toward risk propensity, when applied within the financial context, often translates into higher investments in financial assets, particularly in equities rather than bonds. Users typically fall within this category, where online banking emerges as a vehicle enabling more substantial investments in financial markets, in exchange for a reduced allocation of liquid assets within their current accounts (table 4.28)

4.3.12. Financial Knowledge

The last explanatory variable, financial knowledge, once again strengthens the positive association between online banking utilization and financial investments (table 4.29). This phenomenon arises from the fact that individuals with a solid understanding of financial matters tend to employ online banking services more extensively than those who did not provide correct answers to the three survey questions. Additionally, individuals with better financial knowledge tend to hold a higher proportion of financial assets in their portfolios compared to their less knowledgeable counterparts (table 4.30).

4.4. First time adoption online banking: panel data

In this section, the goal is to evaluate the impact of adopting online banking for the first time and how it changes the portfolios of italians on average. To this end, a panel household dataset of 2,986 families between the 2016 and 2020 surveys was considered. Of these, only 485 reported not having used online banking in 2016 but started using it in 2020. For these families, portfolio allocations were calculated, considering all types of securities among financial assets, as mentioned earlier, ranging from short-term government bonds to foreign assets. Once the percentages were calculated, the changes they underwent in these four years were examined, and the results are shown in the following table 4.31:

Mean Allocation	Liquidity	Short term assets	Short term gov bonds	Long term gov bonds	Corporate bonds
2016	23,38%	0,50%	0,46%	0,51%	0,01%
2020	25,45%	0,63%	0,69%	0,60%	0,73%
Avarage difference	8,1%	20,5%	32,6%	15,4%	16,9%

Funds and ETFs	Stocks and Equity	Other financial assets	Foreign assets	Real Estate
0,71%	0,18%	0,001%	0,01%	71,83%
1,57%	0,38%	0,002%	0,02%	68,13%
54,5%	52,5%	41,9%	35,0%	-5,4%

Table 4.31 Percentage changes of asset allocation between 2016 and 2020.

On average, it can be observed that all assets increased in percentages, except for real estate, which decreased by approximately 5%. These data are not perfectly accurate, as some families did not respond precisely about the amount of their assets, leaving the cell empty, while others provided only an approximate value of their portfolio.

However, this initial aggregated analysis can lead to a preliminary conclusion that, on average, the assets that increased the most in the portfolio are stocks and equity and funds and ETFs, which are the two riskiest assets. This might indicate that those who start using online banking for the first time tend to increase their risk tolerance by increasing their exposure to the stock market.

In the next chapter, through a multivariate analysis, we will test whether these initial hypotheses can be statistically validated or if they could be considered mere biases resulting from the sample used.

5. Multivariate analysis

In all models, a significance threshold of p-value less than or equal to 0.05 is applied, indicating statistical significance at the 95% confidence level.

5.1. Model and hypothesis

The main purpose of this study is to investigate the impact of digitalization on asset allocation of household, especially if this increases the exposure to risky assets.

In this research, three hypotheses have been developed, which have been drawn from existing literature and relevant empirical models. The central objective is to investigate the relationships between key variables and how they influence the financial allocation of households.

The first hypothesis (H1) posits that a higher level of financial knowledge can help resolve the "stockholding puzzle" often observed among households. This hypothesis is rooted in the body of literature that consistently emphasizes the positive link between financial knowledge and the propensity of individuals to invest in stocks.

H1: Financial knowledge solves stockholding puzzle.

Moving to the second hypothesis (H2), it suggests that the utilization of online banking services can lead to an increased risk tolerance among households, although this effect might not be as pronounced when considering individual stocks. The core assumption here is that the practically negligible costs for opening an online account, as mentioned in paragraph 1, along with the entry and exit transaction costs for many financial instruments, can lead less knowledgeable individuals to purchase securities with higher expected returns but also higher volatility.

H2: Online banking increase risk tolerance among households

The third hypothesis (H3) posits that the use of online banking services can result in an overall increase in investments in risky financial assets. This hypothesis aligns as combinations of the previous two and with the notion that the convenience and accessibility of online services may encourage households to explore a broader array of investment options.

Furthermore, as shown in Chetty et al. (2017) when solving the Euler equation to find the optimal share of risky assets in a household's portfolio that maximizes a logarithmic utility function that uses online banking, even if other variables such as mortgage debt (M_0) and labor income (Y_1) are considered, which are included also here for completeness, it is demonstrated the negative relationship between asset reallocation cost and the share of risky assets, as seen from the equation.

$$\alpha = \frac{\mu_r - r_f + \frac{{\sigma^2}_r}{2}}{\frac{(1+R_f)L_0}{(1+R_f)L_0 + (1-\delta)Y_1 - (1+R_m)M_0}{\sigma^2}_r\gamma}$$

This implies that with the use of online banking, a lower cost of household asset reallocation leads to a higher share of risky assets out of the total financial assets. The basic idea is that a decrease in the cost of household asset reallocation increases the total value of assets in the next period. Therefore, the household increase α if want to keep the ratio of share of risky assets to the total financial assets constant overtime.

H3: Online banking increase investment in risky financial assets.

The ultimate aim of the study is to investigate how these factors—financial knowledge, risk attitude, and the use of online banking services—interact and contribute to the financial resource allocation decisions made by households. Empirical analysis will be conducted using data from surveys conducted by the Bank of Italy, allowing to validate these hypotheses and gain insights into their implications for household financial management.

5.2. Logistic regression: who are online banking users

The first regression model created analyse the choice of household to use online banking for financial decisions. The model use is a logistic one because the dependent variable is binary (user and not user) while the independent variables can be binary or continuous variables.
The logistic function $\sigma(t)$ is a sigmoid function that takes any real input t and outputs value between zero and one.

$$\sigma(t) = \frac{1}{1+e^{-t}}$$

	(1) Online Banking	(2) Online Banking	(3) Online Banking	(4) Online Banking	(5) Online Banking
Sex	0.319***	0.116	0.132	0.111	0.0679
	(0.0696)	(0.0743)	(0.0754)	(0.0772)	(0.0784)
Age	0.104***	0.0777***	0.0819***	0.0851***	0.0825***
	(0.0162)	(0.0174)	(0.0176)	(0.0181)	(0.0183)
Age^2	-0.00121***	-0.00108***	-0.00113***	-0.00119***	-0.00116***
	(0.000137)	(0.000147)	(0.000149)	(0.000153)	(0.000155)
Education	0.624***	0.435***	0.434***	0.411***	0.386***
	(0.0198)	(0.0230)	(0.0236)	(0.0242)	(0.0245)
Household size	0.138***	-0.0649	-0.0157	0.0137	0.0360
	(0.0322)	(0.0366)	(0.0374)	(0.0385)	(0.0389)
Relational status	-0.117**	-0.0992**	-0.102**	-0.101*	-0.0975*
	(0.0359)	(0.0385)	(0.0390)	(0.0399)	(0.0404)
Net wealth		-5.85e-08*	-5.39e-08*	-6.36e-08**	-6.80e-08***
		(2.54e-08)	(2.48e-08)	(1.96e-08)	(1.82e-08)
Net disposable income		0.0000160***	0.0000145***	0.0000128***	0.0000122***
		(0.00000148)	(0.00000146)	(0.00000144)	(0.00000144)
Expenses monthly		-0.000666***	-0.000605***	-0.000596***	-0.000587***
		(0.0000677)	(0.0000682)	(0.0000693)	(0.0000710)
Number of bank account		0.598***	0.545***	0.494***	0.478***
		(0.0416)	(0.0425)	(0.0432)	(0.0435)
Employment status		0.0398	0.0490*	0.0446*	0.0425
		(0.0207)	(0.0210)	(0.0214)	(0.0217)
Geographical area			-0.495***	-0.466***	-0.445***
			(0.0476)	(0.0485)	(0.0492)
Town size			0.0856**	0.117***	0.114***
			(0.0300)	(0.0309)	(0.0312)
%_Cash				-0.000639	0.000131
				(0.00107)	(0.00109)
%_Short term assets				0.00155	-0.00119
				(0.00935)	(0.00951)
%_Short term government bonds				0.00292	0.00438

				(0.00832)	(0.00843)
%_Long term government bonds				0.0312*	0.0265
				(0.0151)	(0.0152)
%_Corporate Bonds				0.0283**	0.0280**
				(0.00936)	(0.00938)
%_Funds and ETFs				0.0294***	0.0254***
				(0.00649)	(0.00638)
%_Stocks and Equity				0.0235	0.0197
				(0.0130)	(0.0129)
%_Other financial assets				0.0229***	0.0214***
				(0.00602)	(0.00610)
%_Foreign assets				0.0107	0.0138
				(0.0191)	(0.0189)
%_Real Estate				0	0
				(.)	(.)
Risk Aversion					-0.0584 (-1.27)
Financial Knowledge					0.784***
					(0.0759)
_cons	-4.965***	-3.659***	-2.957***	-2.900***	-3.537***
	(0.539)	(0.578)	(0.599)	(0.620)	(0.723)
N	6239	6239	6239	6031	6031

Standard errors in parentheses
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 5.1 Logistic regression models

The 2020 survey was considered, where there is a higher usage of online banking by the respondents compared to previous years. The table 5.1 shows the significance and the regression coefficients of the model. Some regression coefficients change level of significance when additional predictors are taken into account.

Regarding the overall fit of the model, i.e., if the model that contains the full set of predictors represents a significant improvement over a null model without predictors, the p value is lower than 0.05. So, it can be reject the null hypothesis that the full model exhibit equivalent fit with the null model.

Both age and age squared are significant predictors. The positive coefficient of age and instead the negative coefficient for age squared indicate hump-shape effect that means as age increases the probability of being an online banking user first increases until a certain number and then start to decreases.

Education variable, holding the other predictors at a fixed value, report a regression coefficient of 0.386 with p value lower than 0.001. In a logistic regression, the regression coefficients are the logarithmic of odds, where basically the odds are the ratio of the probability to use online banking over the probability to not use online banking. Taking the exponential of the regression coefficient will get the odds ratio. In the case of education this gets 1,47 meaning an increase of 47% in the odds of use online banking for a one unit increase in education variable, for instance passing from bachelor's degree to master's degree.

Sex dummy variable is statistically significant and fixed the other variables, the odds of use online banking for male (dummy variable = 0) is 37% higher than the odds for female. This holds just for the first model when only socio-demographic characteristics of the households are considered.

Surprisingly, net wealth seems to be negatively correlated with the use of online banking, but considering the square of the variable, a hump-shaped effect, as in age, can be observed. It is not shown in the table for simplicity.

Whereas disposable income is positively correlated. Families that spend more monthly, on average, have a lower probability of using online banking.

Geographically, families living in large cities and northern Italy are more likely to use online banking.

Turning to the portfolio composition, the only statistically significant components are corporate bonds, active funds, ETFs, and other financial assets (such as options, futures, etc.). The relative increase in all these assets in the portfolio is positively correlated with the likelihood of using online banking.

The measure for risk aversion is negatively correlated with online banking but is not statistically significant. On the other hand, financial knowledge, which, as described in section 3, is a dummy variable (with a value of 1 if the reference person answered all 3 questions correctly and 0 otherwise), has an odds ratio of exp (0.784) = 2.19. In terms of percentage, the odds for financially savvy households are 119% higher than the odds for households with a lack of financial knowledge.

5.3. Linear regression: households asset allocation

In the following section, we delve into the impact of online banking usage on Italian households' portfolios, considering socio-demographic characteristics. This model represents an analysis of 'reverse causality' compared to the previous logistic regression model. For comprehensiveness, financial assets have been dissected into the eight instruments described in Section 3. We now proceed to scrutinize each portfolio component in detail, with particular focus on risky securities and their relationship with online banking.

Initially, the liquid component of the portfolio is analyzed, followed by a particular focus on funds, ETFs, stocks, equity, and on real estate. Finally, there are some comments on the other six components of the portfolio considered. For detailed regression tables, please refer to the appendix.

	Model (1)	Model (2)	Model (3)	Model (4)	Model (5)
%Liquidity					
Online Banking	-6.534***	-3.077**	-2.308*	-2.640**	-1.684
	(0.816)	(0.975)	(1.006)	(1.016)	(1.025)
Age		-0.933***	-0.875***	-0.834***	-0.814***
		(0.202)	(0.202)	(0.202)	(0.202)
Age2		0.00521**	0.00557***	0.00520**	0.00494**
		(0.00167)	(0.00167)	(0.00167)	(0.00167)
Education		-2.393***	-2.075***	-2.292***	-1.993***
		(0.253)	(0.266)	(0.273)	(0.275)
Household size		-1.500***	-1.387**	-1.298**	-1.462**
		(0.417)	(0.440)	(0.442)	(0.441)
Relational status		1.819***	1.804***	1.806***	1.635***
		(0.428)	(0.429)	(0.428)	(0.428)
Netwealth			1.45e-08	3.61e-08	5.38e-08
			(0.000000131)	(0.000000131)	(0.000000131)
Net disposable income			-0.00000883	-0.0000116	-0.00000947
			(0.00000679)	(0.00000682)	(0.00000681)
Expenses monthly			0.000792	0.000778	0.000926
			(0.000693)	(0.000695)	(0.000693)
Number of bank account			-0.445	-0.432	-0.239
			(0.378)	(0.383)	(0.384)

Employment status			-1.342***	-1.305***	-1.234***
			(0.240)	(0.240)	(0.240)
Geographical area				-0.871	-1.000
				(0.563)	(0.563)
Town size				1.247***	1.359***
				(0.351)	(0.350)
Risk Aversion					2.274***
					(0.515)
Financial Knowledge					-4.959***
					(0.881)
_cons	23.07***	69.63***	69.75***	67.98***	64.96***
	(0.608)	(6.576)	(6.606)	(6.781)	(7.010)

Table 5.2 Linear regression models with independent variable liquidity

The use of online banking as the sole predictor has emerged as a significantly negative factor with allocation in liquidity, with a regression coefficient of -6.534, indicating that an increase in the adoption of online services is associated with a considerable decrease in financial liquidity. This may suggest that individuals who use online banking tend to be less liquid in their portfolios, reallocating these funds into other financial assets, which may or may not exhibit high volatility.

Education also plays a pivotal role, with higher education levels correlating with diminished liquidity, suggesting a potential inclination towards more complex financial management or increased investment among the more educated.

Furthermore, net disposable income showcases a negative relationship with liquidity, underscoring that an increase in disposable income corresponds to a decrease in liquidity. This aligns with economic theory, where individuals with higher incomes tend to allocate more towards investments or consumption, thereby reducing their liquid assets. Moreover, in our model the relation is not significant and so cannot reject the null hypothesis and confirm the existing literature.

Similarly, the variable Financial Knowledge reveals a negative correlation with liquidity, implying that individuals with higher financial knowledge allocate their funds differently, resulting in decreased liquidity.

% Funds and ETFs					
Online Banking	1.711***	1.594***	1.310***	1.256***	1.039***
	(0.170)	(0.206)	(0.213)	(0.215)	(0.217)
Age		0.0357	0.0204	0.0176	0.0138
		(0.0428)	(0.0428)	(0.0428)	(0.0426)
Age2		-0.0000843	-0.0000475	-0.0000311	0.0000311
		(0.000354)	(0.000354)	(0.000354)	(0.000353)
Education		0.245***	0.164**	0.188**	0.144
		(0.0535)	(0.0564)	(0.0579)	(0.0580)
Household size		-0.282**	-0.406***	-0.390***	-0.350***
		(0.0881)	(0.0931)	(0.0935)	(0.0932)
Relational status		-0.184*	-0.190*	-0.188*	-0.143
		(0.0906)	(0.0908)	(0.0907)	(0.0904)
Net wealth			-2.40e-08	-2.50e-08	-3.05e-08
			(2.77e-08)	(2.77e-08)	(2.77e-08)
Net disposable income			0.00000307*	0.00000325*	0.00000275
			(0.00000144)	(0.00000144)	(0.00000144)
Expenses monthly			-0.000132	-0.000100	-0.000146
			(0.000147)	(0.000147)	(0.000147)
Number of bank account			0.315***	0.280***	0.233**
			(0.0801)	(0.0812)	(0.0810)
Employment status			0.0915	0.0940	0.0735
			(0.0508)	(0.0509)	(0.0507)
Geographical area				-0.252*	-0.224
				(0.119)	(0.119)
Town size				-0.129	-0.163*
				(0.0744)	(0.0742)
Risk Aversion					-0.685***
					(0.109)
Financial Knowledge					1.100***
					(0.187)
_cons	0.592***	-1.357	-0.835	0.0747	1.356
	(0.127)	(1.391)	(1.399)	(1.437)	(1.482)

Table 5.3 Linear regression models with independent variable Funds and ETFs

Now, let's examine how this relationship between risk and online banking reflects on financial assets, specifically, whether digitalization has a more pronounced impact on risky securities or risk-free assets.

Online banking is positively and statistically significantly correlated with the inclusion of funds and ETFs in the portfolio. Using online banking increases the average percentage of active funds and ETFs in the portfolio compared to non-users by over 100%.

Household size displays a negative and significant relationship with investment choices. Larger household sizes are linked to a decreased likelihood of investing in funds and ETFs.

The number of bank accounts variable consistently demonstrates a positive and significant relationship with investment choices, indicating that a greater number of bank accounts is linked to a higher likelihood of investing in funds and ETFs.

Attitudinal factors, Risk Aversion and Financial Knowledge, exhibit significant relationships with investment choices. Higher risk aversion is associated with a lower likelihood of investing, while greater financial knowledge is linked to an increased probability of investing in funds and ETFs.

In details, households that are listed in high levels of risk aversion respect to the precedent level show on average portfolios with 68% lower allocation in funds and ETFs on average. Instead, financially literate individuals have, on average, 110% higher exposure on fund and ETFs compared to households who don’t answer correctly to the questions in the survey.

%Stocks and Equity					
Online Banking	0.838***	0.580***	0.344**	0.319**	0.240
	(0.0990)	(0.120)	(0.121)	(0.123)	(0.124)
Age		-0.0262	-0.0471	-0.0468	-0.0470
		(0.0248)	(0.0244)	(0.0244)	(0.0244)
Age2		0.000338	0.000430*	0.000424*	0.000452*
		(0.000205)	(0.000202)	(0.000202)	(0.000202)
Education		0.229***	0.120***	0.121***	0.0836*
		(0.0310)	(0.0321)	(0.0330)	(0.0332)
Household size		-0.0448	-0.130*	-0.123*	-0.103
		(0.0512)	(0.0531)	(0.0534)	(0.0533)
Relational status		-0.0717	-0.0463	-0.0457	-0.0186
		(0.0526)	(0.0518)	(0.0518)	(0.0516)
Net wealth			9.93e-08***	9.96e-08***	9.52e-08***
			(1.58e-08)	(1.58e-08)	(1.58e-08)
Net disposable income			0.00000540***	0.00000537***	0.00000516***
			(0.000000820)	(0.000000824)	(0.000000836)
Expenses monthly			0.0000378	0.0000467	0.0000106
			(0.0000837)	(0.0000840)	(0.0000836)
Number of bank account			0.0692	0.0591	0.0383
			(0.0457)	(0.0463)	(0.0462)
Employment status			0.00843	0.0102	-0.00435
			(0.0290)	(0.0290)	(0.0290)
Geographical area				-0.0983	-0.0872
				(0.0681)	(0.0677)
Town size				-0.00253	-0.0872
				(0.0424)	(0.0677)
Risk Aversion					-0.520***
					(0.160)
Financial Knowledge					0.365***
					(0.106)
_cons	0.275***	-0.163	0.967	1.184	2.601**
	(0.0738)	(0.808)	(0.798)	(0.820)	(0.845)

Table 5.4 Linear regression models with independent variable stocks and equity

A similar relationship with respect to ETFs and funds is observed when considering stocks and equity participation, but only when the online banking predictor is considered in isolation (an increase of approximately 83%). However, when all predictors are considered, the significance of this relationship diminishes, and we cannot reject the null hypothesis.

Focusing on risky securities, the model aligns with the extensive literature in this domain. Typically, individuals holding risky assets in their portfolios exhibit high risk tolerance, greater education, and hence financial knowledge, as defined in section 4.

An increase of one unit in the ordinal education variable raises the percentage of risky securities in the portfolio by 8.3%, while an increase in risk aversion reduces the exposure by 52%. For financial knowledge, instead it contributes to increasing the allocation by a significant 36% in the portfolio of more educated individuals, supporting the initial hypotheses.

Lastly, individuals with higher wealth and net disposable income tend to allocate a larger percentage of their portfolios to stocks.

%Real estate					
Online Banking	1.139	-1.892	-1.439	-0.918	-1.324
	(0.867)	(1.046)	(1.077)	(1.088)	(1.101)
Age		0.750***	0.786***	0.754***	0.742***
		(0.217)	(0.216)	(0.216)	(0.217)
Age2		-0.00500**	-0.00583**	-0.00551**	-0.00541**
		(0.00179)	(0.00179)	(0.00179)	(0.00179)
Education		1.151***	1.305***	1.443***	1.345***
		(0.271)	(0.285)	(0.292)	(0.295)
Household size		2.395***	2.787***	2.643***	2.699***
		(0.447)	(0.471)	(0.473)	(0.474)
Relational status		-1.208**	-1.267**	-1.275**	-1.232**
		(0.460)	(0.459)	(0.459)	(0.459)
Net wealth			-0.000000437**	-0.000000455**	-0.000000456**
			(0.000000140)	(0.000000140)	(0.000000141)

Net disposable income			-0.0000113	-0.00000909	-0.00000989
			(0.00000727)	(0.00000730)	(0.00000731)
Expenses monthly			-0.000917	-0.00101	-0.00102
			(0.000742)	(0.000744)	(0.000745)
Number of bank account			-0.330	-0.222	-0.292
			(0.405)	(0.410)	(0.412)
Employment status			1.379***	1.332***	1.323***
			(0.257)	(0.257)	(0.257)
Geographical area				1.732**	1.786**
				(0.603)	(0.604)
Town size				-0.828*	-0.837*
				(0.376)	(0.377)
Risk Aversion					-0.207
					(0.533)
Financial Knowledge					2.201*
					(0.948)
_cons	73.69***	39.99***	34.85***	33.57***	32.19***
	(0.646)	(7.054)	(7.073)	(7.262)	(8.147)
N	6031	6031	6031	6031	6031

Standard errors in parentheses
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 5.5 Linear regression models with independent variable Real estate

Age consistently emerges as a significant factor, indicating that as individuals age, their likelihood of engaging in real estate investments increases. Education also plays a crucial role, with higher levels of education positively associated with a greater propensity for real estate investments. Household size positively influences real estate investment decisions, while certain relational statuses are linked to a decreased likelihood of investing in real estate.

Interestingly, higher net wealth is associated with a reduced probability of real estate investments. This, on the other hand, could explain a hump-shaped effect that was not verified in this analysis as it is not very relevant for the purposes of this research.

Employment status positively influences real estate investments, indicating that employed individuals are more inclined to engage in this type of investment. Geographical factors, exhibit mixed results, where higher town size imply lower investment in real estate and instead household living in the north of Italy have more properties.

While risk aversion does not significantly impact real estate decisions, greater financial knowledge positively correlates with a p-value lower than 5% with a higher likelihood of real estate investments.

Finally looking at the remaining variables, the main results found are the following. These variables were not analyzed in detail since they were not relevant to the main purpose of this research. Please, refer to the appendix 2 to the detailed tables.

Online banking has a significant and positive impact on the fixed income portion of the portfolio, particularly concerning long-term government bonds and corporate bonds. The p-value for these relationships is below both the 5% and 1% significance levels, respectively.

Surprisingly, the use of online banking also has a significant positive impact on having other financial assets, such as derivatives, in the portfolio. This is not obvious, as these are highly complex financial instruments not readily accessible to everyone except through brokers, typically incurring relatively high fees. This relationship is further supported by the negative association with risk aversion and the positive correlation with financial knowledge.

5.4 Weighted analysis

The next section presents the previous regressions weighted by sampling weights. Starting from the 2020 survey, adjustments to the sampling weights have been made to accommodate the introduction of household stratification during the second stage of the survey design process.

	(1) Online Banking
Sex	0.0102
	(0.133)
Age	0.0742*
	(0.0290)

Age^2	-0.00119***
	(0.000255)
Education	0.353***
	(0.0442)
Household size	-0.0661
	(0.0705)
Relational status	-0.105
	(0.0689)
Net wealth	-0.000000111
	(0.000000130)
Net Disposable Income	0.0000314***
	(0.00000498)
Expenses monthly	-0.000723***
	(0.000172)
Number of bank account	0.382***
	(0.107)
Employment status	0.0850*
	(0.0365)
Geographical area	-0.557***
	(0.0884)
Town size	0.158***
	(0.0466)
%Liquidity	0.00255
	(0.00176)
%Short term assets	-0.0123
	(0.0134)

%Short term gov bonds	-0.000351
	(0.0201)
%Long term gov bonds	0.00707
	(0.0190)
%Corporate Bonds	0.0317
	(0.0198)
%Funds and ETFs	0.0275*
	(0.0107)
%Stocks and Equity	0.0173
	(0.0221)
%Other financial assets	0.0271**
	(0.0104)
%Foreign assets	0.0963*
	(0.0406)
% Real Estate	0
	(.)
Risk aversion	-0.00312
	(0.0803)
Financial Knowledge	0.589***
	(0.136)
_cons	-3.043**
	(1.037)
N	6031

Standard errors in parentheses
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 5.6 Logistic regression model weighted

Indeed, up to this point, the conducted regressions have been unweighted, meaning they pertain solely to the analyzed sample of 6,239 interviewed households in 2020.
By assigning weights to the observations, it becomes feasible to derive an estimate that accurately represents the entire population.
In the SHIW databases the sampling weights are reported under the variable 'PESO'. The weighting is adjusted to match the demographic statistics concerning the Italian population provided by ISTAT, which includes reconstructions based on intercensal data.
Additionally, the SHIW databases incorporates the variable PESOPOP, calculated by multiplying PESO by a year-specific constant, enabling the estimation of totals for the entire population (Italian residents).
In this study, we have incorporated the latest mentioned weighting schemes. With these weights applied, a comparison has been conducted between the weighted models and their unweighted counterparts to assess the consistency of the previously obtained results in terms of significance and correlation.

Due to space constraints for both regressions, we have only included the final model with all predictor variables.

Regarding the logit model, the first observation is that net wealth loses significance in the weighted model, along with household size and corporate bonds. On the other hand, foreign assets and employment status become significantly positive at a 95% confidence level. The direction of the relationship remains the same for almost all variables, and for all the statistically significant ones, demonstrating some consistency in the results.

	(1) Liquidity	(2) Short term assets	(3) Short term gov bonds	(4) Long term gov bonds	(5) Corporate Bonds
Online banking	0.777	-0.134	-0.125	0.0634	0.532
	(2.176)	(0.159)	(0.315)	(0.0728)	(0.399)
Age	-1.457**	0.00273	0.0390	0.0100	0.114**
	(0.458)	(0.0447)	(0.0308)	(0.0110)	(0.0416)
Age^2	0.00963**	0.0000246	-0.000203	0.00000112	-0.000831**
	(0.00372)	(0.000378)	(0.000280)	(0.000100)	(0.000299)
Education	-2.611***	0.128	0.0962	0.0363	0.0762
	(0.609)	(0.0665)	(0.0669)	(0.0269)	(0.0409)

Household size	-0.564	-0.185*	-0.102	-0.0135	-0.184**
	(1.034)	(0.0752)	(0.0624)	(0.0262)	(0.0684)
Relational status	0.788	-0.0583	-0.0392	-0.0182	0.0574
	(0.815)	(0.0631)	(0.0926)	(0.0400)	(0.132)
Net wealth	-0.00000405**	-8.81e-08	-8.32e-08	4.49e-08	0.000000171
	(0.00000140)	(4.91e-08)	(4.94e-08)	(3.15e-08)	(0.000000109)
Net Disposable Income	-0.000183***	-0.00000446	0.00000147	0.00000140	0.00000719*
	(0.0000314)	(0.00000289)	(0.00000198)	(0.00000121)	(0.00000333)
Expenses monthly	0.000877	0.0000369	-0.000214*	-0.0000587	-0.000105
	(0.00150)	(0.0000932)	(0.000102)	(0.0000422)	(0.000107)
Number Of Bank account	-0.249	0.205**	-0.00412	-0.0222	-0.107
	(0.753)	(0.0639)	(0.109)	(0.0272)	(0.0859)
Employment status	-1.384**	-0.00307	0.0587	-0.00473	-0.0386
	(0.527)	(0.0463)	(0.0625)	(0.0126)	(0.104)
Geographical area	-3.030**	0.142	-0.143	-0.0331	-0.0501
	(1.121)	(0.132)	(0.0869)	(0.0250)	(0.0914)
Town size	3.922***	-0.0436	-0.0883	0.0150	-0.107
	(0.693)	(0.0487)	(0.0528)	(0.0197)	(0.0688)
Risk aversion	2.919**	0.223*	0.0158	-0.0681	-0.0122
	(1.132)	(0.106)	(0.0870)	(0.0385)	(0.0737)
Financial Knowledge	-6.530***	0.214	-0.0412	0.103	0.129
	(1.746)	(0.196)	(0.217)	(0.0719)	(0.246)
_cons	97.39***	-1.114	-0.670	-0.343	-2.959*
	(16.10)	(1.253)	(0.979)	(0.368)	(1.258)
N	6031	6031	6031	6031	6031

Standard errors in parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

	(6) Funds and ETFs	(7) Stocks and Equity	(8) Other financial assets	(9) Foreign assets	(10) Real Estate
Online banking	0.987*	0.166	0.686*	0.208	-3.159
	(0.580)	(0.191)	(0.268)	(0.122)	(2.315)
Age	0.0283	0.00711	-0.00811	0.0109	1.253**
	(0.0506)	(0.0179)	(0.0370)	(0.00679)	(0.465)
Age^2	-0.000101	-0.0000410	0.000463	-0.0000591	-0.00888*
	(0.000393)	(0.000168)	(0.000366)	(0.0000618)	(0.00379)
Education	0.119	0.0824	0.181	0.00332	1.888**
	(0.114)	(0.0463)	(0.101)	(0.0296)	(0.634)
Household size	-0.198	-0.114*	-0.186*	0.0159	1.531
	(0.101)	(0.0450)	(0.0727)	(0.0510)	(1.056)
Relational status	-0.169	-0.0946	0.0211	-0.0120	-0.475
	(0.137)	(0.0664)	(0.107)	(0.0271)	(0.856)
Net wealth	0.000000221	4.57e-08	0.00000127**	4.63e-08	0.00000252*
	(0.000000127)	(6.38e-08)	(0.000000434)	(3.34e-08)	(0.00000119)
Net Disposable Income	0.00000413	0.00000931***	0.0000113	0.000000663	0.000152***
	(0.00000391)	(0.00000196)	(0.00000697)	(0.00000124)	(0.0000313)
Expenses monthly	0.000271	0.0000152	0.0000248	-0.0000529	-0.000794
	(0.000227)	(0.0000633)	(0.000193)	(0.0000538)	(0.00152)
Number Of Bank account	-0.0737	0.00727	0.0781	-0.0174	0.183
	(0.130)	(0.0643)	(0.105)	(0.0386)	(0.811)

Employment status	0.104	0.0813*	-0.0990*	-0.000122	1.286*
	(0.0810)	(0.0391)	(0.0450)	(0.0219)	(0.552)
Geographical area	-0.271	-0.00250	0.0406	0.00503	3.341**
	(0.228)	(0.0544)	(0.144)	(0.0143)	(1.164)
Town size	-0.173	0.00411	-0.0886	-0.0130	-3.429***
	(0.0968)	(0.0451)	(0.0633)	(0.0176)	(0.710)
Risk aversion	0.0107	-0.134*	-0.334*	-0.0189	-2.602*
	(0.141)	(0.0678)	(0.132)	(0.0448)	(1.163)
Financial Knowledge	0.748*	0.197	0.378	-0.0492	4.851**
	(0.356)	(0.177)	(0.248)	(0.0681)	(1.871)
_cons	-0.985	-0.268	-0.753	-0.272	9.977
	(1.824)	(0.653)	(1.256)	(0.199)	(16.30)
N	6031	6031	6031	6031	6031

Standard errors in parentheses
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 5.7 Linear regression models weighted

For the linear regression, on average, there is a loss of significance in many predictors. For instance, financial knowledge loses significance with stocks, long-term government bonds, and other financial assets, while remaining strongly negatively correlated with liquidity in the portfolio.

An interesting case is with stocks where, this time, we cannot reject the null hypothesis that the coefficient is different from zero. Surprisingly, online banking is no longer significant with funds and ETFs, where it previously showed the strongest correlation.

Additionally, the coefficient for risk aversion now exhibits a positive relationship, in line with existing literature, as reported in Guiso (2010), where individuals with higher risk aversion tend to, on average, invest in more diversified instruments like ETFs rather than having a single exposure to a single stock or equity participation.
Other findings with no substantial impact on the purpose of this study will not be mentioned.

6. Results and implications

The purpose of this study is to analyze the determinants of online banking adoption as a means for financial decision-making and the asset allocation of households focusing particularly on the effect of the use of online banking.

Initially, the analysis was conducted at an aggregate level using a set of cross-sectional data covering the time span from 2008 to 2020. Then, a statistical-level analysis was performed considering the 2020 survey, as there is a substantial component of online banking users.
The ultimate goal is to understand whether there is a relationship between the use of online banking and the composition of households' portfolios.
Prior research has examined the factors influencing the adoption of online banking and the allocation of portfolio assets independently and within distinct contexts.
The analysis mainly focuses on 3 components of household portfolio: liquidity, financial assets, and real estate.

Reviewing the existing literature, three hypotheses were formulated and subsequently tested using two regression models. The first model is logistic, with the dependent variable being the use of online banking, while the second model is a linear regression with the dependent variable being the allocation of assets in the considered portfolio.

The first hypothesis H1, "financial knowledge solves the stockholding puzzle," is supported by the two regression models. Financial knowledge significantly influences the use of online banking at a 99.99% confidence level and investments in stocks and equity. However, the latter relationship is significant only in the unweighted linear regression model. At the aggregate level, individuals with financial knowledge allocate approximately twice as much to financial assets compared to those without it. This relationship can also be explained by other factors associated with financial knowledge, such as education.

Net wealth seems to be negatively correlated with online banking, which remains statistically significant in the unweighted logistic model, even though this could be due to a hump-shaped effect. However, looking at the data distribution, it is evident that online banking is also used by families with relatively low net wealth. As the net wealth increases, the distribution shifts towards online banking users, and not vice versa of course.
This shift towards online banking is not limited to wealthier families, as most banks offer this service for free, and it provides significant time savings and access to information. The online investment service provided by banks is typically free, with costs primarily associated with transaction fees for buying and selling securities.
These transaction costs are generally higher than those offered by online brokers. Some online brokers, in fact, offer very low fixed fees for buying and selling, even for capital amounts below one thousand euros.

In the existing literature, efforts have been made to justify the restricted involvement in financial markets, i.e., stockholding puzzle, by considering the existence of transaction costs and information expenses. According to these hypotheses, a reduction in the costs associated with holding equities should facilitate the inclusion of less wealthy individuals.

Therefore, the results of this study partly support hypothesis H3. Online banking exhibits a positive relationship with investments in both funds/ETFs and Stocks/equity, while the former is statistically significant, allowing us to reject the null hypothesis. On a national level, Italian households seem to, on average, use online banking more for investing in active funds and ETFs. Compared to individual stocks, the latter are more diversified and have lower management costs, which aligns with the notion that online banking users tend to have net wealth also in the lower quartiles.
Furthermore, hypothesis H2 also aligns with this direction because online banking exhibits a negative relationship with risk aversion, and the same, of course, holds for risky assets like stocks, as inferred from our models.

On the contrary, the logistic model reveals that risk aversion has a negative impact on the utilization of online banking, while financial knowledge exerts a positive influence. However, the former variable did not attain statistical significance in either the weighted or unweighted models, whereas the latter demonstrated statistical significance with a p-value below 0.001.

Therefore, it becomes evident that the key variables under consideration exhibit correlations across all models, whether treated as dependent or independent variables, contributing to the examination of conclusions related to the stockholding puzzle. Households, irrespective of commencing with substantial net wealth, possessing a commendable level of financial literacy, and exhibiting higher educational attainment, tend to adopt online banking as a means for financial decision-making. Notably, households with these characteristics are also more inclined to invest in risky securities.

As mentioned earlier, financial knowledge positively influences both stocks/equity and funds/ETFs, and this effect is statistically significant. While education yields a similar effect, it was found to be statistically insignificant concerning funds/ETFs. Furthermore, risk aversion is negatively correlated with statistical significance, although it does not emerge as one of the significant characteristics of families.

Moreover, special attention was dedicated to the examination of geographical variables such as area and town size. Families residing in northern Italy and inhabiting cities with a population exceeding 500,000 have a higher probability of utilizing online banking. This relationship remains statistically significant, even in the weighted model. However, when analyzed in the regression model, these two variables do not reach statistical significance concerning Stocks/Equity, with only town size demonstrating statistical significance with funds/ETFs.

Finally, in alignment with other empirical studies, age exhibits a hump-shaped effect on the utilization of online banking and the allocation of stocks/equity.

Overall, the conducted study enables a reasonably accurate prediction of whether an Italian family utilizes online banking. Conversely, choices in asset allocation display greater heterogeneity. Investment decisions can only be partially elucidated through the analyzed characteristics. Numerous unexplored factors, such as family background, past experiences, sociological and historical considerations, beliefs, and non-standard utility functions, play a significant role in portfolio choices.

Future research could follow this pattern, focusing particularly on other components such as bonds and Real Estate Investment (REITs), which when combined, constitute the majority portfolios for most Italian families.

Another important effect to consider would be that of online brokers, mentioned in this study but not yet quantitatively analyzed, as family portfolio data is private, and brokers only make their aggregate balance sheets public.

Examining how the latter impacts the allocation in risky securities could provide further insights into the research on the "stockholding puzzle" effect.

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Appendix 1: explanatory variables tables

User (household size)	2008	2010	2012	2014	2016	2020
1	6,98%	14,23%	18,73%	36,73%	19,50%	36,26%
2	10,66%	16,31%	20,20%	22,98%	23,12%	49,69%
3	18,92%	15,65%	17,18%	34,11%	36,22%	66,26%
4+	20,85%	14,97%	16,80%	23,88%	40,06%	70,97%

Table 4.11 Percentage of user by household size

Household size		2008	2010	2012	2014	2016	2020
1	Liquidity	21,57%	16,73%	18,85%	21,55%	29,39%	26,17%
	Financial assets	9,96%	8,73%	5,03%	5,52%	5,23%	5,90%
	Real assets	68,46%	74,54%	76,10%	72,93%	65,33%	67,92%
2	Liquidity	17,82%	17,46%	19,55%	20,52%	19,11%	16,83%

	Financial assets	8,11%	9,00%	4,65%	5,91%	5,33%	7,78%
	Real assets	74,06%	73,54%	75.81%	73,57%	75,54%	75,38%
3	Liquidity	17,07%	16,49%	19,56%	21,32%	19,33%	18,56%
	Financial assets	7,72%	8,89%	4,87%	5,43%	3,96%	5,07%
	Real assets	75,20%	74,60%	75,57%	73,26%	76,69%	76,36%
4+	Liquidity	16,42%	18,01%	20,06%	21,25%	22,28%	17,04%
	Financial assets	6,48%	8,59%	4,67%	5,63%	3,02%	4,99%
	Real assets	77,10%	73,39%	75,26%	73,12%	75,04%	77,96%

Table 4.12 Asset allocation by household size

User	2008	2010	2012	2014	2016	2020
Married	16,57%	18,02%	21,00%	29,64%	31,02%	59,97%
Single	16,17%	18,53%	18,01%	27,33%	30,09%	58,98%
Separated/divorced	12,46%	18,09%	17,84%	25,17%	31,65%	57,39%
Widow/er	2,98%	2,80%	2,97%	5,96%	7,16%	19,86%

Relational status		2008	2010	2012	2014	2016	2020
Married	Liquidity	16,14%	15,05%	16,81%	17,39%	18,93%	16,13%
	Financial assets	7,33%	7,82%	4,69%	5,58%	4,39%	6,62%

	Real assets	76,52%	77,12%	78,49%	77,03%	76,68%	77,24%
Single	Liquidity	27,21%	26,72%	26,77%	27,98%	32,63%	27,45%
	Financial assets	9,87%	11,79%	5,69%	6,66%	5,89%	6,98%
	Real assets	62,90%	61,48%	67,54%	65,35%	61,38%	65,57%
Separated/divorced	Liquidity	30,09%	27,05%	28,94%	33,98%	34,79%	24,13%
	Financial assets	11,09%	8,27%	5,04%	5,68%	4,62%	6,25%
	Real assets	58,83%	64,66%	66,01%	60,34%	60,59%	69,60%
Widow/er	Liquidity	16,69%	15,22%	20,89%	22,08%	22,22%	24,95%
	Financial assets	8,63%	10,41%	4,20%	5,09%	4,59%	3,93%
	Real assets	75,69%	74,36%	74,90%	72,83%	73,18%	71,11%

Table 4.13 Percentage of users by relational status

Table 4.14 Asset allocation by relational status

Table 4.15 Average income of user and not user

Average income (€)	2008	2010	2012	2014	2016	2020
User	51.947	52.841	50.907	47.392	45.717	80.441
Not user	29.215	29.548	27.822	26.054	25.192	31.411

Net disposable income		2008	2010	2012	2014	2016	2020
0-25k	Liquidity	25,39%	25,38%	29,05%	31,72%	33,17%	33,41%
	Financial assets	8,40%	10,17%	2,98%	3,95%	2,82%	2,34%
	Real assets	66,19%	64,45%	67,96%	64,32%	63,94%	64,25%
25k-50k	Liquidity	14,76%	13,95%	14,29%	14,42%	15,95%	16,25%
	Financial assets	7,41%	7,64%	4,99%	6,12%	5,45%	4,90%
	Real assets	77,82%	78,41%	80,72%	79,46%	78,58%	78,85%
50k+	Liquidity	8,86%	7,42%	7,65%	8,55%	10,46%	11,26%
	Financial assets	9,08%	8,44%	8,93%	9,16%	8,50%	10,78%
	Real assets	82,05%	84,13%	83,42%	82,28%	81,33%	77,95%

Table 4.16 Asset allocation by net disposable income

Table 4.17 Average of user and not user net wealth

Average Net wealth (€)	2008	2010	2012	2014	2016	2020
User	442.297	513.687	459.131	382.370	354.503	1.147.876
Not user	222.914	225.274	220.389	189.046	171.919	282.415

Net wealth		2008	2010	2012	2014	2016	2020
0-100k	Liquidity	51,52%	49,29%	55,65%	57,26%	58,05%	53,50%
	Financial assets	16,05%	17,28%	5,41%	6,79%	4,24%	2,91%
	Real assets	32,42%	33,43%	38,93%	35,95%	37,65%	43,58%
100-250k	Liquidity	4,74%	4,74%	5,33%	5,78%	6,50%	8,40%
	Financial assets	3,69%	3,98%	2,74%	3,65%	3,19%	2,92%
	Real assets	91,56%	91,28%	91,93%	90,57%	90,30%	88,68%
250k+	Liquidity	4,10%	3,91%	4,66%	5,29%	6,23%	8,95%
	Financial assets	5,84%	6,40%	5,95%	6,79%	6,99%	9,86%
	Real assets	90,05%	89,68%	89,39%	87,92%	86,88%	81,19%

Table 4.18 Asset allocation by net wealth

Average expenses (€)	2008	2010	2012	2014	2016	2020
User	1.737	1.808	1.868	1.688	1.515	628
Not user	1.174	1.219	1.184	1.089	962	644

Table 4.19 Average monthly expenses for user and not user

Monthly expenses		2008	2010	2012	2014	2016	2020
0-300 €	Liquidity	20,61%	21,73%	26,02%	38,79%	28,04%	21,22%

	Financial assets	12,72%	10,14%	0,00%	2,78%	1,88%	5,83%
	Real assets	66,67%	68,12%	73,97%	58,42%	70,07%	72,95%
300-800 €	Liquidity	19,39%	20,25%	26,87%	27,43%	6,53%	19,64%
	Financial assets	8,92%	10,32%	3,25%	3,83%	2,62%	5,90%
	Real assets	71,68%	69,43%	69,87%	68,74%	90,85%	74,56%
800 €+	Liquidity	17,98%	16,65%	18,75%	18,95%	22,08%	17,67%
	Financial assets	7,77%	8,26%	4,91%	6,20%	5,05%	7,15%
	Real assets	74,24%	75,07%	76,33%	74,74%	72,94%	75,18%

Table 4.20 Asset allocation by monthly expenses

User	2008	2010	2012	2014	2016	2020
1	11,32%	12,84%	11,36%	17,45%	19,22%	34,96%
2	28,94%	29,75%	24,37%	34,57%	36,36%	64,57%
3+	42,66%	42,35%	39,74%	54,99%	56,12%	85,44%

Table 4.21 Percentage numbers of user by bank accounts

Numbers of bank account		2008	2010	2012	2014	2016	2020
1	Liquidity	23,45%	21,82%	22,93%	25,06%	26,45%	24,14%
	Financial assets	6,50%	6,88%	4,20%	5,56%	4,35%	4,10%
	Real assets	70,03%	71,29%	72,85%	69,38%	69,19%	71,75%
2	Liquidity	14,85%	14,58%	18,18%	17,95%	21,05%	17,36%
	Financial assets	8,47%	8,86%	5,28%	6,09%	5,25%	6,72%
	Real assets	76,66%	76,54%	76,53%	75,95%	73,69%	75,90%
3+	Liquidity	2,55%	3,78%	14,60%	14,18%	16,34%	14,34%
	Financial assets	13,55%	15,74%	7,34%	6,81%	6,58%	10,12%
	Real assets	83,90%	80,47%	78,05%	79,00%	77,54%	75,53%

Table 4.22 Asset allocation by numbers of bank account

User	2008	2010	2012	2014	2016	2020
North	17,99%	20,28%	23,08%	30,35%	33,65%	64,17%
Center	15,48%	20,78%	20,30%	27,46%	28,01%	61,53%
South and Islands	6,59%	6,09%	9,70%	14,52%	14,89%	36,79%

Table 4.23 Percentage of user by geographical area of residence

Geographical area		2008	2010	2012	2014	2016	2020
North	Liquidity	21,32%	21,32%	22,32%	23,68%	25,22%	18,91%
	Financial assets	9,40%	9,40%	7,00%	8,86%	7,32%	9,75%
	Real assets	69,26%	69,28%	70,65%	67,45%	67,45%	71,33%
Center	Liquidity	16,85%	14,90%	17,00%	19,01%	19,89%	19,77%
	Financial assets	6,90%	9,35%	4,36%	4,59%	4,75%	5,14%
	Real assets	76,24%	75,74%	78,64%	76,39%	75,35%	75,08%
South and Islands	Liquidity	14,36%	13,58%	17,99%	18,78%	22,55%	19,94%
	Financial assets	6,87%	7,55%	2,07%	1,73%	1,18%	2,27%
	Real assets	78,76%	78,86%	79,94%	79,49%	76,21%	77,79%

Table 4.24 Asset allocation by geographical area

User	2008	2010	2012	2014	2016	2020
0-20k	12,07%	13,16%	14,54%	20,79%	21,33%	35,86%
20k-40k	15,26%	16,01%	17,68%	26,07%	28,04%	55,12%
40k-500k	13,22%	15,49%	17,44%	24,80%	26,08%	56,67%
500k+	18,68%	19,12%	21,16%	29,00%	33,28%	63,51%

Table 4.25 Percentage of user town size of residence

Town size (inhabitants)		2008	2010	2012	2014	2016	2020
0-20k	Liquidity	15,92%	15,05%	18,27%	19,44%	21,36%	19,56%
	Financial assets	7,83%	9,44%	5,25%	6,10%	4,65%	5,36%
	Real assets	76,23%	75,49%	76,47%	74,46%	73,98%	75,07%
20k-40k	Liquidity	17,74%	17,58%	20,92%	19,78%	22,69%	17,35%
	Financial assets	7,99%	8,78%	4,23%	5,24%	3,99%	5,88%
	Real assets	74,26%	73,63%	74,84%	74,98%	73,30%	76,76%
40k-500k	Liquidity	19,67%	17,45%	19,80%	22,28%	24,20%	20,42%
	Financial assets	8,28%	8,74%	4,87%	5,83%	5,00%	6,30%
	Real assets	72,04%	73,80%	75,32%	71,88%	70,76%	73,27%
500k+	Liquidity	20,83%	23,53%	20,53%	22,90%	23,39%	18,46%
	Financial assets	8,44%	8,07%	3,62%	4,00%	4,40%	7,35%
	Real assets	70,74%	69,39%	75,84%	73,08%	72,19%	74,18%

Table 4.26 Asset allocation by town size of residence

User	2008	2010	2012	2014	2016	2020
Risk averse	8,00%	9,56%	12,19%	17,23%	20,32%	45,12%
Medium risk	19,67%	20,79%	26,58%	34,37%	34,97%	61,62%
Risk lover	41,82%	32,53%	32,79%	50,98%	36,36%	76,64%

Table 4.27 percentage of user by degree of risk aversion

Risk attitude		2008	2010	2012	2014	2016	2020
Risk averse	Liquidity	18,14%	16,58%	20,83%	23,67%	25,13%	22,51%
	Financial assets	7,72%	9,44%	3,87%	4,66%	3,55%	3,72%
	Real assets	74,13%	73,96%	75,30%	71,68%	71,29%	73,77%
Medium risk	Liquidity	18,44%	18,21%	17,55%	17,69%	19,56%	16,79%
	Financial assets	8,47%	8,16%	6,32%	6,92%	6,65%	8,19%
	Real assets	73,08%	73,61%	76,12%	75,39%	73,79%	75,01%
Risk lover	Liquidity	11,88%	12,49%	15,17%	7,25%	31,15%	14,88%
	Financial assets	10,45%	8,72%	10,69%	13,15%	4,14%	16,45%
	Real assets	77,65%	78,77%	74,12%	79,59%	64,69%	68,67%

Table 4.28 Asset allocation by degree of risk aversion

User	2016	2020
Financial knowledge	45,93%	74,80%
Not financial knowledge	18,50%	29,48%

Table 4.29 Percentage of user by financial knowledge

Financial knowledge		2016	2020
No	Liquidity	24,79%	22,42%
	Financial assets	3,68%	4,26%
	Real assets	71,50%	73,31%
Yes	Liquidity	18,86%	14,46%
	Financial assets	7,30%	9,54%
	Real assets	73,83%	75,99%

Table 4.30 Asset allocation by financial knowledge

Appendix 2: linear regression models

%Short term assets					
Online Banking	-0.0324 (0.0890)	-0.0142 (0.108)	-0.0346 (0.112)	-0.0387 (0.113)	-0.0593 (0.115)
Age		0.0162 (0.0224)	0.0174 (0.0225)	0.0159 (0.0225)	0.0145 (0.0225)
Age2		-0.000150 (0.000186)	-0.000126 (0.000186)	-0.000114 (0.000186)	-0.000112 (0.000187)
Education		-0.00369 (0.0281)	0.00612 (0.0296)	0.0159 (0.0304)	0.0169 (0.0308)
Household size		-0.105*	-0.127**	-0.126*	-0.126*
		(0.0463)	(0.0490)	(0.0492)	(0.0493)
Relational status		-0.0401	-0.0485	-0.0481	-0.0521
		(0.0476)	(0.0477)	(0.0477)	(0.0478)
Net wealth			-2.37e-09 (1.46e-08)	-3.07e-09 (1.46e-08)	-1.75e-09 (1.46e-08)
Net disposable income			-0.000000840	-0.000000743	-0.000000797
			(0.000000756)	(0.000000760)	(0.000000761)
Expenses monthly			-0.00000958	-0.00000271	0.00000825
			(0.0000772)	(0.0000774)	(0.0000774)
Number of bank account			0.0813	0.0735	0.0723
			(0.0421)	(0.0427)	(0.0428)
Employment status			-0.0540*	-0.0543*	-0.0506
			(0.0267)	(0.0267)	(0.0268)
Geographical area				-0.0335	-0.0310
				(0.0628)	(0.0628)
Town size				-0.0544 (0.0391)	-0.0470 (0.0391)
Risk Aversion					0.148* (0.0576)
Financial Knowledge					0.132

					(0.0986)
_cons	0.395***	0.330	0.357	0.586	-0.0398
	(0.0663)	(0.730)	(0.735)	(0.756)	(0.784)
%Short term government bonds					
Online Banking	-0.151	0.0405	0.0560	0.0364	0.0629
	(0.104)	(0.126)	(0.131)	(0.132)	(0.134)
Age		-0.0240	-0.0251	-0.0280	-0.0269
		(0.0262)	(0.0263)	(0.0263)	(0.0263)
Age2		0.000370	0.000362	0.000383	0.000378
		(0.000217)	(0.000217)	(0.000218)	(0.000218)
Education		0.0439	0.0337	0.0534	0.0572
		(0.0327)	(0.0346)	(0.0355)	(0.0360)
Household size		-0.0981	-0.121*	-0.115*	-0.117*
		(0.0540)	(0.0572)	(0.0574)	(0.0575)
Relational status		-0.0692	-0.0645	-0.0637	-0.0637
		(0.0555)	(0.0557)	(0.0557)	(0.0558)
Net wealth			-1.14e-08	-1.26e-08	-1.31e-08
			(1.70e-08)	(1.70e-08)	(1.70e-08)
Net disposable income			-0.000000132	4.84e-08	0.000000103
			(0.000000882)	(0.000000887)	(0.000000888)
Expenses monthly			0.000210*	0.000227*	0.000223*
			(0.0000901)	(0.0000904)	(0.0000903)
Number of bank account			0.0215	0.00153	0.00511
			(0.0492)	(0.0498)	(0.0500)
Employment status			0.00647	0.00669	0.00548
			(0.0312)	(0.0312)	(0.0313)
Geographical area				-0.111	-0.114
				(0.0733)	(0.0733)
Town size				-0.109*	-0.112*
				(0.0456)	(0.0458)
Risk Aversion					-0.0569
					(0.0672)
Financial Knowledge					-0.153
					(0.115)

_cons	0.664***	0.699	0.699	1.252	1.589
	(0.0776)	(0.852)	(0.859)	(0.882)	(0.915)
% Long term government bonds					
Online Banking	0.238***	0.265***	0.247**	0.225**	0.185*
	(0.0644)	(0.0782)	(0.0809)	(0.0818)	(0.0828)
Age		0.0159	0.0143	0.0143	0.0135
		(0.0162)	(0.0162)	(0.0163)	(0.0163)
Age2		-0.0000311	-0.0000292	-0.0000316	-0.0000206
		(0.000134)	(0.000134)	(0.000135)	(0.000135)
Education		0.0512*	0.0433*	0.0460*	0.0333
		(0.0203)	(0.0214)	(0.0220)	(0.0222)
Household size		-0.0450	-0.0538	-0.0476	-0.0406
		(0.0334)	(0.0354)	(0.0355)	(0.0356)
Relational status		-0.0632	-0.0623	-0.0617	-0.0543
		(0.0344)	(0.0345)	(0.0345)	(0.0345)
Net wealth			5.43e-09	5.54e-09	4.72e-09
			(1.05e-08)	(1.05e-08)	(1.05e-08)
Net disposable income			0.000000173	0.000000172	0.000000830
			(0.000000546)	(0.000000549)	(0.000000549)
Expenses monthly			0.0000155	0.0000242	0.0000174
			(0.0000558)	(0.0000559)	(0.0000560)
Number of bank account			0.0167	0.00676	-0.00142
			(0.0304)	(0.0308)	(0.0309)
Employment status			0.00987	0.0113	0.0113
			(0.0193)	(0.0193)	(0.00193)
Geographical area				-0.0883	-0.0829
				(0.0454)	(0.0453)
Town size				-0.0131	-0.0182
				(0.0283)	(0.0283)
Risk Aversion					-0.103*
					(0.248)
Financial Knowledge					0.205**
					(0.0712)
_cons	0.191***	-0.703	-0.652	-0.426	-0.270
	(0.0480)	(0.527)	(0.531)	(0.546)	(0.566)
% Corporate Bonds					

Online Banking	0.668***	0.724***	0.662***	0.659***	0.629***
	(0.104)	(0.126)	(0.130)	(0.131)	(0.133)
Age		0.0535*	0.0485	0.0453	0.0453
		(0.0261)	(0.0261)	(0.0261)	(0.0261)
Age2		-0.000275	-0.000251	-0.000226	-0.000215
		(0.000216)	(0.000216)	(0.000216)	(0.000217)
Education		0.0953**	0.0732*	0.0934**	0.0787*
		(0.0327)	(0.0344)	(0.0353)	(0.0357)
Household size		-0.131*	-0.105	-0.104	-0.0960
		(0.0539)	(0.0569)	(0.0571)	(0.0571)
Relational status		-0.0825	-0.0744	-0.0739	-0.0629
		(0.0554)	(0.0554)	(0.0554)	(0.0554)
Net wealth			5.67e-08***	5.52e-08**	5.34e-08***
			(1.69e-08)	(1.69e-08)	(1.70e-08)
Net disposable income			0.00000213*	0.00000234**	0.00000225**
			(0.000000877)	(0.000000882)	(0.000000883)
Expenses monthly			-0.000239**	-0.000227*	-0.000242*
			(0.0000896)	(0.0000899)	(0.0000899)
Number of bank account			-0.0821	-0.0962	-0.104*
			(0.0489)	(0.0496)	(0.0497)
Employment status			0.0201	0.0192	0.0132
			(0.0310)	(0.0310)	(0.0311)
Geographical area				-0.0493	-0.0451
				(0.0729)	(0.0729)
Town size				-0.113*	-0.124*
				(0.0454)	(0.0454)
Risk Aversion					-0.215**
					(0.0668)
Financial Knowledge					0.134
					(0.114)
_cons	0.453***	-1.769*	-1.447	-1.014	-0.413
	(0.0775)	(0.850)	(0.854)	(0.877)	(0.909)
%Other financial assets					
Online Banking	1.929***	1.687***	1.142***	1.087***	0.896***
	(0.196)	(0.236)	(0.238)	(0.240)	(0.243)

Age		0.102*	0.0569	0.0581	0.0547
		(0.0490)	(0.0477)	(0.0478)	(0.0476)
Age2		-0.000319	-0.0000510	-0.0000674	-0.0000128
		(0.000405)	(0.000395)	(0.000395)	(0.000394)
Education		0.517***	0.295***	0.294***	0.229***
		(0.0612)	(0.0629)	(0.0646)	(0.0652)
Household size		-0.198*	-0.444***	-0.429***	-0.394***
		(0.101)	(0.104)	(0.104)	(0.104)
Relational status		-0.103	-0.0605	-0.0593	-0.0199
		(0.104)	(0.101)	(0.101)	(0.101)
Net wealth			0.000000277***	0.000000278***	0.000000273***
			(3.09e-08)	(3.10e-08)	(3.10e-08)
Net disposable income			0.00000861***	0.00000853***	0.00000809***
			(0.00000160)	(0.00000161)	(0.00000161)
Expenses monthly			0.000271	0.000289	0.000250
			(0.000164)	(0.000164)	(0.000164)
Number of bank account			0.332***	0.312***	0.272**
			(0.0894)	(0.0906)	(0.0908)
Employment status			-0.122*	-0.118*	-0.135*
			(0.0567)	(0.0568)	(0.0567)
Geographical area				-0.209	-0.183
				(0.133)	(0.133)
Town size				0.0121	-0.0169
				(0.0830)	(0.0829)
Risk Aversion					-0.586***
					(0.122)
Financial Knowledge					0.974***
					(0.209)
_cons	0.604***	-6.091***	-3.440*	-3.031	-1.964
	(0.146)	(1.593)	(1.560)	(1.603)	(1.658)
% Foreign Assets					
Online Banking	0.193***	0.0914	0.0203	0.0159	0.0147
	(0.0533)	(0.0648)	(0.0667)	(0.0675)	(0.0683)
Age		0.00941	0.00381	0.00355	0.00373
		(0.0134)	(0.0134)	(0.0134)	(0.0134)
Age2		-0.0000563	-0.0000301	-0.0000286	-0.0000274

		(0.000111)	(0.000111)	(0.000111)	(0.000111)
Education		0.0646***	0.0350*	0.0371*	0.0350
		(0.0168)	(0.0177)	(0.0181)	(0.0184)
Household size		0.00963	-0.0125	-0.0112	-0.0102
		(0.0277)	(0.0292)	(0.0293)	(0.0294)
Relational status		0.00265	0.00879	0.00894	0.0110
		(0.0285)	(0.0284)	(0.0284)	(0.0285)
Net wealth			2.16e-08*	2.15e-08*	2.11e-08*
			(8.69e-09)	(8.70e-09)	(8.70e-09)
Net disposable_ income			0.00000169***	0.00000170***	0.00000169***
			(0.000000450)	(0.000000453)	(0.000000453)
Expenses monthly			-0.0000285	-0.0000259	-0.0000294
			(0.0000460)	(0.0000461)	(0.0000462)
Number of bank account			0.0203	0.0174	0.0184
			(0.0251)	(0.0254)	(0.0255)
Employment status			0.00308	0.00328	0.00197
			(0.0159)	(0.0159)	(0.0160)
Geographical area				-0.0206	-0.0203
				(0.0374)	(0.0374)
Town size				-0.0112	-0.0137
				(0.0233)	(0.0234)
Risk Aversion					-0.0491
					(0.0343)
Financial Knowledge					0.000786
					(0.0588)
_cons	0.0679	-0.563	-0.253	-0.177	-0.0108
	(0.0397)	(0.437)	(0.438)	(0.450)	(0.467)