FINANCIAL LITERACY IMPACT ON INVESTMENT DECISIONS IN LITHUANIA

A Thesis

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by

Ieva Vitaitytė

Advised by

Doc. Dr. Asta Klimavičienė

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Summary

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Although financial literacy has been the focus of various research outputs for quite a while, the subject remains highly relevant in Lithuania, where financial literacy is below-average. Most Lithuanians up to date prefer saving in cash over investing in financial instruments. The synthesis of research studies establishes a causal and significant relationship between financial literacy and investment decisions.

This paper aims to assess how financial literacy may determine decisions to utilize savings and impact the choice of an investment instrument in Lithuania. The initial belief is that more financially literate people opt for more complex financial instruments, whereas less financially knowledgeable people follow the most popular investment trends or save at home/bank account. Therefore, the objectives of this study were to (1) overview an outstanding problem of low financial literacy levels in Lithuania which relates to inefficient participation in investment markets activities, (2) provide general information about financial education practices and conduct Lithuania investment markets' analyses by comparing the situation with other Baltic states and the regional average, (3) assess the empirical findings of other research works investigating the relationship between financial literacy and investment decisions, (4) develop a research method that determines financial literacy impact on investment decisions in Lithuania, and (5) examine empirically how financial literacy influences investment decisions in Lithuania and discuss the findings. The empirical research employs the Bank of Lithuania *Survey of Households H2 2018* data. Based on developed logistic regression models, financial literacy is found to be insignificant for investment decisions. The study also finds that financial literacy has no impact on investing in real estate assets in Lithuania. Nevertheless, the thesis reveals that financial literacy is an essential determinant for investing in stocks.

Keywords: financial literacy, saving habits, investment decisions, binary logistic regression, Lithuania.

Number of Words:13,843.

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Introduction

Topic Relevance

It goes without saying that financial education is a matter of increasing importance worldwide. Some use it as a political resolution to win elections. Others see it as a mean to earn money, while for some, it is a choice that sustains the quality of life. Across Europe, the focus on financial savviness could be to some extent related to the year 2014, when an active promoter of financial education Wim Mijs became European Banking Federation's newly appointed Chief Executive Officer (European Banking Federation, 2019). Since then, financial education-related programs have been initiated more actively across many countries, including Lithuania.

The relevance of this subject is reflected on many global agendas. World Economic Forum (2015) announced the commitment to develop contemporary skills for current market needs and mentioned financial literacy as one of the core foundational skills. The topic was also addressed by the European Commission (2020), which identified financial literacy as an essential skill for personal finance management. Financially savvy people are told to be more prominent to use the market in an advantageous manner (European Commission, 2020). Therefore, European Commission (2020) committed to an action point to support financial education within the EU, specifically long-term investing promotion, and aimed at developing a European financial competencies framework (under the key objective of making the EU a safer place for long-term saving and investing).

Despite all the aspirations by international entities, the worsening situation among Lithuanians requires timely actions. Lithuanians have relatively poor investment habits, and most people still prefer keeping savings in cash or on a bank account. Especially after the recent slump on deposits' interest rates, financial knowledge has become even more relevant to choose an alternative inflation hedge. Nevertheless, financial education is a choice rather than a necessity in the country. It results in the residents of Lithuania lacking essential knowledge on personal finance management. It signals the relevance of the topic to be investigated more thoroughly.

Research Problem

The main research problem examines whether the lack of financial literacy determines poor investment habits among market participants. It raises the question if Lithuanians were

more financially knowledgeable, would more people choose to utilize savings in financial instruments instead of piling up cash, and if so, which financial instruments are likely to be chosen?

Aim of the Thesis

This paper aims to analyze the impact of financial literacy on choosing an investment instrument in Lithuania's market. The initial hypothesis is that more financially literate people opt for more complex financial instruments given the fact that they understand the nature, risks, and benefits related to such investment, while less financially literate people follow the most popular investment trends or retain savings in cash/bank account.

Objectives

The objectives set in the thesis are as follows:

1. To overview an outstanding problem of low financial literacy levels in Lithuania which relates to inefficient participation in investment markets activities;
2. To provide general information about financial education practices and conduct Lithuania investment markets' analyses by comparing the situation with other Baltic states and the regional average;
3. To assess the empirical findings of other research works investigating the relationship between financial literacy and investment decisions;
4. To develop a research method that determines financial literacy impact on investment decisions in Lithuania;
5. To examine empirically how financial literacy influences investment decisions in Lithuania and discuss the findings.

Research Methods

The paper seeks to relate the concept of financial literacy to investment practices on the households' level in Lithuania. For this purpose, the study uses data from the Bank of Lithuania *Survey of Households H2 2018*. It is one of the latest surveys investigating Lithuanian households' financial behavior and incorporating financial literacy questions. Binary logistic regression (in *Gretl* software) is used as the primary tool to determine whether and how much

financial literacy can explain investment decisions in the country, particularly in real estate (the most preferred asset class in Lithuania) and stocks holdings (taken as a more conceptually complex financial instrument). Moreover, using the data from the newest available financial literacy survey obtained from the Banks Association of Lithuania (2021), the study incorporates the statistical analysis of financial literacy levels in Lithuania.

Practical Value of the Thesis

The research paper will be a practical help kit to create awareness about the financial education impact and its importance. Besides, the research findings could be applied to promote financial literacy, analyze investment markets trends, and recommend policies targeted at financial education in Lithuania. Investors could also use this study to relate which factors are the most important for personal investment decisions. To my best knowledge, this is the first research output investigating the relationship between financial literacy and investment decisions in Lithuania.

Situation Analysis

Financial Literacy in Lithuania

Financial literacy is a relatively under-researched topic in Lithuania. There were only several attempts to ascertain the level of financial literacy in the country. One of the most extensive determinants was the survey conducted by OECD INFE in 2015, which aimed to compare financial literacy levels across nations worldwide (OECD, 2016). The study results showed that the level of financial literacy was slightly lower in Lithuania, opposed to the OECD average, in 2015. The average score approximated 13.5 for Lithuania, compared to 13.7 for OECD countries (Latvia and Estonia scored 13.3 and 13.4, respectively) (OECD, 2016). Although it may seem like a moderate achievement, some concepts required improvements from Lithuanians. There were 7% lower scores in the field of compounding interest, 8% worse results in risk and return topic, and 14% underscoring in the understanding of inflation as opposed to the OECD average (OECD, 2016). In 2019, Baranauskas and Gudaitis confirmed the need to approach financial education in Lithuania. They investigated the financial literacy of Y generation (people aged 16-26) who are on the edge of the financially independent life (Kryževičiūtė, 2020). The findings state that there is a shortage of necessary financial knowledge

since more than half of respondents admitted not keeping track of their financial footprint and the vast majority of respondents lack long-term financial goals (Kryževičiūtė, 2020).

The Banks Association of Lithuania has recently conducted the newest study on adults' financial literacy. The research supplements the above-stated findings and reveals that the financial literacy metric stands at the level of 45 (on a scale of 0-100) in 2021 (Kuzmickaitė, 2021). The metric improved by 2 data points from 2019 when the reported financial literacy was 43 (Kuzmickaitė, 2021). What stands out from the analysis is that there was a gradual improvement in theoretical knowledge about savings. Yet, compounding interest remains one of the most complicated topics for an average Lithuanian (Kuzmickaitė, 2021). Hence, the financial knowledge improvements of the general public are relevant up to date.

The huge gap in financial literacy pertains to the youth, as well. The research of the joined investigation by National Tax Inspection and Vilnius University indicates that around 35% of children have never heard anything about taxes, and ca. 48% of kids indicated tax evasion positively (Deveikis, 2019). Such findings are supported by the OECD PISA survey in 2015, which outlined that ca. 32% of all 15-year-old pupils did not reach the fundamental level of financial literacy, while only ca. 4% of respondents were identified as the top performers (as opposed to OECD average of 12%) (OECD, 2017). The repeated OECD PISA study in 2018 disclosed marginal improvement of numbers (OECD, 2020b). This improvement was the most substantial across the OECD countries (rose by 50 scale points); however, financial literacy remains below the OECD average (Ministry of Education, Science and Sport of the Republic of Lithuania, 2020). Hence, not only Lithuanian adults but also pupils lack basic financial knowledge.

Financial Education in Lithuania

According to Kaiser and Menkhoff (2017), financial literacy results from financial education. Low financial literacy of the Lithuanian youth mainly arises from lack of teachers' competence on the subject, the fact that educational methods, materials, and tools are outdated, as well as the discontinuous teaching of the subject (Ministry of Education, Science and Sport of the Republic of Lithuania, 2020). However, some argue that the example set by family members is also relevant and might determine further interest in financial matters (Invalda, 2021b).

In Lithuania, financial education is integrated among other subjects in primary and secondary schools and taught in a more focused manner only in the 9th and 10th grades when *Economics and Entrepreneurship* appears as a separate mandatory subject (Ministry of Education, Science and Sport of the Republic of Lithuania, 2020). Economics subject helps develop economic reasoning, which is essential in making more informed financial decisions (Morton, 2005). Nevertheless, there exist only two textbooks in the Lithuanian language for financial education purposes (Ministry of Education, Science and Sport of the Republic of Lithuania, 2020). This evidence only escalates the problem and highlights the need for financial education improvements in the country.

Lithuania has already taken some corrective actions and created initiatives targeted at the lack of financial literacy in the country. Bareikienė et al. (2018) established methodical recommendations for finance and taxes literacy programs at schools, which encompass personal finance management, savings and investment, taxes, borrowing, and insurance modules. Furthermore, the *Plan for the Financial Education of the Public* was prepared in 2017 with the actions to be taken to improve the saving habits and awareness of financial products ("Plan", 2020). This plan also joined forces of various institutions to promote finance teaching ("Plan", 2020). Examples of such programs include the *Young Wallet* initiative targeted at financial literacy teaching at schools, e-lessons released by the Bank of Lithuania, as well as such projects as Economics or Finance Olympics organized by ISM University of Management and Economics and Vilnius Tech University, respectively (Černiauskaitė & Kairė, 2018; "Plan", 2020). Although the action points in the plan are ambitious, most of the deliverables are high-level with little or no direct impact on the outstanding issue (Černiauskaitė & Kairė, n.d.), e.g., pilot studies, analyses of foreign practices, public consultations, etc.

Even though Lithuania took some steps for improvement, there is still a long way to go. As the President of the Banks Association of Lithuania Eivilė Čipkutė argues, financial education requires life-long learning (Lingė, 2021). It should be taught not only at schools but also intended to be provided for adults, especially when they need it the most, e.g., when trying to take a loan (Lingė, 2021). Also, financial literacy has to be integrated into other subjects and seek to showcase more practical aspects. For example, instead of solving a mathematics exercise

related to calculations of the depth of a pool, pupils might instead be asked to solve a more practical problem, such as the square meters of an apartment (Lingė, 2021).

The shortage of available financial media also relates to low financial literacy levels in Lithuania. Only several public sources in the local language educate Lithuanians consistently about investment opportunities. The proxies for financial media in Lithuania are such news portals as *Verslo žinios*, *LRT, IQ*, periodic journals as *Investuok*, and several others. However, these sources lack an analytical tone. Trending information is usually presented descriptively without digging deeper into the causes and consequences of a certain event. As Engelberg and Parsons (2011) explain, local financial analytics has a strong positive correlation with the probability and size of trading. Moreover, Merton (1987) proved that investors choose securities, which they are aware of. Therefore, media coverage might be an applicable consideration for the levels of financial literacy and investment market practices existing in the country.

As OECD (2019) identifies, some countries have good practices in strengthening financial education that could be seen as benchmarks. In England, for example, financial education is a "compulsory subject in secondary schools" due to the positive externalities and spillovers related to such kind of knowledge (OECD, 2019, p. 43). Belgium has employed digital solutions and created an interactive laboratory for high school students, which gives them hands-on experience with budgeting, consumption, investment markets, and similar topics (OECD, 2019). A severe problem worldwide is also related to not qualified enough teachers, who would spread financial awareness at schools. To address this matter, the Central Bank of Austria, together with Austrian universities, created a one-semester program to improve school teachers' competencies in finance education (OECD, 2019). In addition, Japan established financial literacy competitions for teachers where the winners provide training to other participants (OECD, 2019). Financial education is encouraged to start at schools but not end there. Various tools also help to cope with poor financial education among adults, such as purposely developed financial education websites in Azerbaijan or Belarus, nation-wide occasional financial literacy seminars, or related events (OECD, 2019).

Financial Literacy Relation with Personal Finance

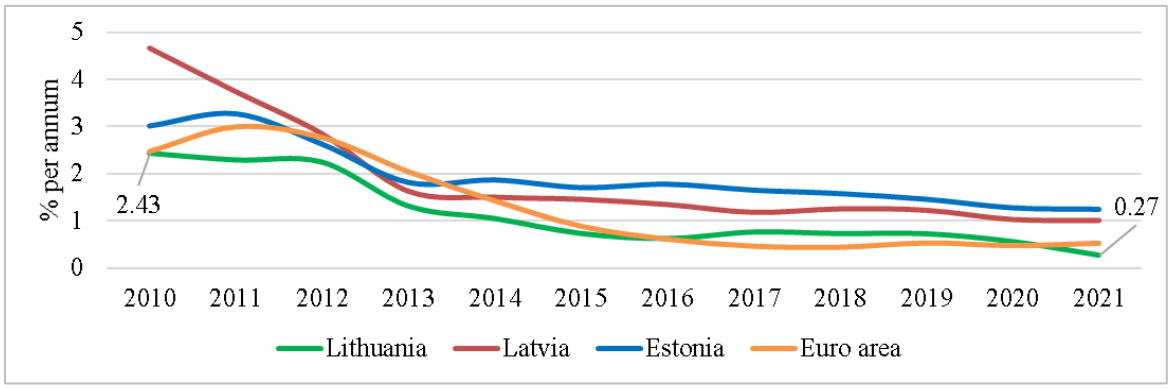
Financial literacy triggers many personal finance matters, including indebtedness, budgeting, tax planning, etc. However, this paper will explore how financial literacy relates to

saving habits and investment markets. The need for such study in Lithuania is validated by the Banks Association of Lithuania, which showed that almost 40% of respondents faced a situation when expenses exceeded income over 2020, 67% of surveyed people kept their savings in cash, while only less than a tenth of Lithuanians invested their savings over the last 12 months (Kuzmickaitė, 2021).

Some financial instruments, such as deposits, are popular in Lithuania (with the total deposited amount of EUR 19,933 mln in October 2021) and require no deep financial understanding (Bank of Lithuania, 2021b). However, since there was a slump in interest rates, deposits have become less attractive, and the alternative inflation hedge has become desired. As Figure 1 reflects, the interest rates on bank deposits in Lithuania, consistently with Latvia, Estonia, and the average of Euro area countries, have contracted over the last decade by more than 2.1% for deposits with a maturity over a year. The average interest rate in Lithuania stood at 0.05% for deposits with maturity less than one year and at 0.27% with maturity over one year at the beginning of 2021. Thus, it calls to explore alternative investment opportunities. Yet, to choose an effective inflation hedge, knowledge of different financial instruments is required.

Figure 1

Euro-Denominated Deposits with an Agreed Maturity of Over One Year from Euro Area Households



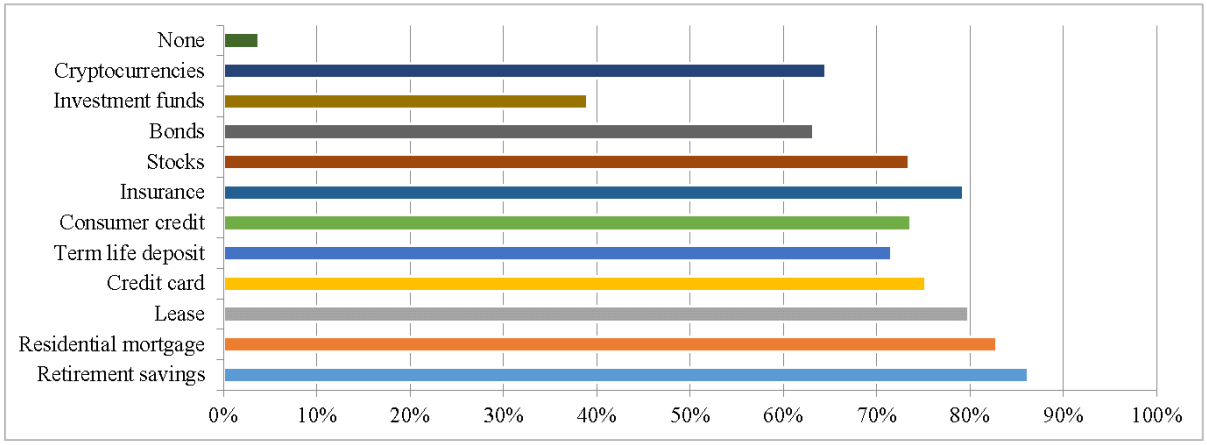
Note. Created by the author. Data are from Euro Area Statistics (2021).

The Banks Association of Lithuania (2021) suggests that people in Lithuania are mainly aware of financial instruments, which are encouraged by the state (e.g., retirement savings), related to livelihood (e.g., residential mortgage), or have ties with consumption (e.g., consumer

credit, credit cards). Figure 2 shows the percentage of cases when respondents in the Banks Association of Lithuania (2021) survey confirmed being aware of the respective financial instruments. The chart raises the question if more people knew how to use those instruments advantageously, would there be more decisions to save money in higher returns bearing accounts?

Figure 2

Percent of Cases when People were Aware of Indicated Financial Instruments in Lithuania



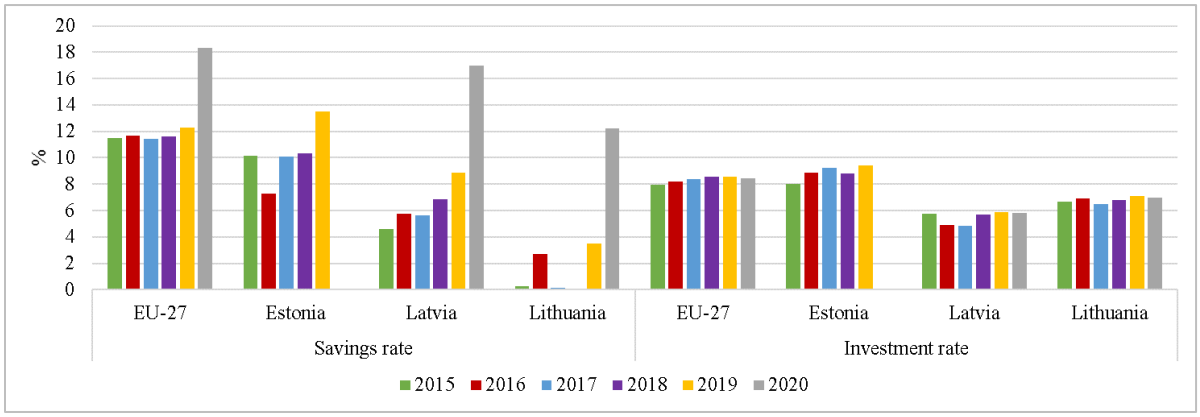
Note. Created by the author. Data are from the Banks Association of Lithuania (2021). The chart shows the percentage of cases for the question "Which of the indicated financial instrument have you heard/are aware of?". Respondents were allowed to choose multiple answers.

Saving Habits in Lithuania

In general, over the last five years, the savings rate in Lithuania significantly underscored the EU-27 general practices. As Figure 3 indicates, Lithuanians tend to spend most of their income on consumption and not plan savings accordingly. The average savings rate over 2015-2020 was ca. 3.15%. It is not in line with the general good practices such as a commonly referred 50/20/30 rule promoted by U.S. Senator Elizabeth Warren, where 50% of earnings should go to necessities, 20% allocated to long-term savings, and 30% to consumption of lifestyle choices. Although not reflected for Estonia in Figure 3 due to missing data in Eurostat, years 2020 and 2021 led to a drastic spike in savings rate worldwide. Over the lockdown period, people accumulated earnings, and as of Q1 2021, the savings rate in the Euro area rose to an average of 21.5% (Eurostat, 2021a).

Figure 3

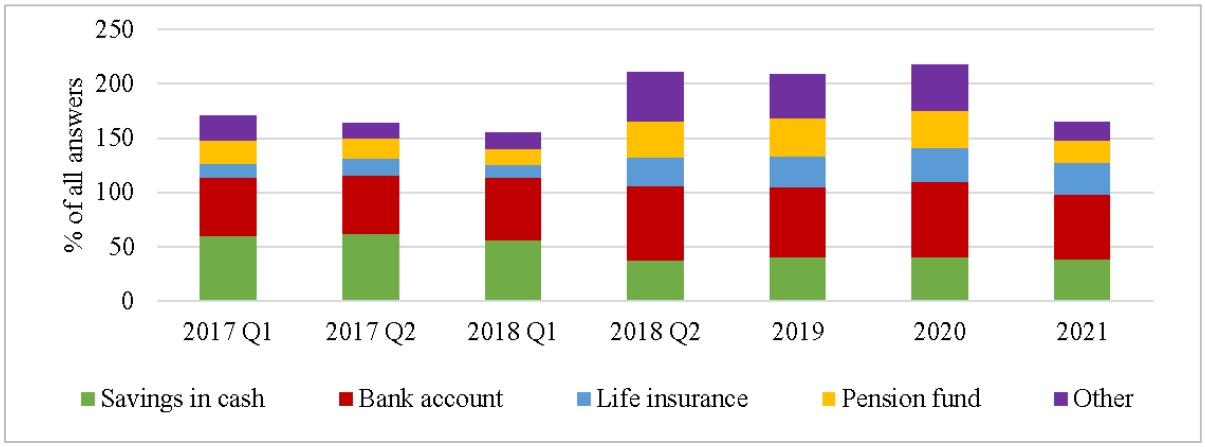
Gross Household Saving and Investment Rates



Note. Created by the author. Data are from Eurostat (2021b).

Figure 4

Saving Instruments in Lithuania



Note. Created by the author. Data are from the Bank of Lithuania (2021c). The chart displays the answers to the question "Which of the savings instruments does your household use? Indicate all instruments used by household members". Respondents were allowed to choose multiple answers. Thus, the total results exceed 100% and differ over given periods.

The Bank of Lithuania conducts surveys of households regularly, which encompass households' financial behavior determinants. Figure 4 shows that, on average, 54% of Lithuanians kept their savings either in cash or on their bank account over 2017-2021. In other

words, more than half of Lithuanians lose money to inflation which, based on the Eurostat database, approximated ca. 2.4% annually over 2017-2021 in Lithuania. It could be perceived as a poor investment habit since, as Fujiki (2020) suggests, more financially literate people tend to hold “lower cash ratio value” (p. 1).

Investment Habits in Lithuania

In the meantime, investment habits are closer to the EU average, but Lithuania is still lagging behind. Figure 3 suggests that, on average, 6.8% of annual income was allocated for investment purposes in Lithuania, opposed to 8.4% in the EU-27 average from 2015 through 2020. Unfortunately, even though there was a considerable increase in the savings rate in 2020, no improvement was noticeable in investment behavior.

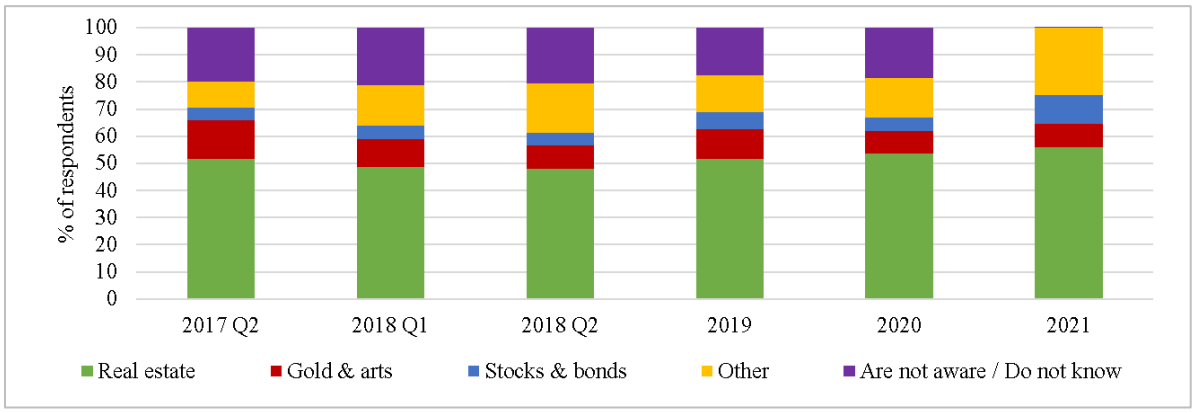
The investment habits in Lithuania are highly dependent on many demographic and socioeconomic characteristics. Based on the Banks Association of Lithuania (2021), gender, income, age, and education determine significant variations in savings instruments. For instance, although most men in Lithuania display similar savings behavior as women, men are slightly more active in choosing risky assets, such as cryptocurrencies and stocks (see Table A1). As for income, the wealthier households prefer higher risk instruments, e.g., stocks, cryptocurrencies (see Table A1).

Age is another consideration for savings practices in Lithuania. It is common to choose the risky investment with potentially higher returns at a young age and gradually shift towards lower-risk securities approaching retirement. Such observations are consistent with Table A1, which confirms that the preference for such risky assets as cryptocurrencies or stocks is almost absent for beyond 46 years old respondents. According to Tvarijonas (1999), after the country regained its independence, many Lithuanians lost their savings in deposits due to high inflation and inefficient public finance policies of the newly established government, which seeded mistrust for financial markets among the current elderly. Another slump in Lithuanians’ trust for investment accounts was evident during the global financial crisis when decreasing asset prices led to massive sales of financial holdings (Šarkinas, 2008). Besides, more standardized economics education appeared in Lithuania only after its acceptance to the EU. Therefore, most of the elderly up-to-date prefer having savings in cash due to lack of knowledge or negative personal experience with investment markets.

Educational achievements are also relevant for investment market analysis in Lithuania. Higher education usually determines the decision to invest money, especially in riskier asset classes (see Table A1). Such findings are backed by Official Statistics Portal (2021), which suggests that in Lithuania over the last consecutive years, people having higher education were more eager to save (people with higher education displayed a 20% higher likelihood to save) and less likely to live making ends meet (17% lower probability). However, there is usually a strong correlation between education and earnings, which determines a better financial situation for households. The emphasis is that Lithuania's investment markets are heavily reliant on educated people. This phenomenon will be investigated further in this paper in more detail.

Figure 5

The Most Preferred Investment Opportunities by Lithuanians



Note. Created by the author. Data are from the Bank of Lithuania (2021c).

In general, from the investment instruments point of view, there are supposedly a few asset classes preferred by Lithuanian investors. Historical data reveals that over the last four years, on average, 52% of surveyed Lithuanians indicated residential real estate as the most preferred market opportunity (Figure 5). Gold, together with artworks and the securities market, was recognized as other attempting investment instruments with four years respondents' averages of 10% and 6%, accordingly.

Residential Real Estate Market

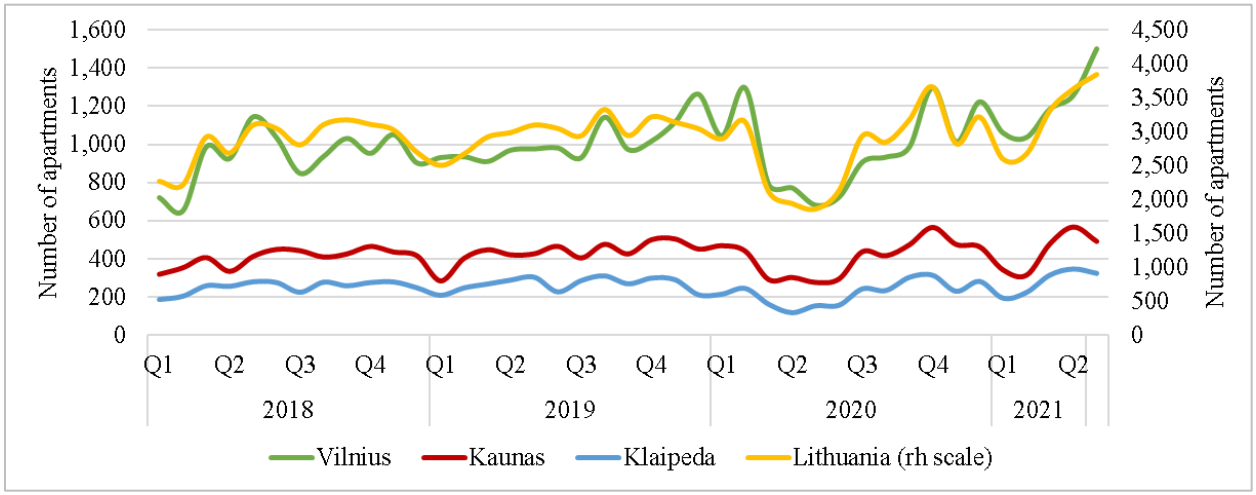
Residential real estate stock has been expanding in Lithuania over the last decade. Such bullish market sentiment is associated with practical purpose serving underlying assets and the

fact that the market size is huge. Both leasing and selling of real estate assets are active in Lithuania: while some buy and sell a piece of real estate with a premium, others rent out owned dwellings with the long-term returns' rationale.

Regarding the supply of real estate in Lithuania, the Registry center (2021) statistical database shows that Lithuania's residential market spotlights a modest yet continuous expansion of ca. 1% per annum in terms of the number of registered apartments. According to the Registry center (2021), the stock of registered apartments in Lithuania approximated 891,950 at the beginning of Q3 2021. As it could be intuitively presumed, Vilnius, Kaunas, and Klaipeda are the most active markets in the country, which form on average 33%, 21%, and 13% of the total supply (Registry Center, 2021).

Figure 6

Sold Apartments in Lithuania and its Largest Cities



Note. Created by the author. Data are from Registry Center, as cited in Povilaitytė (2021).

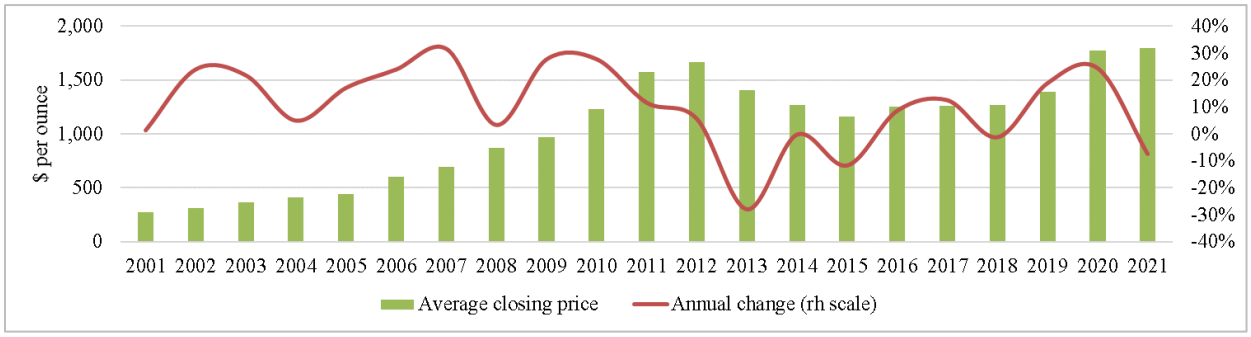
Even though the pandemic outbreak provided much uncertainty and economic vulnerability, the demand remains robust (Figure 6). In general, the demand to purchase apartments has not fluctuated considerably over the last three years but spotlighted a surge during the Covid-19 pandemic, especially in Vilnius. The seasonality is to some extent evident in Lithuania's real estate market, as it is common to observe a surge in transactions at the year-end when initiated deals are usually closed (Figure 6). The purchases of older construction apartments and houses determine the lively demand (Bank of Lithuania, 2021a).

The Bank of Lithuania (2021a) explains that the prices index of selling and leasing real estate observed solid growth rates after the mortgage distress during the global financial crisis. The anticipated further upward price development results from demand exceeding supply (the number of provided building allowances was lower than apartments under construction last year in Vilnius, signaling contracting supply) (Bank of Lithuania, 2021a). Also, increased construction materials costs in the country drive prices up. Statistics Lithuania announces that the housing price index has surged by 20% over the last three years. As Invalda (2021a) suggests, real estate renting brings relatively higher average returns than selling since the return related to dwellings rent was ca. 4.7% annually over the last decade and only 2.8% for selling. *Aruodas.lt* portal confirms such a finding by stating that rent prices increased by 10% in March 2021, compared to March 2020 (Bank of Lithuania, 2021a).

Gold and Art

Figure 7

Gold Prices



Note. Created by the author. Data are from Macrotrends (2021).

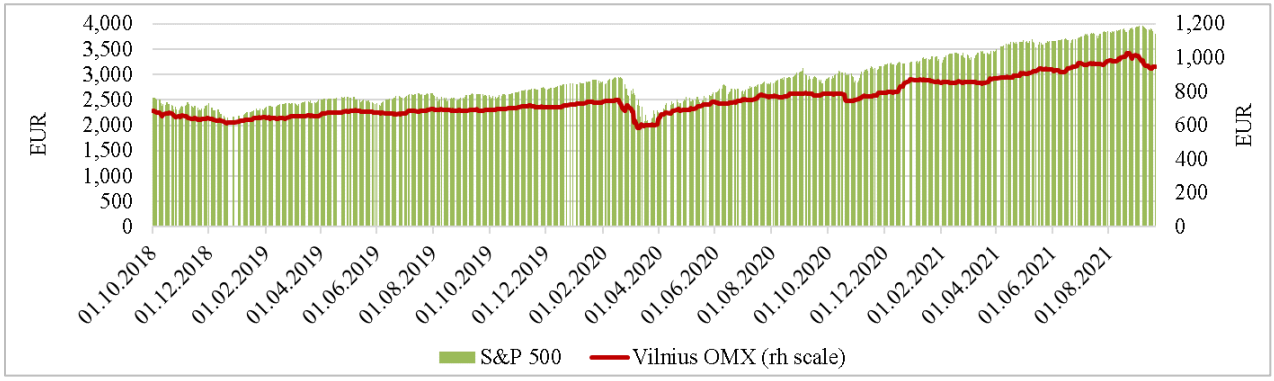
Gold and art pieces are the second most preferred investment tools in Lithuania. As Figure 7 indicates, during the economic shocks, such as the financial crisis in 2008-2010 and the recent pandemic outbreak in 2020-2021, the gold price increased, which suggests the countercyclical features of the asset. In general, the risk appetite for Lithuanians is comparably low since, based on Gulseven and Ekici (2020), the riskiness of the optimal portfolio to hedge against inflation increases markedly in the absence of real estate assets and gold, which are the most preferred assets classes in Lithuania. As for pieces of artwork, this investment class attracts not only due to the price appreciation but also because it could be a design décor at home. Also,

in the same manner, as real estate assets, artworks are an easily understandable asset class due to the practical-purpose serving underlying asset.

Stocks

Figure 8

Prices of S&P 500 and Vilnius OMX Stock Indices



Note. Created by the author. Data are from Nasdaq Baltics (2021) & Yahoo Finance (2021).

The stocks market in Lithuania has been expanding over the last decade. The Lithuanian benchmark index for the stock market is OMX Vilnius, which has been on a steady expansion path recently. However, compared to the S&P 500 benchmark index, which defines the optimal market portfolio of shares in the USA, the Lithuanian benchmark has displayed less robust results (38% versus 47.5% price changes over the last three years) (Figure 8).

Table 1

Statistics for the First-Order Difference of S&P 500 and OMX Vilnius Indices

Variable	Mean	Median	S.D.	Min	Max
d_SP500	1.67	3.21	37.13	-283.30	200.9
d_VilniusOMX	0.35	0.39	5.21	-63.91	28.60

Note. Created by the author. Data are from Nasdaq Baltics (2021) & Yahoo Finance (2021) for the period October 2018 – October 2021.

In Table 1, the first-order difference was used to bring data closer to a normal distribution and get rid of a price appreciation trend. Table 1 suggests that the standard deviation of the S&P 500 first-order difference over the last three years is more than seven times higher compared to

the Vilnius OMX index. It implies that observations for the market portfolio in Lithuania are less scattered around the mean, compared to the USA. Therefore, the Lithuanian market portfolio is relatively less risky, but should, in theory, make investors expect less robust returns.

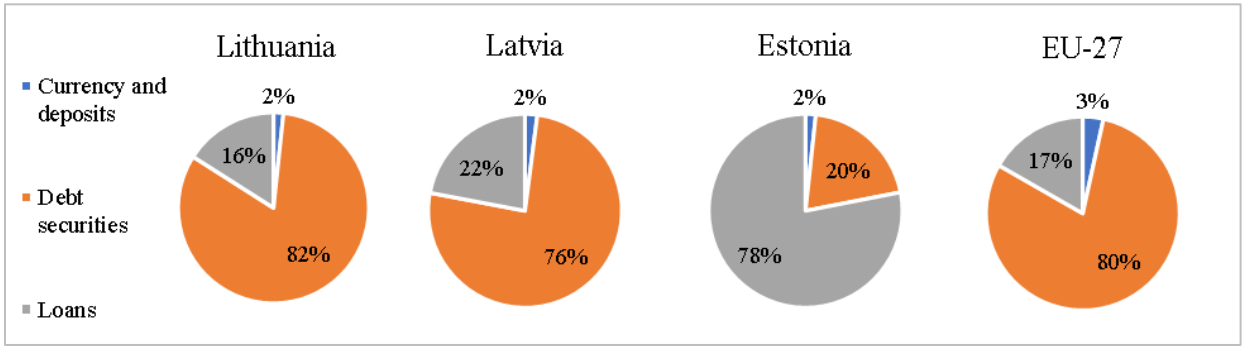
According to Bacevičius and Cibas (2021), the shares of *AB Šiaulių bankas* remain the most liquid in Lithuania the second year in the row. Investors who originated in Lithuania are the most active participants of the Vilnius stock exchange, accounting for more than three fourth of the total investors' pool (Bacevičius & Cibas, 2021). According to Invalda (2021a), Lithuanian companies' stocks have generated the most robust return of ca. 7.1% annually over the last ten years, which is the leading performance among other investment classes in the local market.

Bonds

Regarding the bonds market, it is not yet fully saturated in Lithuania. This market is mainly stipulated by governmental bonds, with long-term maturity being the main financing instrument for governmental debt in Lithuania, as seen in Figure 9. According to Nasdaq Baltic (n.d.), the overall bond issue as of October 2021 stood at ca. EUR 6.9 bln (compared to EUR 1.6 bln in Latvia and the value of zero in Estonia).

Figure 9

Gross Government Debt by Financial Instrument, 2015-2020



Note. Created by the author. Data are from the European Central Bank (2021).

According to Invalda (2021a), Lithuania was commonly perceived as a risky investment environment several decades ago. However, the outlook is gradually changing. The maturing market is reflected by the fact that investors did not liquidate the bond holdings in 2020 so massively as during the financial crisis in 2008-2009 (Invalda, 2021a). The average annual

returns over the last decade in the Lithuanian bond market (1.6%) are more modest compared to such matured markets as the USA (4.4%) or Germany (4.3%) (Invalda, 2021a).

Another class of bonds is corporate bonds. As Nasdaq Baltics announces, the total size of the corporate bonds market is ca. EUR 1.6 bln (as opposed to EUR 0.35 bln and EUR 0.25 bln in Latvia and Estonia, respectively) as of October 2021. The most popular bonds belong to the Ignitis and Maxima groups (sharing approximately EUR 1.2 bln or 75% of corporate bonds market) (Nasdaq Baltic, n.d.). The substantial focus has also shifted towards the so-called green bonds for sustainable projects financing, with the examples set by Auga and Ignitis groups. The increasing popularity of the corporate bonds market in Lithuania is reflected by numerous listings in Nasdaq First North, which is an alternative, non-regulated securities market. As of October 2021, there were seven companies on Nasdaq First North with a total issue of ca. 33 mln (in relation to 45 mln in Latvia and 19.7 mln in Estonia) (Nasdaq Baltic, n.d.).

Problem Formulation

Situation analysis of financial literacy and investment markets in Lithuania reveals that the levels of financial literacy are below-average, and there are severe educational gaps in understanding basic financial literacy concepts. Research also states that Lithuanian investment habits are relatively insufficient, with most people retaining savings in cash. Particularly, with the rough decrease in interest rates on deposits recently, the necessity of financial markets knowledge has increased to pick a financial instrument for investment. Thus, it calls to evaluate whether and how much financial literacy determines investment habits in Lithuania.

Theoretical Justification and Research Methods

Financial Literacy Concept

Since financial literacy is a broad and indefinite concept, many researchers argue on the definition of this phenomenon. One of the most cited definitions was written by Lusardi and Mitchell (2014), where financial literacy was expressed as the ability to make informed financial decisions. Another well-known understanding is provided by OECD (2020a), which recognizes financial literacy as an aggregate result of knowledge, behavior, and attitude. Another popular approach is to view financial literacy as a human capital input, underlying the ability to understand and use financial information (Huston, 2010). The application of cognitive skills,

especially numeracy, is another common consideration in defining financial literacy (yet, nowadays, it is compensated by calculators and software) (Huston, 2010). Even though researchers fail to find a consensus on the topic, most definitions underline the repeating keywords that financial literacy is the mix between financial knowledge and financial skills (Nicolini & Haupt, 2019).

The analysis in this paper understands financial literacy as per OECD definition since it incorporates common points from different research outputs. As mentioned before, OECD (2020a) understands financial literacy as a mix of financial knowledge, financial behavior, and financial attitude. Financial knowledge ensures the ability to make well-informed assessments of financial products and services and relates to confidence (OECD, 2020a). Behavior reveals long-term financial planning capabilities and a rational mindset which shows whether a person can judge the opportunities in capital markets individually or instead seeks help from others (OECD, 2020a). Lastly, financial attitude describes awareness in seeking financial wellness (OECD, 2018, as cited in OECD, 2020a). From the theoretical point of view, financial literacy depends on a person's time preferences. According to Monticone (2010), financial literacy is an investment into individual financial wellness for the future, and those who tend to discount their future are likely to remain less financially knowledgeable compared to future-oriented people.

An important consideration is that financial literacy depends considerably on demographic factors. Gender helps to predict financial literacy scores in a way that men are found to be more financially literate than women (37.2% of men versus 12.1% of women fall within the most advanced financial literacy quartile) (Van Rooij et al., 2011). In terms of age, financial literacy scores tend to be lower for the young, the highest among middle-aged respondents (working-age population), and usually start declining approaching retirement, with a negative skew in distribution (Van Rooij et al., 2011). Agarwal et al. (2007) state that this represents a reverse U-shaped distribution. Financial literacy rises from gained experience as a person matures, followed by the subsequent drop approaching retirement due to deteriorating analytical capabilities, worse cognitive functions, as well as "diminishing returns to learning" (Agarwal et al., 2007, p. 27). Regarding education, Lusardi and Mitchell (2011b) established a correlation between education and personal finance knowledge, supporting the idea that higher levels of education usually lead to better financial literacy scores. Yet, education should be

perceived as an imperfect proxy that is positively correlated with financial literacy, but not equivalent concepts. They both turn out statistically significant when included in the same regression model (Lusardi & Mitchell, 2011b). Another consideration influencing financial literacy is parents' educational attainment, especially from the maternal side (Lusardi & Mitchell, 2014).

Socio-economic factors also play a crucial role in financial literacy achievements. Such characteristics as employment status (employed people tend to have higher financial literacy scores compared to the non-working population, while even more robust financial literacy is found among self-employed individuals) and occupation (managers display higher financial literacy scores) are claimed to matter (Gallery et al., 2011; Lusardi & Mitchell, 2011b). In addition, financial literacy depends on income levels and correlates with it positively (ANZ Bank, 2008, as cited in Gallery et al., 2011). Some studies find that the racial and ethnic aspects also influence financial literacy achievement (Lusardi & Mitchell, 2011b). However, this paper does not elaborate on this perspective deeper due to the lack of diversification in races in Lithuania and ethnic identities being the statistically insignificant minorities. Region of residence is another consideration as city-dwellers are usually better financially-informed than rural residents (Lusardi & Mitchell, 2011b). The source of information also matters. Financially illiterate people tend to rely on family and friends as their sources for investment advice (Van Rooij et al., 2011), while financially advanced people are more eager to research independently and rely on analytical market analyses.

Financial Literacy Relation to Investment Markets

According to Nicolini (2019), financial literacy association with long-term financial planning has become essential, especially after the appearance of the multi-pillars pension scheme. Pension, based on voluntary contribution and supposedly bearing the highest returns to retirement, "stresses the need to be financially literate" and plan the savings more responsibly (Nicolini, 2019, p. 2). However, the ability to manage personal finance has the fundamental condition – financial markets understanding. As the research implies, financially literate people are indeed more likely to choose long-term investing because they can appreciate the power of compounding interest (Lusardi & Mitchell, 2007).

Classical economic theories presume that all investors are rational, fully-informed, and have the same preferences, so they will consider all available opportunities and allocate their limited resources efficiently. Early economic outputs by Friedman (1957) stated that rational individuals should smooth the marginal utility over time and accumulate savings during the high-income periods to support future-self when income drops or becomes absent (as cited in Lusardi & Mitchell, 2014). However, such a practice does not hold in real life. In reality, many people fail to save in advance due to numerous factors, including psychological biases, misperception of risk, short-run preferences, and, according to Lusardi & Mitchell (2014), a lack of knowledge about long-term investment planning.

This paper adopts the logic from the Keynesian equation, which displays that the total aggregate savings are equal to the total aggregate investment in the economy. Thus, investment behavior is highly dependent on accumulated savings, which are proven to be partially explained by the concept of financial literacy. Deuflhard et al. (2015) estimated that a household earns on average 39 basis points extra returns with the advancement from the lowest financial literacy quartile to the highest. Bernheim & Garrett (2003) also discovered that employees' savings rates are by ca. 4.5% higher and, consequently, they have more accumulated assets when an employer proposes financial education programs at work. As savings are expected to be accumulated in the form of investment, the further analysis focuses on how researchers associate financial literacy with investment decisions. In general, most empirical evidence pieces establish a strong connection between financial literacy and investment decisions (Table 2).

In general, investment decisions are investors' choice to place savings in an investment instrument (Subramaniam & Velnampy, 2017). The knowledge of the financial concepts should eliminate uncertainty cascades and help evaluate all investment options in the market. The most suitable investment option is a personal judgment, given the individual mix and horizon (Subramaniam & Velnampy, 2017). Yet, as behavioral finance theories predict, investors are not entirely rational and usually choose acceptable yet not optimal investment solutions (Subramaniam & Velnampy, 2017). Thus, the financial literacy concept is expected to grasp at least partially the financial decision-making rationale, because lack of knowledge is an essential consideration for investment opportunities (Subramaniam & Velnampy, 2017).

Table 2

Selected Research Evidence of Financial Literacy Impact on Investment Decisions, Real Estate, and Stocks Holdings

		Authors	Year	Country	Methods used	Results
POSITIVE IMPACT	INVESTMENT DECISIONS	Bernheim, B. D., & Garrett, D. M.	2003	USA	OLS, quantile regression, and probit models	Employees' savings rates rise by 4.5%, and, as a result, they have more accumulated assets with financial education programs at work. Participation in long-term investing (retirement planning) goes up by 12.1% with financial education programs at the workplace.
		Deuflhard, F., Georgarakos, D., & Inderst, R.	2015	Netherlands	OLS regression, instrumental variable approach	A positive relationship is observed between the savings interest rate (increase by 29 basis points) and financial literacy, leading to a higher aptitude for investment.
		Lusardi, A., & Mitchell, O. S.	2011	USA	OLS regression, instrumental variables approach	Answering all three financial literacy questions correctly leads to a 9.1% higher likelihood of long-term investing. One additional answer to financial literacy questions brings a 4.3% likelihood that a person plans personal finance (for retirement purposes).
		Mian, T. S.	2014	Saudi Arabia	OLS regression	The positive relationship exists between the financial literacy and the long-term investment decision (for retirement), with β=0.285.
		Nicolini, G., & Haupt, M.	2019	Germany, France, Italy, Sweden, the UK	Logistic regression model	In more than 100 statistical analyses, financial literacy failed to explain financial behaviors 17 times, appearing as statistically significant. Financial literacy is positively tied to long-term investment decisions. One additional correct answer testing financial knowledge is found to increase the likelihood to (1) save for rainy days, (2) plan for retirement, (3) mutual fund investments.
		Tabiani, S., & Mahdzan, N. S.	2013	Malaysia	Probit regression	Financial literacy positively and significantly influences the probability of saving decision, which is the base for long-term investing.
	REAL ESTATE	Ongan, S., & Gocer, I.	2017	USA	Panel unit root and cointegration tests	With the rise of uncertainty on home prices, negative effects are less evident in more financially literate cities compared to less literate cities.
	STOCKS	Almenberg, J., & Widmark, O.	2011	Sweden	Probit regressions	A unit increase in financial literacy score leads to the probability of participating in the stock market rising by 6%.
		Fong, J. H., Koh, B. S., Mitchell, O. S., & Rohwedder, S.	2021	Singapore	Probit regressions	Financial literacy is significantly and positively related to stock market participation: a unit rise in financial literacy score leads to an 8.3% higher propensity of holding stocks investment.
		Mian, T. S.	2014	Saudi Arabia	OLS regression	Financial literacy is positively and significantly related with stock market participation, with β=0.259.
		Van Rooij, M., Lusardi, A., & Alessie, R.	2011	Netherlands	OLS regression, generalized method of moments	One unit increase in financial literacy quantiles leads to an increase of stock market participation by ca. 8%.
NEGATIVE IMPACT	INVESTMENT DECISIONS	Al-Tamimi, H. A. H., & Bin Kalli, A. A.	2009	UAE	Logistic regression, one-way ANOVA test	Financial literacy bears a negative and significant effect on investment decisions.
		Hayat, A., & Anwar, M.	2016	Pakistan	Linear regression, ANOVA	Financial literacy affects investment decisions significantly negatively.
	REAL ESTATE	Calcagno, R., & Urzi-Brancati, M. C.	2014	Italy	Pooled OLS regression	An extra correct financial literacy answer decreases the share of housing wealth by 0.009 points. In the meantime, answering all three financial literacy questions correctly shows a 0.015 points lower share of housing wealth. The impact is stronger for the older respondents.
NO IMPACT	INVESTMENT DECISIONS	Ademola, S. A., Musa, A. S., & Innocent, I. O.	2019	Nigeria	Partial Least Square	Financial literacy does not affect investment decisions significantly.
		Mazumdar, S.	2014	India	Chi-Square test	There is no statistically significant relationship between financial knowledge and investment decisions (particularly to equity, fixed income instruments, real estate, gold, cash).
	REAL ESTATE	Almenberg, J., & Widmark, O.	2011	Sweden	Probit regressions	Financial literacy is found not to predict homeownership.

Note. Created by the author from consolidated findings.

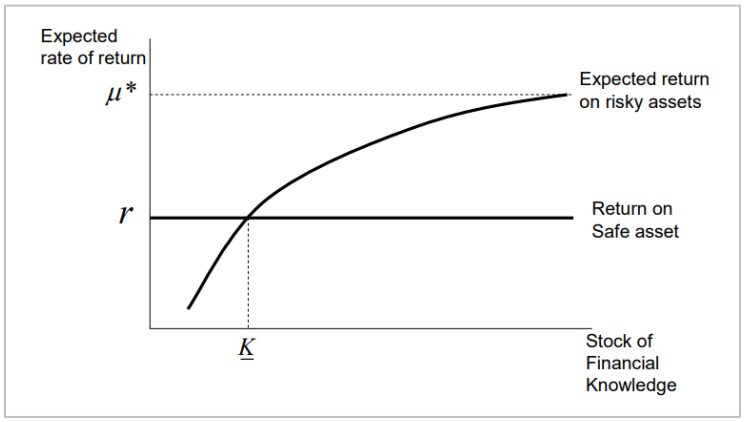
Most studies find that financial literacy determines consistent investment decisions (Table 2). Lusardi and Mitchell (2014) establish a causal link between financial literacy and finance-related decision-making since limited understating of financial concepts makes it

challenging to use complex markets tools that call for "sophisticated financial decision-making" (p. 42). In addition, financially illiterate households are subject to lower wealth accumulation as they are likely to diversify less and be not even aware of certain investment opportunities. Back in the 20th century, Markowitz (1952) claimed that investors construct certain beliefs about securities. Chang et al. (2010) elaborated on this point saying that investors tend to avoid financial products with which they are unfamiliar. Hence, it is acknowledged that financial literacy is one of the fundamental factors for selecting a portfolio.

Delavande et al. (2008) also establish a strong connection between financial literacy and investment markets and highlight that financial sophistication leads to a higher expected rate of returns on risky assets, given the constant risk tolerance, as shown in Figure 10. Investors tend to make investment decisions given their expected utility (Hodnett & Hsieh, 2012). Hence, financially literate people are more eager to participate in investment market activities as higher expected returns cause higher expected satisfaction. Abdeldayem (2016) elaborated on such observation and stated that less literate investors prefer safe investments, while more literate market participants prioritize riskier and more complex instruments, which bring a higher return.

Figure 10

Effect of Financial Knowledge on Portfolio Rate of Return



Note. Adapted from "Preparation for retirement, financial literacy and cognitive resources" by Delavande et al., 2008, p. 42.

Moreover, financial knowledge is a part of the human capital production function. A financially knowledgeable person could adapt more quickly to changes in markets due to a

higher learning rate (Delavande et al., 2008). Therefore, financially savvy people should participate more actively in the investment market and make more profitable investments, as they make decisions timelier. Furthermore, financial illiteracy causes “inertia and suboptimal” decisions (Gallery et al., 2011, p. 4). The literature claims that financially illiterate households tend to make quick investment decisions and heavily rely on previous experience because they lack the skills to use data analysis tools to assess the current market state (Subramaniam & Velnampy, 2017).

Based on the above-stated findings, this paper expects to observe a positive and significant effect of financial literacy on investment decisions (as per Bernheim & Garrett, 2003; Deuflhard et al., 2015; Lusardi & Mitchell, 2011a; Mian,2014; Nicolini & Haupt, 2019; Tabiani & Mahdzan, 2013) with the numeric magnitude of influence specified in Table 2.

On the other hand, not all research outputs find the existing relationship between financial literacy and investment decisions (see Table 2). Ademola et al. (2019) reveal that the link between the two is positive but insignificant in Nigeria. Mazumdar (2014) found that among Indians, no significant relationship is evident between financial literacy and personal investment decisions, arguing about social norms, upbringing, and psychological biases. Hayat and Anwar (2016) proposed that financial literacy and investment decisions have statistically significant negative ties in Pakistan. However, the authors outlined that most of the investors in the country tend to be illiterate and usually make only short-term investments (Hayat and Anwar, 2016). Al-Tamimi and Bin Kalli (2009) also provided evidence that financial literacy has a significant negative relationship with investment decisions in UAE and insignificant relation with preferences for accounting information, which is considered a vital tool for equity investors. The researchers argued that financially literate people depend less on factors that affect groups and tend to rely on unique characteristics (Al-Tamimi & Bin Kalli, 2009). Authors also elaborate that the establishment of the relationship between financial literacy and investment decisions is highly reliant on socio-economic and political factors (Al-Tamimi & Bin Kalli, 2009).

As common in economics, many concepts tend to be interrelated. Some researchers have even tried to establish an opposite dependency relationship, implying that investment decisions might impact financial literacy, not otherwise. Due to the fact that experience is the solid way of learning, hands-on investment experience might impulse to read more, clarify unknown

concepts, and, in general, see what the market is and how it works (Monticone, 2010). As Monticone (2010) establishes, it is probably a "both directions" causality (p. 405). This paper relies primarily on the rationale from previously discussed writings which imply that financial literacy helps to explain investment choices by households.

The further analysis will focus on two investment products – real estate and stocks. Real estate investment instrument is picked due to Lithuanians' affection for this investment class. Stock-holdings are deeper explored because of empirical evidence of a strong link between higher financial literacy and more active stock markets. In general, the findings by Almenberg and Widmark (2011) emphasize that financially literate people are more likely to opt for riskier investments, which might include both real estate markets (as real estate requires high leverage and is illiquid) and stocks (due to high prices volatility).

Investments in the residential real estate market sparked the clash of opinions in literature. From one perspective, evidence suggests that financially literate people have lower preferences for holding illiquid assets and would tend to exclude housing assets from their portfolios (Calcagno & Urzi-Brancati, 2014). Researchers suggest that answering all financial literacy questions correctly leads to a 0.015 points lower housing wealth share (Calcagno & Urzi-Brancati, 2014). Another view is that financial literacy does not affect owning housing assets. It is argued that only numeracy, but not financial literacy, predicts real estate holdings due to the competency to compute risks (Almenberg & Widmark, 2011). This paper argues that incentives targeted at intermediaries (mortgages suppliers) explain real estate investments better than illiterate households (Almenberg & Widmark, 2011). Furthermore, since real estate concerns the acquisition of physical property, financial literacy might not be that crucial in such kind of investment. People grew up surrounded by residential real estate, so the underlying asset is well-recognized and serves a practical use that brings awareness for investors. Yet, there is a strong emphasis that real estate investors should have advancement in financial matters to make a well-informed selection from all available assets in the market rather than rely on other people's suggestions (Musundi, 2014, as cited in Abdeldayem, 2016). Ongan and Gocer (2017) confirm such findings and explain that increasing uncertainty in housing markets has lower negative spillovers for more financially-literate citizens and that financially illiterate people drive uncertainty on housing prices. Thus, this study expects that financial literacy is related to real

estate holdings but does not try to predict the sign of relationship due to non-uniform literature findings.

Meanwhile, almost all researchers agree that stock market participation is positively and substantially determined by financial literacy (Table 2). Especially in the context of the stock market, people with a lower level of financial literacy are unlikely to invest due to a lack of knowledge on asset pricing techniques (Van Rooij et al., 2011). In numerical terms, a unit increase in financial literacy score leads to a higher likelihood of stock market participation by 6-8% (Almenberg & Widmark, 2011; Fong et al., 2021). Lusardi and Mitchell (2014) validate such findings by demonstrating that moving from lower-medium (25^{th}) to upper-medium (75^{th}) percentiles, financial literacy causes a 17-30% higher likelihood of investing in stocks.

Factors Influencing Investment Decisions

As established above, financial literacy is perceived as an important explanatory variable for investment decisions. However, investment is an aggregate phenomenon, and many contextual factors determine investment choices. Other explanatory dimensions are detailed below, with a specific focus on real estate and stock holding, given their further importance in explaining Lithuanians' investment choices.

First of all, demographic characteristics are told to be relevant. Gender is one of such factors. Males are expected to be higher risk-takers and prefer equity investments with a more extreme asset allocation proportion (Agnew et al., 2003; Bajtelsmit & Bernasek, 1996). Other demographic perspectives are age and education. The theory of life cycle states that people make investment choices at each age being constrained by spare resources (Ademola et al., 2019). In 1954, Modigliani and Brumberg introduced age as a finite variable and suggested that the working-age population should be the most active investors class thinking about retirement when income becomes irregular, insufficient, or absent (Ademola et al., 2019). In addition, according to Chavali and Mohan Raj (2016), age and risk tolerance are inversely related variables, and the younger households are expected to opt for riskier investment instruments. Although the elderly has the least tolerance for risk, Calcagno and Urzi-Brancati (2014) find that older people tend to accumulate more illiquid assets. Thus, the investment decision model could expect older people to hold more real estate assets. Regarding education, Lusardi and Mitchell (2007) claim that low

levels of education usually seed investments deficiencies. Thus, educated people are more likely to hold any investment instrument.

What also matters is the socioeconomic characteristics. Disposable income is one of such variables explaining investment decisions (Lusardi & Mitchell, 2011a) because the more extra savings a household has, the more agility there is for investment. Savings habits should also be proportionally related to investment, but the collected and non-invested savings are inversely related to the investment decision. In addition, employed people should invest more, especially those working in financial services, investment, or banking sectors are more likely to make better financial decisions (Al-Tamimi & Bin Kalli, 2009). As for the family status, single-person households usually have a higher risk appetite, but married couples may pursue risky investment decisions due to double income (Grable and Joo, 2000, as cited in Chavali & Mohan Raj, 2016). However, it is relevant to note that subsistence expenses for larger households go up accordingly. Furthermore, city residents should invest in real estate more because residential real estate investors usually pick investment properties close to where they live, and cities are much livelier investment environments than rural areas (D'Lima & Schultz, 2021).

The theory also suggests that behavioral finance can help to assess investment options. Irrational decisions are encoded in people's beliefs, and preferences (Subramaniam & Velnampy, 2017). Hence, various psychological biases, such as overconfidence or loss-aversion, and certain expectations help explain investment decision-making (Gallery et al., 2011). Planning habits also predict investment decisions due to defined financial future expectations. Self-perception could also determine behavioral finance as anticipating oneself in a good financial state raises confidence for financial stability (Duval and Wicklund,1972, as cited in Mumtaz, 2018). In addition, if the purpose of planning is a long-term gain, such an investor is also more likely to participate in investment market activities (Lusardi & Mitchell, 2014). Moreover, the core investment principle says, higher risk leads to a higher return. Investors should earn a risk premium when choosing riskier assets. Risk tolerance is one of the most considerable factors determining individual investment opportunities when the uncertainty for expected results is high (Chavali & Mohan Raj, 2016). However, risk appetite is hard to conceptualize, and it is usually non-directly reflected in various models through demographic and socio-economic variables, such as age, gender, earnings, and others, as they entail a great deal of explanation.

Research Methods

Across the world, many researchers were similarly trying to answer whether and how much financial literacy can explain investment choices in different countries. However, to my best knowledge, this is the first study answering such a question in Lithuania. Since previous studies used heterogeneous data sets, different methods were employed in solving this research problem, as well (the most commonly used research methods are specified in Table 2). In this thesis, the logistic model is chosen due to its efficiency when predicting dummy dependent variables.

Financial Literacy

Due to the complexity of the financial literacy concept, no universal measurement technique has been derived so far (Huston, 2010). There are two main measurement techniques of financial literacy: questionnaires and the self-assessment approach. The most frequently referred questionnaire for financial literacy is created by Lusardi and Mitchell (2011b), which uses the concepts of compounding interest rates, inflation, and risk diversification (usually referred to as *Big Three* questions). All three or at least several of the given questions are re-used in many global financial surveys, including the Bank of Lithuania *Survey of Households H2 2018*, which will be further on investigated in the empirical analysis part of this paper.

The self-assessment approach of financial literacy is also quite common in literature due to empirical evidence of a high correlation between self-efficacy and financial literacy scores (ANZ/The Social Research Center, 2011, as cited in Titko et al., 2015). However, Lusardi and Mitchell (2011b) claimed that younger people usually know less about finance but tend to acknowledge it, while older individuals assess themselves as being financially advanced, even though they tend to have a below-average knowledge. This paper will also test how the self-assessed financial literacy is distributed against actual scores using the Banks Association of Lithuania (2021) dataset. The attention will also be placed on statistical analysis to reflect financial literacy scores given different demographic and socio-economic characteristics specified in the literature review.

However, the primary focus in this study will be on assessment through the questionnaire. The household survey questions (Bank of Lithuania, 2018b), examining

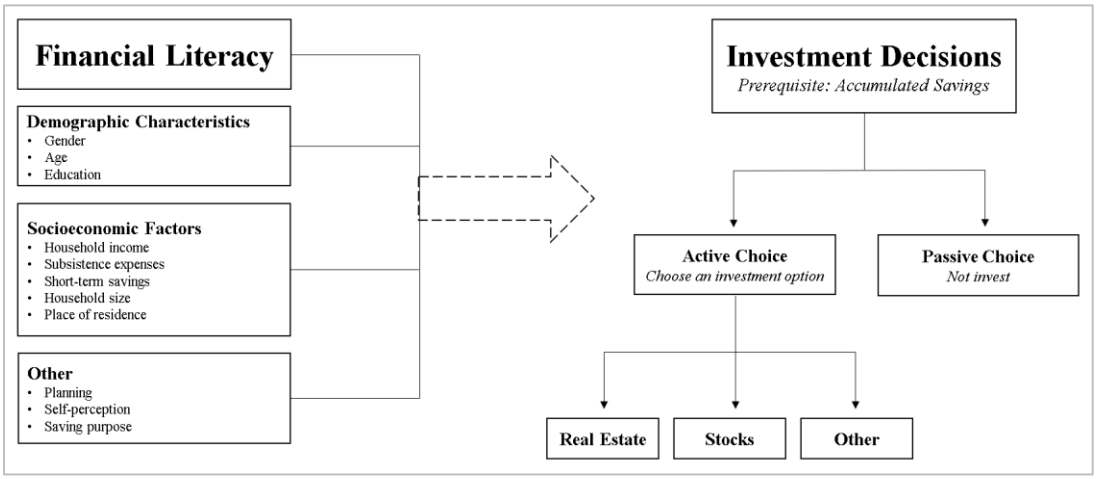
understanding of interest rate, inflation, and loan conditions, will be used for financial literacy determination and further associated with investment decision variables in the regression model.

Investment Decisions Model

This thesis uses binary logistic regression to construct the investment decisions model (as per Al-Tamimi & Bin Kalli, 2009; Nicolini & Haupt, 2019). Researchers use binary logistic models when predicting the outcome for dichotomous variables. It uses the maximum likelihood technique when the dummy dependent variable is bounded by 0 and 1. The final output in the model is provided in terms of the probability of some pre-specified event. The outcomes under 0.5 are perceived as 0 (a particular event does not happen), while values above 0.5 are identified as 1 (pre-specified event happens). Binary logistic regression was preferred over the linear probability model (also commonly used with dummy dependent variables) because the logistic model is bounded by 0 and 1 and is expected to yield more realistic results.

Figure 11

Financial Literacy and Investment Decisions Model



Note. Created by the author and partially adapted from "Framework for assessing financial literacy and superannuation investment choice decisions" by Gallery et al., 2011, p. 7.

In this paper, households' investment decisions will be taken as a dummy dependent variable, with financial literacy and numerous control variables used as independent ones. This paper aims to determine how financial literacy influences the general decision to hold any financial instrument for saving. Also, additional focus in the empirical part will be placed on

how financial savviness impacts the decision to invest in real estate assets and stock holdings in Lithuania. The rationale behind the investment decisions model is visualized in Figure 11. The excepted effects of explanatory variables to be used in empirical research (based on available information in the Bank of Lithuania (2018b) dataset) are listed in Table 3.

Table 3

Explanatory Variables for Regression Models

Independent Variables	Abbreviation	Kind	Measurement Scale	Investment Decision	Investment to Real Estate	Investment to Stocks
Financial literacy variable						
Financial literacy	*FinLit_B*	Categorical	1 - all three financial literacy questions answered correctly 0 - otherwise	+	+ / -	+
	FinLit_N	Numeric	Count of correct answers to financial literacy questions	+	+ / -	+
Interest Rate	*IntRate*	Categorical	1 - answered correctly 0 - otherwise	+	+ / -	+
Inflation	*Inflation*	Categorical	1 - answered correctly 0 - otherwise	+	+ / -	+
Loan Conditions	*LoanCond*	Categorical	1 - answered correctly 0 - otherwise	+	+ / -	+
Demographic factors						
Gender	*Gender*	Categorical	1 - man 0 - woman	+	N/A	+
Age	*Age*	Categorical	1 - 18-29 years old 2 - 30-49 years old 3 - 50+ years old	-	+	-
Education	*Education*	Categorical	1 - primary education 2 - not finished secondary education 3 - secondary education 4 - Vocational (vocational school, secondary with vocational qualification) 5 - High school (technical school, high schools) 6 - Non-university higher (college) 7 - University degree - Bachelor's degree 8 - University degree - Master's degree or equivalent professional qualification 9 - University graduate - Doctor of science (PhD)	+	+	+
Socioeconomic factors						
Household income	*Income*	Categorical	1 - EUR <401 2- EUR 401-800 3 - EUR 801-1200 4 - EUR 1201-1600 5 - EUR >1600	+	+	+
Subsistence expenses	*Subsistence*	Numeric	In euros	N/A	-	N/A
Short-term savings habits	*Savings*	Categorical	1 - 0 EUR / mth 2 - 30 EUR / mth 3 - 31-150 EUR / mth 4 - 151-300 EUR / mth 5 - 301-600 EUR / mth 6 - >600 EUR / mth	+	N/A	+
Household composition	*Size*	Numeric	Headcount of people	-	-	-
Place of residence	*Location*	Categorical	1 - city 0 - smaller town, rural area	N/A	+	N/A
Other						
Planning	*Planning*	Categorical	1 - plan 0 - otherwise	+	+	+
Self-perception	*Perception*	Categorical	1 - good 0 - otherwise	+	+	+
Saving purpose	*SaveToInvest*	Categorical	1 - savings purpose is investing (either for favorable return on assets (i.e. the opportunity to earn interest on available savings) or for generation of the long-term savings) 0 - other savings purpose / no savings purpose	+	+	N/A

Note. Created by the author. The choice of variables and logic for their signs are based on the afore-stated literature overview. *Gender* variable is not used for real estate due to lack of empirical evidence for such relationship. The *Short-term savings habits* variable was replaced by *Subsistence expenses* in the real estate model as the initial investment for this asset is high and requires covering households' subsistence. Both variables were not used in the same model due to their logical identity. *Place of residence* is related only to real estate in research works, while *Savings purpose* is not found to be relevant for stocks, as most third-party brokers do not put a minimum order limit. The detailed descriptions per each variable are specified in Table B1.

Hypotheses

Based on the findings from the literature review, this paper intends to test the following hypotheses:

H1. Financial literacy is positively related to holding an investment instrument;

H2. Financial literacy is related to holding investment into a real estate asset;

H3. Financial literacy is positively related to holding an equity investment.

Limitations

This research is exposed to certain limitations. First of all, some respondents might have guessed one or several answers, and it might lead to mistaken conclusions for financial literacy impact on investment decisions. In addition, this research is limited to the extent of the survey data, and some explanatory variables (e.g., working sector, family composition, etc.) are not available. Also, the survey was done at a certain point in time and cannot guarantee that answers to questions would remain the same if respondents were re-assessed.

Empirical Research

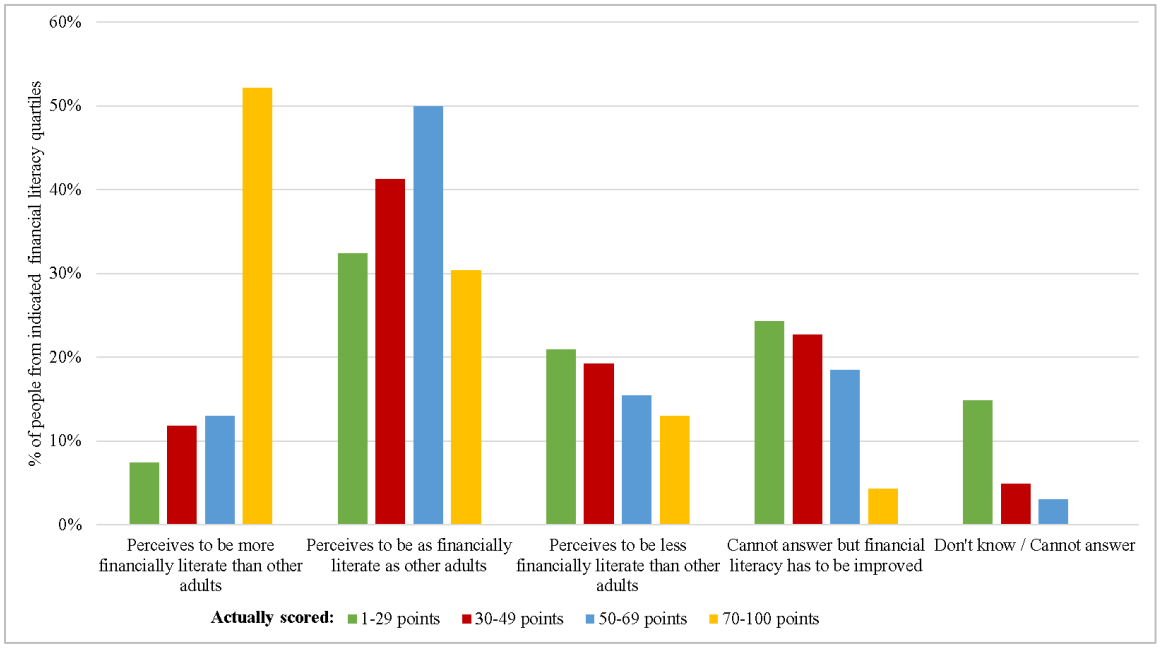
Statistical Analysis of Financial Literacy

Before diving deeper into assessing the financial literacy relationship with investment decisions, the study examines whether financial literacy observations adhere to literature review findings. For this purpose, the data was obtained from the Banks Association of Lithuania (2021), which concerns the answers of 1,013 Lithuanian respondents collected in March 2021.

As detailed in Table A2, the mean (45.17) and median (45.00) metrics are not dispersed, meaning that financial literacy in Lithuania is relatively normally distributed (confirmed by the visual representation in Figure A1). Overall, financial literacy varies consistently with predictions from the literature review in Lithuania (Figure A2, Table A3). Men outscore women in the relative comparison for financial literacy (39% of men versus 36% of women score above average) and have a 2.1% higher likelihood to fall within the most advanced financial literacy quartile. The advancement in financial literacy also gradually increases with maturity and peaks at 46-55 years old but starts declining quite rapidly afterward. Moreover, education is a significant factor for scoring higher achievements since 65% of the most advanced financial literacy quartile has already completed or is about to obtain higher education. Socioeconomic perspective is relevant, as well. While family status does not predict financial literacy in Lithuania, a living place variable shows that financially literate people tend to live in cities. What is more, income seems to correlate positively with financial literate at the estimated rate of 0.19.

Figure 12

Comparison of Self-Assessed Financial Literacy versus Factual Scores



Note. Created by the author. Data are from the Banks Association of Lithuania (2021).

Interestingly, the actual financial literacy scores indeed correlate with the self-assessed financial literacy in Lithuania. Figure 12 shows that 52% of all people achieving the most advanced financial literacy quartile claim to have higher financial literacy than others. However, some people having an actual financial literacy score below average are eager to overestimate their financial skills (Lusardi and Mitchell, 2011b). Data shows that men (53%), the working-age population (54% being people aged 26-45), and city residents (54%) are the most confident about their financial competencies and tend to categorize themselves as more financially knowledgeable than the average (Table A4).

Data overview

The dataset used to assess financial literacy impact on investment decisions was obtained from the Bank of Lithuania (2018b)[1]. The purpose of the survey was to collect detailed information on households' financial habits in Lithuania through 85 financial planning questions. Table B1 presents the formulation of selected questions used in the further analysis.

The sample consists of cross-sectional data of responses collected from 1,000 households who in this study are generalized for the population of Lithuania. This research was conducted in August 2018 on Lithuanian households who are 18 years old and elder (Bank of Lithuania, 2018a). In this research, a household is identified as an alone-living person or a group of people living in the same dwelling who share the costs and income for subsistence (no prerequisite for kinship or marital relationship) (Bank of Lithuania, 2018a).

For this study, the sample was narrowed down to 639 households for the investment decisions model and to 380 for real estate and stock holding models (using the rationale from Figure 11). Initially, the sample was reduced to 639 respondents (referred further as a *sample of savers*) after eliminating households with missing data and those who identified not using any financial instrument due to the absence of savings (as savings is a pre-requisite for investment). The savers' sample was further reduced to 380 households (referred to as *a sample of investors*) for real estate and stocks models, keeping in the analysis only respondents who use at least one financial instrument (eliminating savers in cash or on a bank account).

[1] Based on the "Statistinių duomenų teikimo sutartis Nr. 41.22-21". The contract is signed between the Bank of Lithuania and ISM University of Management and Economics.

Descriptive Statistics

Financial Literacy Variable

Bank of Lithuania (2018b) relies on financial literacy assessment on questionnaires (as per Lusardi & Mitchell, 2011b). The Bank of Lithuania (2018b) assesses that answering three questions on interest rates, inflation, and loan conditions is associated with the highest level of financial literacy. Three questions could be considered enough, as Huston (2010) recommends including three to five questions for a fair financial literacy assessment. A relevant consideration to financial literacy questions was the *Do not know* answer because Lusardi and Mitchell (2011) explain, such answers define the least financially knowledgeable respondents. Therefore, the *Do not know* answers were characterized as a lack of knowledge.

Table 4

Descriptive Statistics for Financial Literacy Variables

Variable	Explanation	Savers' sample		Investors' sample	
		Frequency	Percentage	Frequency	Percentage
FinLit_B	(1) All 3 questions answered correctly	265	41%	169	44%
	(0) Otherwise	374	59%	211	56%
FinLit_N	0 correct answers	69	11%	34	9%
	1 correct answer	116	18%	67	18%
	2 correct answers	189	30%	110	29%
	3 correct answers	265	41%	169	44%
InterestRate	(1) Correct answer	423	66%	254	67%
	(0) Otherwise	216	34%	126	33%
Inflation	(1) Correct answer	482	75%	302	79%
	(0) Otherwise	157	25%	78	21%
LoanConditions	(1) Correct answer	384	60%	238	63%
	(0) Otherwise	255	40%	142	37%

Note. Created by the author.

Further in the analysis, three distinct techniques will be used to measure financial literacy and evaluate financial literacy's impact on investment decisions. First of all, this analysis tests if answering all three financial literacy questions (*FinLit_B* variable) increases the odds of investing savings. In addition, financial literacy will be taken as a numeric variable with the

count of correct answers per respondent (*FinLit_N* variable). The higher the number of correct answers, the more financially literate a respondent is perceived to be. Moreover, it will be examined which of the specific financial literacy concepts (*IntRate*, *Inflation*, and *LoanCond* variables) are the most beneficial in determining the dependent variable. This study is curious to investigate if different measures of financial literacy yield a change in results (following Nicolini & Haupt, 2019).

Overall, over 40% of respondents in both savers and investors' samples answered all three financial literacy questions correctly, while ca. 10% of respondents answered all questions wrong (Table 4). Lithuanians seem to be the most aware of the inflation concept and least knowledgeable about loan conditions (since it was a computation question, it might be the case that respondents lacked computational skills to answer, as suggested by Huston, 2010).

Investment Decision Variables

Table 5

Investment Decisions Variables Descriptive Statistics

Variable	Explanation	Frequency	Percentage
InvDec	(1) Holding at least one investment instrument (namely term deposits, life insurance, pension funds, investment funds, bonds, stocks, real estate, etc.)	380	59%
	(0) Otherwise	259	41%
RE	(1) Holding RE as an investment instrument (namely, apartment, house, land, forest, etc.)	59	16%
	(0) Otherwise	321	84%
Stocks	(1) Holding stocks as an investment instrument	42	11%
	(0) Otherwise	338	89%

Note. Created by the author.

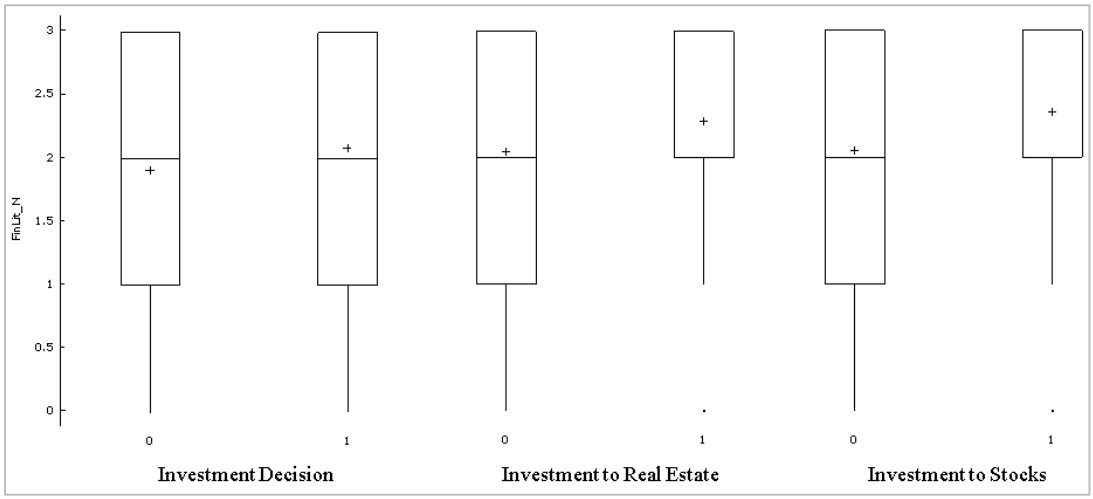
Investment decisions (with the separate specification for using real estate and stocks instruments) will be used as dummified dependent variables (Table 5). In total, the thesis will investigate nine separate regressions – three models for each of the raised hypotheses. However, only three out of nine equations will be analyzed in-depth and referenced as the primary ones.

Others will only complement findings. As for primary models, the thesis refers to regressions, where financial literacy is used as a binary variable (with 1 being all three correct answers, 0 otherwise). Equations with different measurements of financial literacy will show if changing the measure provides a difference in results. Firstly, the econometric models test whether financially literate people invest savings and are discouraged to save in cash. Furthermore, the analysis tests how financial savviness influences the willingness to choose investments, specifically in real estate and stocks.

As literature predicts, the decision to invest is bound to various factors. Cross-tabulation analysis reveals that of those who use at least one investment instrument, 61% were men, the majority were working-age, 66% hold a university degree, and 45% answered all three financial literacy questions correctly. The decision to invest is also found to relate positively to income levels and saving habits. The detailed information is in Tables B2-B7.

Figure 13

Factorized Boxplots for Financial Literacy Scores by Investment Decisions, Investment to Real Estate, and Investment to Stocks Variables



Note. Created by the author. Graph for *Investment Decision* uses the sample of savers, while *Real Estate* and *Stocks* variables are tested in the sample of investors, as specified previously.

The factorized boxplots in Figure 13 let us graphically observe the expected relationship of financial literacy achievements and the two groups – active and passive investors. Given the visual observations, it could be presumed that financial literacy might not be statistically

significant for the decision to hold at least one financial instrument because the median scores are equivalent to both groups while the difference of means is relatively marginal. Nevertheless, real estate choice seems to be impacted by the financial knowledge of the asset holder. What stands out from Figure 13 is that the relationship of the second hypothesis predicting that financial literacy is related to real estate holdings is likely to be positive. In addition, the quick graphical observations reveal that it is likely to observe a positive and significant relationship between financial literacy and decisions to utilize savings in stocks.

Other Variables

The regression selectively uses variables that are likely to be the most relevant for investment decisions, based on literature review findings. However, this study is limited by survey data. Thus, some relevant variables might be missing and left in residuals. Control variables for each model are specified in Tables 3 and B1.

Correlation

The correlation analysis is conducted to detect if none of the variables entirely depend on each other, which may cause difficulties with collinearity when fitting the model. The correlation analysis among the primary variables is provided in Table 6.

Table 6

Correlation Matrix

InvDec	RE	Stocks	FinLit_B	FinLit_N	
1.00	N/A	N/A	0.07	0.09	InvDec
	1.00	0.15	0.04	0.09	RE
		1.00	0.19	0.10	Stocks
			1.00	N/A	FinLit_B
				1.00	FinLit_N

Note. Created by the author. The matrix for input *InvDec* uses the sample of savers, while *RE* and *Stocks* variables are tested in the sample of investors, as specified previously.

In general, Table 6 shows that financial literacy correlates positively, yet quite modestly with investment decisions, real estate investments, and stock market participation. The highest

observed correlation (of 0.19) relates to stocks. Yet, correlation lacks an explanation of how one variable affects another, as it only says that a relationship exists. Thus, to get more preciseness, the final assumptions will be tested with regression.

As for other explanatory variables, the correlation matrix shows that the *InvDec* variable is mostly correlated with *SaveToInvest* (correlation coefficient of 0.35) which mirrors that the ultimate purpose of saving is investing (Figure C1). *InvDec* also correlates noticeably with *Education* and *Income* variables (at 0.28) (Figure C1). Regarding the real estate model, *Income* (correlates with *RE* variable at 0.22), *Planning* (-0.20), and *Perception* (0.14) correlate with the dependent variable the most (Figure D1). As for shares, *FinLit_B* comes as the variable with the highest correlation coefficient of 0.19, which implies that financial literacy might indeed help to evaluate stock holding (Figure E1). The *Size* of the household is negatively correlated with the shares' holdings (-0.18), while *Education* (at 0.17) and *Savings* (at 0.16) appear to be other relevant positive influences (Figure E1).

Among explanatory variables, *Savings* and *Perception*, *Income* and *Size*, as well as *Income* and *Subsistence* are correlated the most significantly (at around 0.4-0.5). They will be guarded with caution for potential collinearity when used in a single model. High correlation among multiple financial literacy measures should be ignored as they will not be used in a single model (Figures C1, D1, E1).

Regression Analysis

As implied before, the hypotheses will be tested using binary logistic regressions. Unlike the ordinary least squares, logistic regression has no classical assumptions and requires no normality, linearity, or homoscedasticity testing (Ghozali, 2011, as cited in Irman, 2020). The logistic model primarily requires independent distribution of data and no multicollinearity among explanatory variables. The regression analyses in this study rely on a 10% significance level.

Investment Decisions Model

In the investment decisions model, data is relatively well-balanced (59% of the sample hold an investment instrument, while 41% save either in cash or on a bank account), which is considered good practice in maximum likelihood technique models and brings more reliability

(Table 5). After running the binary logit regression and eliminating noise (variables with a p-value above 10%), equation (1) was obtained:

$$\ln\left(\frac{P\,(InvDec=1)}{1-P\,(InvDec=1)}\right) = -1.57 + 0.40 * Gender + 0.28 * Education + 0.24 * Income - 0.23 * Savings + 0.49 * Perception + 1.35 * SaveToInvest \quad (1)$$

The confusion matrix implies that such a model would correctly predict 70.7% of all investigated cases (Table C3). The model displays 17% type I error (false positive) and 12% type II error (false negative). The maximum likelihood technique relies on McFadden R-squared metric to assess the goodness of fit, which for this model is 0.17. It is an acceptable result for the study with the real-life dataset because the excellent fit would be in the region of 0.2-0.4 (McFadden, 1977). No multicollinearity issues were evident in the model. Other metrics for the goodness of fit, regression details, and residuals analysis are specified in Appendix C.

Table 7

Transformation of Logit Coefficients for Investment Decisions Model

	Logit coefficient	Odd's ratio	Odd's ratio (in %)	Probability	Marginal effect	Significance
	ln[P/(1-P)]	exp(P)	exp(P) – 1	exp[P/(1+P)]	Logit coefficient * 0.25	
Const	-1.57	N/A	N/A	N/A	N/A	0.0170 **
Gender	0.40	1.49	49.06%	59.85%	9.98%	0.0426 **
Education	0.28	1.32	31.74%	56.85%	6.89%	1.40e-07 ***
Income	0.24	1.27	26.61%	55.87%	5.90%	0.0178 **
Savings	-0.23	0.80	-20.16%	44.39%	-5.63%	0.0035 ***
Perception	0.49	1.64	63.53%	62.05%	12.30%	0.0261 **
SaveToInvest	1.35	3.86	286.24%	79.43%	33.78%	1.31e-010 ***

Note. Created by the author. *P* refers to the probability that variable *InvDec = 1*.

Since the predictions in this model are produced as logarithmic values, after transformation, the coefficients of relevant variables (with p-values below 0.1) are expressed in odds ratios and translated to probabilities. Odds are most commonly used for interpreting logistic coefficients and represent the ratio of occurrence to non-occurrence (Gelman & Hill, 2007), while probabilities express the chance of the occurrence given all possible outcomes. Additionally, the coefficients are transformed to proxies of linear probability model coefficients to display the marginal effects. This so-called *Divide by 4* rule corresponds to the upper bound of

predicted difference for a unit increase in the independent variable (Gelman & Hill, 2007). The transformed values are specified in Table 7.

The findings suggest that answering all three financial literacy questions does not affect the decision to save money through investment instruments, keeping all other variables constant. With a p-value of 0.41, being above the specified threshold, the *FinLit_B* variable seems to have a statistically insignificant effect on the decision to attain investment (Table C2). It means that financial literacy is just a noise in the given regression, and awareness of all three financial literacy concepts brings no change in the decision to invest savings.

In essence, the model suggests that the odds of a person holding an investment instrument increase by 286% if the ultimate purpose of saving money is investing, other variables constant. Based on logical reasoning, if a household saves to invest, it either holds a financial instrument or expects one in the future. Another significant variable is *Education* which implies that moving to the higher educational attainment brackets increases the odds of investing by 32%, ceteris paribus. However, there are 20% lower odds of investing when moving to the higher saving brackets, ceteris paribus. The negative relationship between the two could be justified by savings in this equation reflecting the indicated short-term habits (monthly savings over the last half-year). Also, keeping other variables fixed, when households perceive themselves at a good financial state, the odds of investing rise by 64%, as confidence determines investment decisions (Duval and Wicklund,1972, as cited in Mumtaz, 2018). Masculine gender has 49% higher odds of investing, ceteris paribus, potentially given higher risk tolerance (Agnew et al., 2003; Bajtelsmit & Bernasek, 1996). In addition, by moving to the higher income brackets, the odds that a household holds at least one investment instrument increase by 27%, other variables fixed, as higher income allows more flexibility in the market.

As introduced before, the regression with the same control variables was re-run by changing the measure of financial literacy and investigating if it causes any change in results. Measuring financial literacy as the count of correct answers (*FinLit_N*) yields no changes (Table C5). The financial literacy metric still turns out insignificant (with a p-value of 35%). Hence, one additional correct answer to the financial literacy survey has no impact on investment decisions, ceteris paribus. Moreover, if taken as separate independent variables, neither interest rate, nor inflation, nor loan conditions concepts provide a change in results (Table C7).

The findings suggest that financial literacy is insignificant in predicting whether a Lithuanian holds a financial instrument for savings (as per Ademola et al., 2019; Mazumdar, 2014). Hence, the first hypothesis that financial literacy is positively related to holding an investment instrument in Lithuania is rejected.

Real Estate Model

The observations for real estate holdings in the investors' sample seem somewhat imbalanced (16% of respondents invest in real estate for savings purposes) (Table 5). Researchers cope with imbalanced data in different ways. One of the techniques is to create a weighted logistic regression, assigning the higher cost to the wrong-guessing for minority observations (King & Zeng, 2001). Another commonly used technique is oversampling or reproducing the minority observations. However, as both of these methods would require changing the reality and assigning more weight to modeled versus actual observations, the thesis chooses to accept the sample as it is. The literature claims that if one of the groups dominates in the population (not only in the sample), the equivalent balancing of data might lead to biased predictions, which are unlikely to occur in reality (King & Zeng, 2001). Therefore, as the sample in this study is based on a real-life survey, the model expects such proportionality in real-life distribution.

The detailed regression findings are represented in Appendix D. Transformed values are provided in Table 8. With a 90% confidence level, equation (2) was obtained:

$$\ln\left(\frac{P(RE=1)}{1-P(RE=1)}\right) = -2.99 + 0.20 * Education + 0.68 * Income - 0.38 * Size - 1.32 * Planning \qquad (2)$$

Such a model is anticipated to correctly predict 87.9% of cases in Lithuania, with the dominant type II error. However, the confusion matrix should be perceived with caution due to the prior mentioned relative data misbalance. The more reliable metric for the goodness of fit in such a case is considered McFadden R-squared being 0.14, which is an acceptable outcome for real-life data models. Although the residual analysis suggests that the model could be improved, this analysis is exposed to a limited dataset. No multicollinearity issues are identified.

The model shows that financial literacy is not a relevant consideration for real estate holdings, with the p-value being beyond the acceptable threshold (approaching 31%) (Table D2).

In essence, answering correctly to financial literacy questions yields no impact on the decision to utilize savings through real estate holdings in Lithuania.

Table 8

Transformation of Logit Coefficients for Real Estate Model

	Logit coefficient	Odd's ratio	Odd's ratio (in %)	Probability	Marginal effect	Significance
	ln[P/(1-P)]	exp(P)	exp(P) – 1	exp[P/(1+P)]	Logit coefficient * 0.25	
Const	-2.99	N/A	N/A	N/A	N/A	0.0056 ***
Education	0.20	1.23	22.71%	55.10%	5.12%	0.0551 *
Income	0.68	1.96	96.47%	66.27%	16.88%	0.0007 ***
Size	-0.38	0.68	-31.90%	40.51%	-9.60%	0.0278 **
Planning	-1.32	0.27	-73.33%	21.06%	33.04%	0.0004 ***

Note. Created by the author. *P* refers to the probability that variable *RE = 1*.

Findings suggest that income and planning are the two most important dimensions for investing in real estate holdings. Moving to a higher income group, the odds of holding a real estate asset increase by 96%, holding other variables constant. It is justified by substantial investments needed for the acquisition of such assets. Planning, however, is found to lower odds of real estate investment by 73% when moving from non-planners to planners' category, other variables fixed. If households track income and expenses, there is little financial flexibility within the family, and the suitability of real estate investment drops. With the increase of one member per household, the odds of holding real estate decrease by 32%, ceteris paribus. It could be explained by family budget redistribution (especially for families having children). Education is also found to play a relevant role with the odds increasing by 23% of holding real estate when moving to a more educated households' category, keeping other variables constant.

After rerunning the regression with the change in the measure of financial literacy, no changes in results were evident. While other significant predictors remained unchanged, the correct number of financial literacy answers is not found to determine real estate ownership (Table D5). Although logically, the knowledge of loan conditions would be considered relatively important for real estate investment, none of the specific concepts of financial literacy turn out to be significant, as well (Table D7).

The second hypothesis claiming that financial literacy is related to investing in real estate in Lithuania is rejected. According to the model, financial literacy bears no explanatory power for picking real estate asset class as a way to utilize savings (as per Almenberg & Widmark, 2011; Mazumdar, 2014).

Stocks Model

Alike the real estate model, the stocks model also faces a potential data imbalance issue (with stock-holders being 11% of the investors' sample) (Table 5). However, as was mentioned before, this study believes that this is the most accurate representation of reality. Overall, the model is found to predict 90.5% of the cases (type I error – ca. 1%, type II error – ca. 9%). Yet again, due to the high concentration of non-stock owners, this metric should be seen with caution. However, the McFadden R-squared shows a fit of ca. 0.23, which signals a favorable model fit (Table E3). No multicollinearity issues are evident. Other characteristics to assess the goodness of fit, residuals graphs, and detailed regression specifications are in Appendix E.

Transformed values are provided in Table 9. With variables of under 10% threshold of p-value, the equation (3) for the decision to invest in stocks was obtained:

$$\ln\left(\frac{P\,(Stocks=1)}{1-P\,(Stocks=1)}\right) = -5.47 + 1.30 * FinLit\_B + 0.30 * Education + 0.81 * Income - 1.24 * Size \quad (3)$$

Table 9

Transformation of Logit Coefficients for Stocks Model

	Logit coefficient	Odd's ratio	Odd's ratio (in %)	Probability	Marginal effect	Significance
	ln[P/(1-P)]	exp(P)	exp(P) – 1	exp[P/(1+P)]	Logit coefficient * 0.25	
Const	-5.47	N/A	N/A	N/A	N/A	0.0002 ***
FinLit_B	1.30	3.67	266.51%	78.56%	32.47%	0.0014 ***
Education	0.30	1.36	35.60%	57.56%	7.61%	0.0617 *
Income	0.81	2.24	124.42%	69.18%	20.21%	0.0005 ***
Size	-1.24	0.29	-71.08%	22.43%	-31.02%	2.65e-05 ***

Note. Created by the author. *P* refers to the probability that variable *Stocks = 1*.

As the literature review predicts, financial literacy turns out to be one of the most significant determinants for the decision to hold stocks (with a p-value below 1%) (Table E2). The findings suggest that if a respondent answered all three financial literacy questions correctly,

the odds of investing in stocks for saving purposes increase even by 267%, holding other variables fixed. The probability of 79% (above the 50%) implies that *InvDec*=1, or otherwise – investment decision is pursued. In addition, an increase in *FinLit_B* by one unit (noting people with all three correct answers) increases the probability of investing by 32%, other things constant. It implies that with the increase in financial literacy education in Lithuania, stock markets are likely to get livelier.

Apart from financial literacy, income and household size affect stocks holdings. Moving to a wealthier income group raises the odds that the respondents hold stocks by 124%, other things constant. Cash flows availability is distinctively important for agile behavior in the markets. Nevertheless, one additional member per family decreases the odds of holding stocks by 71%, ceteris paribus. As with other asset classes, extra education also increases odds to own stocks by 36%, other variables fixed.

The additional investigation of the model with changing the measure of financial literacy yields similar conclusions, yet relatively less robust. With the p-value of 10.9% (slightly above the threshold), one additional correct answer to the financial literacy survey increases the odds of holding stocks by 38%, ceteris paribus (Table E5). More precisely, the model with *IntRate*, *Inflation*, and *LoanCond* variables reveals that the concept of interest rates is the most impactful in explaining stocks ownership (Table E7). By answering the interest rates question, the probability that a household owns stocks is 70%, while the odds increase by 133%, ceteris paribus.

Overall, the research shows that the third hypothesis stating that financial literacy is positively related to holding an equity investment in Lithuania cannot be rejected. Financial literacy indeed tends to determine the higher ownership of companies' shares, especially if households answer all three financial literacy questions correctly (as per Almenberg & Widmark, 2011; Fong et al., 2021; Mian, 2014; Van Rooij et al., 2011). A distinctively important predictor for stocks holdings is found to be the concept of interest rates.

Discussions and Recommendations

In essence, the financial literacy concept does not help predict the decision to invest saved money (*H1* rejected). Financial literacy is just a noise in the model and cannot establish a

statistically significant connection in Lithuania. One reason could be relatively underdeveloped financial education and media, leading to an awareness gap for long-term investment planning in Lithuania. The failure to establish a significant relationship could also be related to risk misperception (Lusardi & Mitchell, 2014), psychological biases, cultural norms, especially upbringing (Mazumdar, 2014), or that the most literate households decrease the dependency on group factors (Al-Tamimi & Bin Kalli, 2009). Willis (2008) also heavily criticized that it is implausible to blame illiteracy for stagnant markets behavior due to insufficient empirical evidence about marketplace determinants and human decision-making. It might be so that financial literacy is much less of an issue compared to the government's failure to regulate markets coherently (Willis, 2008). What is also noticeable is that financial literacy was found to lack impact in such developing economies as Nigeria and India. Hence, it could be argued that the lack of relationship is bound to Lithuania since it is still perceived as a converging country towards the EU average.

The study also reveals that financial literacy does not affect the investment in real estate (*H2* rejected). Although Lithuanians favor real estate, financial literacy is not found to grant such market behavior. Probably financial determinants, such as income or investors' creditworthiness, are more relevant due to heavy investment requirements. Numeracy should also explain real estate, if assessed, due to households taking calculated risk decisions (Almenberg & Widmark, 2011). Also, as suggested by Almenberg & Widmark (2011), the real estate market highly relies on intermediaries (mortgages suppliers), and households' (demanders of mortgages) illiteracy has lower explanatory power. However, the research finds a positive influence of financial literacy on stocks ownership in Lithuania (*H3* not rejected). Since shares pricing techniques require quite sophisticated knowledge, long-term investing in stocks is heavily reliant on financial advancement. An important consideration is found to be the component of interest rates. In theory, interest rates and stock prices are inversely related, and mastering interest rates could help investors better anticipate stock market fluctuations.

Overall, income was the primary determinant for all three models, increasing the odds that households hold financial instruments for investment purposes. Higher-income creates more financial flexibility for investment execution. Education is another variable that is tied with each model. Consistently to Lusardi and Mitchell (2007), more educated people have a better sense of

markets and are predicted to be active investors, assumably due to higher human capital stock. Another common observation among all models was the size of the household. The larger families tend to be more resistant to investment, specifically real estate and stocks. It could be explained by the risky nature of the asset, as single-member households tend to tolerate higher risk (Grable and Joo, 2000, as cited in Chavali & Mohan Raj, 2016). The psychological dimension of how the household perceives its financial situation also plays an important role (Subramaniam & Velnampy, 2017), primarily due to anchoring traps, reality perception, and other cognitive biases.

Recommendations for future research would be to extend the sample size. Such action would bring better approximates for the population. An important consideration is that the research might also be improved by different measurements of financial literacy (with financial knowledge, behavior, and attitude variables included, as suggested by OECD, 2020a). Also, alternative regression models could be explored, as the form of a logistic regression might not be the most suitable for the relationship. It is also recommended for future studies to approach data imbalances for real estate and stocks models to investigate the change in outcomes.

Conclusions

The below-specified conclusions were derived from the study, in accordance with the raised objectives.

1. In Lithuania, financial literacy is found to be at the below-average level. As both adults and pupils are found to underscore compared to other OECD countries, more stipulation is needed from the government to improve the situation. The root causes for insufficient financial knowledge are underdeveloped financial education programs, lack of teachers' competencies, scarcity of material in the Lithuanian language, and a shortage of local analytical financial media sources. Although Lithuania has already initiated many programs to improve the situation, the financial literacy gap persists up to date, with the Banks Association of Lithuania determined financial literacy metric standing at 45 (on a scale of 0-100) in 2021.
2. Investment and savings habits seem to be insufficient in Lithuania and underscore the general practices of other EU countries. With the rough decrease in interest rates on deposits recently, the necessity of financial markets awareness has increased to pick

an alternative inflation hedge. Many Lithuanians find real estate, gold, artworks, and securities investment instruments attractive. However, preferences are not found to translate to investment behavior in reality, as around 54% of Lithuanians save in cash at home or hold money on bank accounts with no extra returns. Real estate (together with art) is found to be distinctly attractive due to the easy conceptual understanding of the asset.

3. The study shows that, in theory, most researchers establish financial literacy as a relevant consideration for investment decision-making. Financial literacy is expected to eliminate uncertainty cascades, create awareness, provide necessary knowledge about diversification, help determine individual preferences, and upscale the learning rate. Furthermore, financial literacy raises returns expectations which eventually lead to higher expected satisfaction. As investors tend to place their investment decision on expected utility, financially advanced people should invest more actively. However, antagonists argue that there is a lack of empirical evidence that financial literacy is relevant for investment behavior explanation.
4. Real estate is the most preferred investment type in Lithuania. However, there is no uniform agreement in the literature about the connection between real estate and financial literacy. While some argue that more knowledgeable people tend to hold fewer illiquid assets, others explain that financial literacy lowers uncertainty in housing markets. Some authors even fail to establish the relationship between the two. However, stocks, which were examined as more sophisticated financial instruments, are found to relate to financial literacy significantly positively due to intricate asset pricing techniques.
5. There is a noticeable differentiation of financial literacy scores based on various demographic, socioeconomic, and psychological factors. Specifically, masculine gender, working-age, higher education, city residency, and higher-income are found to predict the likelihood of falling within the most advanced financial literacy quartile in Lithuania. In addition, self-assessed financial literacy is found to correlate positively with the determined financial savviness scores through questionnaires but tend to be overestimated for certain groups.

6. Through the developed research method using binary logistic regression, the assessment of the Bank of Lithuania *Survey of Households H2 2018* revealed that financial literacy is not causal for a decision to invest savings. The study establishes that financial literacy has no impact on investment decisions in Lithuania, potentially due to lack of investors' awareness, lack of consistent financial education and media, cultural upbringing, undereducated investors, risk misperception, and psychological biases.
7. Financial literacy is not found to explain robust Lithuanians' preference for the real estate asset class. The research revealed real estate market usually highly relies on mortgages suppliers, and, thus, households, who are mortgages demanders, literacy has lower explanatory power.
8. Financial literacy is relevant for more sophisticated investment instruments as stocks due to intricate asset pricing techniques. It indeed helps to predict the holdings of stocks, given that if a respondent answers all financial literacy questions correctly, the odds of investing in stocks increase even by 267%, ceteris paribus.
9. Changes in financial literacy measurement techniques yield only marginal changes in results. The financial literacy assessment through the binary classification (with 1 being all three correct answers, 0 otherwise) bears the highest explanatory power. Meanwhile, one additional correctly answered question does not help to predict investment decisions. However, the type of question can make a difference. Specific concepts, such as interest rates for stocks holdings, might be significant and relevant.
10. Income, education, and the number of members per household turned out as the most relevant concepts for investment decision-making. Additionally, variables, covering behavioral economics, should be considered due to psychological biases in the investment decision-making.

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Appendix A

Supporting Data from the Banks Association of Lithuania Dataset

Table A1

Saving Instruments per Different Demographic and Socioeconomic Groups

		Gender		Age					Education			Income			
		Men	Women	18-25 y.o.	26-35 y.o.	36-45 y.o.	46-55 y.o.	56 y.o. and more	Higher education / not fully finished higher education	Secondary education / Vocational training	Not finished secondary education	Up to EUR 300	EUR 301–500	EUR 501–700	More than EUR 700
Have you saved money in any of the following ways in the last 12 months?	Cash / Bank account	310	370	94	148	129	138	171	226	404	45	147	263	119	78
	Current account	129	140	31	37	41	52	108	85	171	13	61	96	45	33
	Bonds	20	6	4	5	6	6	5	14	11	1	4	7	4	7
	Cryptocurrencies	35	12	9	25	11	1	1	13	33	1	6	11	7	13
	Stocks	58	29	17	27	29	8	6	42	42	3	15	24	13	26

Note. Created by the author. Data are from Banks Association of Lithuania (2021).

Table A2

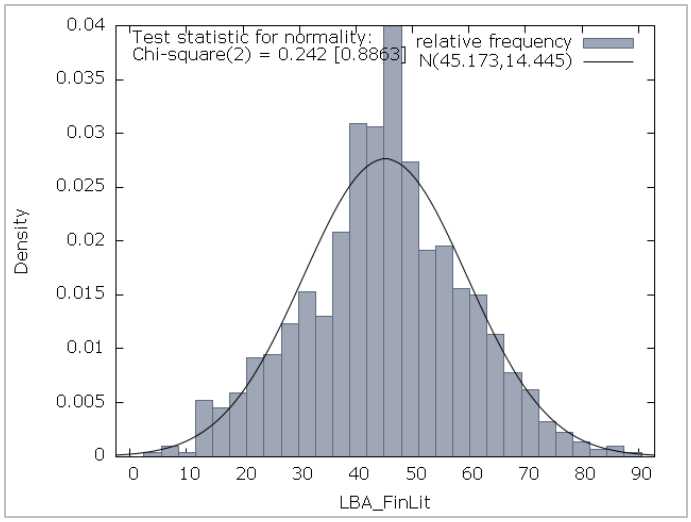
Summary Statistics for Financial Literacy Metric in 2021

Mean	45.17
Median	45.00
Minimum	4.00
Maximum	89.00
Std. Dev.	14.45
C.V.	0.32
Skewness	-0.03
Ex. kurtosis	-0.08
5% Perc.	20.00
95% Perc.	69.00
IQ range	19.00
Missing obs.	0

Note. Created by the author. Data are from Banks Association of Lithuania (2021).

Figure A1

Histogram for Financial Literacy Scores in 2021



Note. Created by the author. Data are from Banks Association of Lithuania (2021).

Table A3

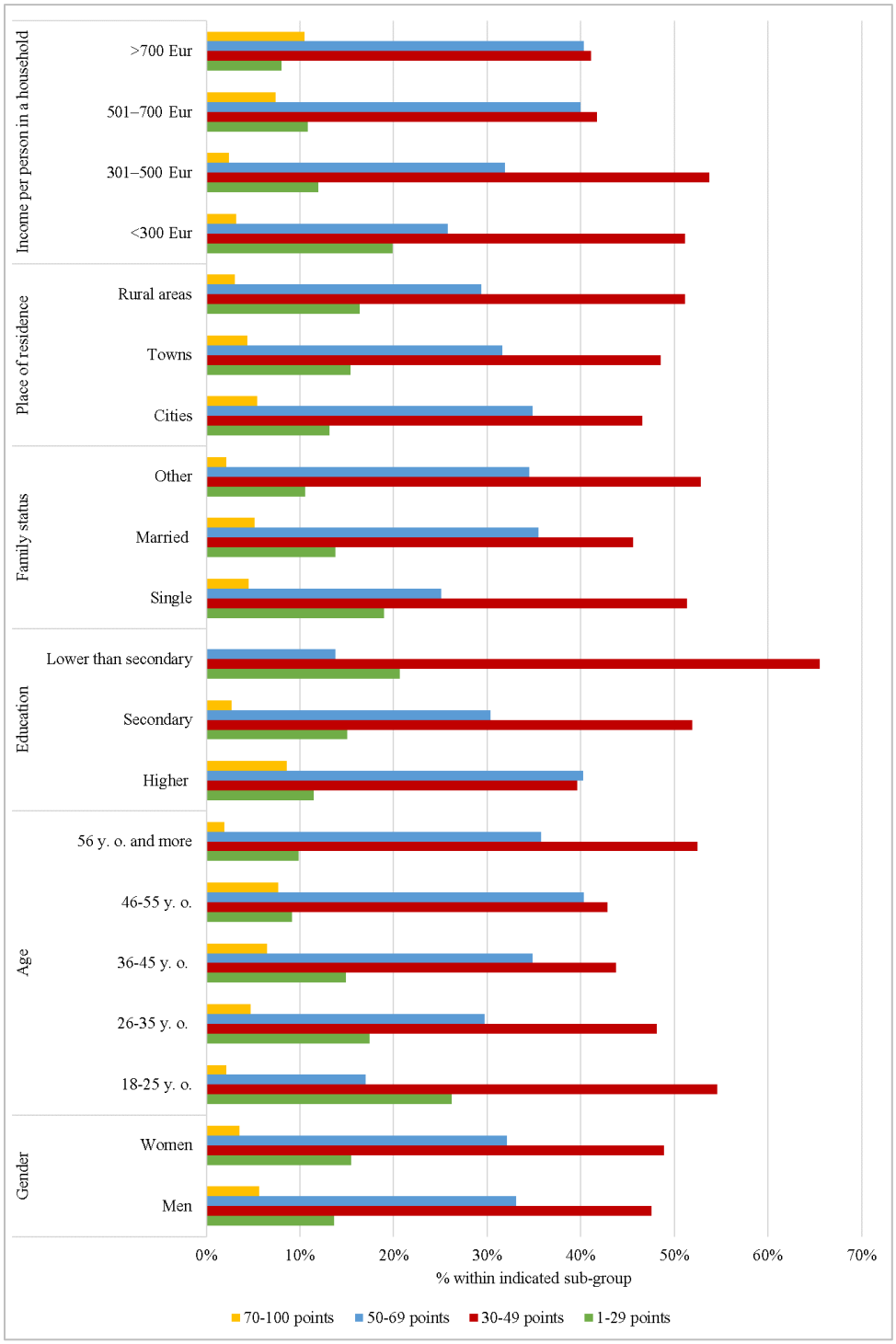
Cross-Tabulation Analysis for Actual Financial Literacy Scores

			Gender		Age					Education			Income per person in a household				Family status			Place of residence		
			Man	Woman	18-25 y. o.	26-35 y. o.	36-45 y. o.	46-55 y. o.	56 y. o. and more	Higher	Secondary	Lower than secondary	<300 Eur	301–500 Eur	501–700 Eur	>700 Eur	Single	Married	Other	Cities	Towns	Rural areas
Financial Literacy Index	1-29 points	Count	65	83	37	37	30	18	26	40	90	12	44	45	19	10	50	83	15	63	42	43
		% within group (Gender, Age, etc.)	13.6%	15.5%	26.2%	17.5%	14.9%	9.2%	9.9%	11.5%	15.0%	20.7%	19.9%	12.0%	10.9%	8.1%	19.0%	13.8%	10.6%	13.2%	15.4%	16.4%
	30-49 points	Count	227	262	77	102	88	84	138	138	311	38	113	202	73	51	135	275	75	223	132	134
		% within group (Gender, Age, etc.)	47.6%	48.9%	54.6%	48.1%	43.8%	42.9%	52.5%	39.7%	51.9%	65.5%	51.1%	53.7%	41.7%	41.1%	51.3%	45.6%	52.8%	46.6%	48.5%	51.1%
	50-69 points	Count	158	172	24	63	70	79	94	140	182	8	57	120	70	50	66	214	49	167	86	77
		% within group (Gender, Age, etc.)	33.1%	32.1%	17.0%	29.7%	34.8%	40.3%	35.7%	40.2%	30.4%	13.8%	25.8%	31.9%	40.0%	40.3%	25.1%	35.5%	34.5%	34.9%	31.6%	29.4%
	70-100 points	Count	27	19	3	10	13	15	5	30	16	0	7	9	13	13	12	31	3	26	12	8
		% within group (Gender, Age, etc.)	5.7%	3.5%	2.1%	4.7%	6.5%	7.7%	1.9%	8.6%	2.7%	0.0%	3.2%	2.4%	7.4%	10.5%	4.6%	5.1%	2.1%	5.4%	4.4%	3.1%
Total		Count	477	536	141	212	201	196	263	348	599	58	221	376	175	124	263	603	142	479	272	262
		% within group (Gender, Age, etc.)	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%

Note. Created by the author. Data are from Banks Association of Lithuania (2021).

Figure A2

Financial Literacy in Lithuania Based on Demographic and Socioeconomic Characteristics



Note. Created by the author. Data are from Banks Association of Lithuania (2021). 100% is obtained by adding up the sub group scores, e.g., all points for men.

Table A4

Cross-Tabulation Analysis for Self-Assessed Financial Literacy

			Gender		Age					Education			Income per person in a household				Family status			Place of residence		
			Man	Woman	18-25 y. o.	26-35 y. o.	36-45 y. o.	46-55 y. o.	56 y. o. and more	Higher	Secondary	Lower than secondary	<300 Eur	301–500 Eur	501–700 Eur	>700 Eur	Single	Married	Other	Cities	Towns	Rural areas
How would you rate your financial literacy knowledge compared to other adults?	My knowledge is better than most other adults	Count	72	64	20	38	36	17	25	64	66	6	25	39	24	30	45	76	14	74	38	24
		% within group (Gender, Age, etc.)	15.1%	11.9%	14.2%	17.9%	17.9%	8.7%	9.5%	18.4%	11.0%	10.3%	11.3%	10.4%	13.7%	24.2%	17.1%	12.6%	9.9%	15.4%	14.0%	9.2%
	My knowledge is similar to most other adults	Count	205	224	54	90	81	82	122	160	243	26	92	167	83	52	98	267	62	213	115	101
		% within group (Gender, Age, etc.)	43.0%	41.8%	38.3%	42.5%	40.3%	41.8%	46.4%	46.0%	40.6%	44.8%	41.6%	44.4%	47.4%	41.9%	37.3%	44.3%	43.7%	44.5%	42.3%	38.5%
	My knowledge is worse than most other adults	Count	89	93	27	36	29	46	44	40	125	15	52	75	23	12	55	97	30	76	56	50
		% within group (Gender, Age, etc.)	18.7%	17.4%	19.1%	17.0%	14.4%	23.5%	16.7%	11.5%	20.9%	25.9%	23.5%	19.9%	13.1%	9.7%	20.9%	16.1%	21.1%	15.9%	20.6%	19.1%
	I can't answer the question, but I know I need to improve my knowledge	Count	80	130	27	39	41	44	59	68	129	9	43	76	36	25	52	123	33	93	51	66
		% within group (Gender, Age, etc.)	16.8%	24.3%	19.1%	18.4%	20.4%	22.4%	22.4%	19.5%	21.5%	15.5%	19.5%	20.2%	20.6%	20.2%	19.8%	20.4%	23.2%	19.4%	18.8%	25.2%
	I don't know / can't answer	Count	31	25	13	9	14	7	13	16	36	2	9	19	9	5	13	40	3	23	12	21
		% within group (Gender, Age, etc.)	6.5%	4.7%	9.2%	4.2%	7.0%	3.6%	4.9%	4.6%	6.0%	3.4%	4.1%	5.1%	5.1%	4.0%	4.9%	6.6%	2.1%	4.8%	4.4%	8.0%
Total		Count	477	536	141	212	201	196	263	348	599	58	221	376	175	124	263	603	142	479	272	262
		% within group (Gender, Age, etc.)	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%

Note. Created by the author. Data are from Banks Association of Lithuania (2021).

Appendix B

Supporting Data from the Bank of Lithuania Dataset

Table B1

Questions from the Survey of Households of the Bank of Lithuania Used for Regressions

Concept	Question	Answers
Investment Decisions	Which of the following savings and investment instruments does your household use? Mark all financial instruments used by any household member. Multiple answers are allowed.	a) The household does not use any financial instrument due to the absence of savings *(households with such answers were eliminated from the sample used in this research)* b) Savings at home in cash c) Savings on a bank account or at the credit union d) Terminated account in a bank or credit union e) Life insurance f) Pension fund g) Investment fund h) Debt securities (bonds, savings certificates) i) Stocks j) Real estate (apartment, house, land, forest, etc.) k) Other l) Don't know / Not answered *(households with such answers were categorized as missing data and eliminated from the sample used in this research)*
Interest rates *(part of Financial Literacy evaluation)*	Let's say that you deposited EUR 100 in a bank on a 5-year deposit with an annual interest rate of 2%. You made no additional contributions or deductions from this deposit during the five years. How much money would you recover after the 5-years' time?	**a) <u>More than EUR 102</u>** b) Exactly EUR 102 c) Less than EUR 102 d) Don't know / Not answered *(classified as a lack of knowledge)*
Inflation *(part of Financial Literacy evaluation)*	Let's say you are paid a 1% annual interest rate for the EUR 100 deposited in a bank. Simultaneously, the annual inflation rate is at 2%. If you liquidated the money after one	a) More than today b) Exactly the same as today **c) <u>Less than today</u>** d) Don't know / Not answered *(classified as lack of knowledge)*

	year, how much do you think you could buy for the recovered money from the deposit?	
Loan conditions *(part of Financial Literacy evaluation)*	Let's say you intend to take a loan of EUR 1,000 for one year. The loan would be repaid at the end of the year. The bank proposes two types of loan conditions. Which of the loans, do you think, would be cheaper?	**a) <u>The loan that has an annual interest rate of 15% and is subject to an administration fee of EUR 100 at the end of the year</u>** b) A loan with an annual interest rate of 26% and no administration fees c) Don't know / Not answered *(classified as lack of knowledge)*
Gender	Sex of the maximum income receiving member of a household.	a) Man b) Woman c) Not answered *(none such answers were received)*
Age	Age of the maximum income receiving member of a household.	a) 18 – 29 y. o. b) 30 – 49 y. o. c) 50 y. o. and elder
Education	Education of the maximum income receiving member of a household.	a) Primary education b) Not finished secondary education c) Secondary education d) Vocational (vocational school, secondary with vocational qualification) e) High school (technical school, high schools) f) Non-university higher (college) g) University degree - bachelor's degree h) University degree - master's degree or equivalent professional qualification, higher education diploma after 5 years of study (as before) i) University graduate - doctor of science (PhD) j) Not answered *(none of such answers were received)*
Income	What is the average monthly income of your household? Add the after-tax income of all household members: salaries, pensions, scholarships, benefits, and other income.	a) EUR <401 b) EUR 401 – 800 c) EUR 801 – 1200 d) EUR 1201 – 1600 e) EUR >1600 f) Don't know / Not answered *(households with such answers were categorized as missing data and eliminated from the sample used in this research)*

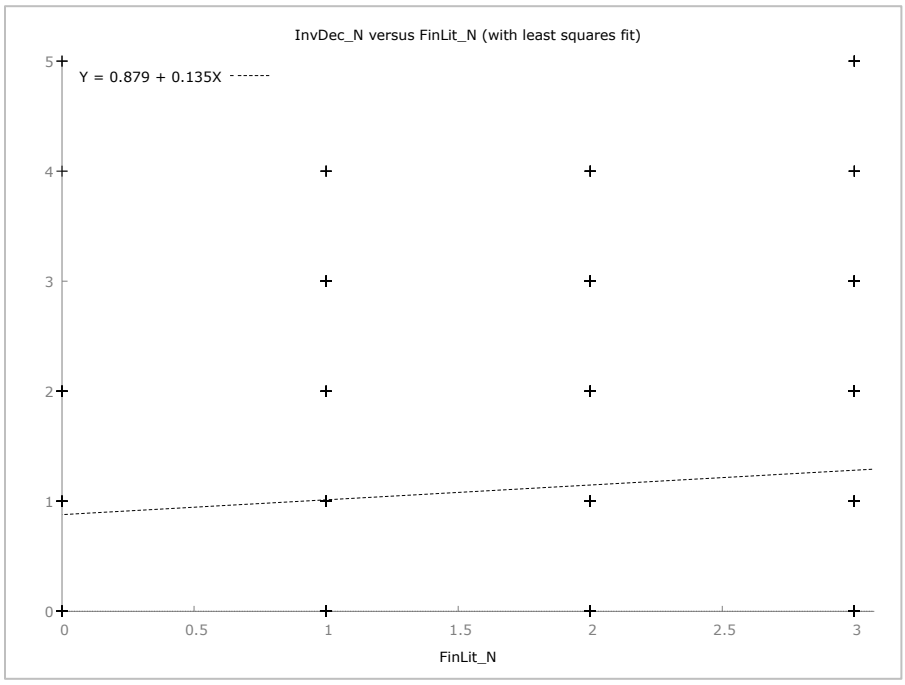
Subsistence	What do you think should be the lowest income (NET) that your household should receive (you personally if you live alone) to be satisfied with living conditions in Lithuania, i.e., to spend less than you earn and to be able to dedicate at least part of your income to savings?	Open question *(households with missing answers were eliminated from the sample used in this research)*
Short-term savings habits	Has your household saved money over the last six months? If so, what is the average savings per month?	a) Not managed to save b) Up to EUR 30 per month c) EUR 31 – 150 d) EUR 151 – 300 e) EUR 301 – 600 f) More than EUR 600 per month g) Don't know / Not answered *(households with such answers were categorized as missing data and eliminated from the sample used in this research)*
Household size	In total, how many people, including yourself, live with you and run a joint household (including children under 19)?	Open question *(households with missing answers were eliminated from the sample used in this research)*
Place of residence	Where do you live?	a) Rural area b) Town c) City
Planning	Do you / your member of the household plan income and expenses?	a) Yes b) No c) Don't know / Not answered *(households with such answers were categorized as missing data and eliminated from the sample used in this research)*
Perception	Self-perceived financial status of the household.	a) Bad b) Average c) Good d) Don't know / Not answered *(households with such answers were categorized as missing data and eliminated from the sample used in this research)*
Savings purpose	For what purposes or for what reasons do you / your household members save? Multiple answers available	a) Saves nothing b) Favorable return on assets (i.e., the opportunity to earn interest on available savings) c) Small purchases and other expenses are planned for the future

		d) Long-term savings (expensive purchases, children 's education, old-age savings, etc.) e) The desire to have enough money for unforeseen expenses f) Possible deterioration of the financial situation in the future ("black day reserve") g) Other h) Don't know / Not answered *(households with such answers were categorized as missing data and eliminated from the sample used in this research)*

Note. Created by the author. Data are from Bank of Lithuania (2018b). The correct answers for questions are bolded and underlined, where needed. Additional comments are provided in italics, where necessary.

Figure B1

Scatterplot for the Number of Investment Instruments Held Versus Correct Financial Literacy Answers



Note. Created by the author.

Table B2

Cross-tabulation of InvDec Variable (Rows) Against FinLit_B Variable (Columns)

	0	1	**TOTAL**
0	62.9%	37.1%	**259**
1	55.5%	44.5%	**380**
TOTAL	**58.5%**	**41.5%**	**639**

Note. Created by the author.

Table B3

Cross-tabulation of InvDec Variable (Rows) Against Gender Variable (Columns)

	0	1	**TOTAL**
0	47.5%	52.5%	**259**
1	39.5%	60.5%	**380**
TOTAL	**42.7%**	**57.3%**	**639**

Note. Created by the author.

Table B4

Cross-tabulation of InvDec Variable (Rows) Against Age Variable (Columns)

	1	2	3	**TOTAL**
0	8.1%	30.1%	61.8%	**259**
1	10.0%	43.9%	46.1%	**380**
TOTAL	**9.2%**	**38.3%**	**52.4%**	**639**

Note. Created by the author.

Table B5

Cross-tabulation of InvDec Variable (Rows) Against Education Variable (Columns)

	1	2	3	4	5	6	7	8	9	**TOTAL**
0	2.7%	3.9%	10.8%	18.9%	18.1%	8.5%	21.2%	12.4%	3.5%	**259**
1	0.5%	2.6%	5.8%	9.7%	7.4%	8.4%	26.8%	35.3%	3.4%	**380**
TOTAL	1.4%	3.1%	7.8%	13.5%	11.7%	8.5%	24.6%	26.0%	3.4%	**639**

Note. Created by the author.

Table B6

Cross-tabulation of InvDec Variable (Rows) Against Income Variable (Columns)

	1	2	3	4	5	**TOTAL**
0	17.0%	36.7%	20.8%	15.8%	9.7%	**259**
1	3.4%	22.4%	32.6%	17.9%	23.7%	**380**

TOTAL	**8.9%**	**28.2%**	**27.9%**	**17.1%**	**18.0%**	**639**

Note. Created by the author.

Table B7

Cross-tabulation of InvDec Variable (Rows) Against Savings Variable (Columns)

	1	2	3	4	5	6	**TOTAL**
0	17.0%	23.2%	28.6%	17.4%	10.0%	3.9%	**259**
1	21.6%	8.2%	28.2%	21.3%	12.6%	8.2%	**380**
TOTAL	**19.7%**	**14.2%**	**28.3%**	**19.7%**	**11.6%**	**6.4%**	**639**

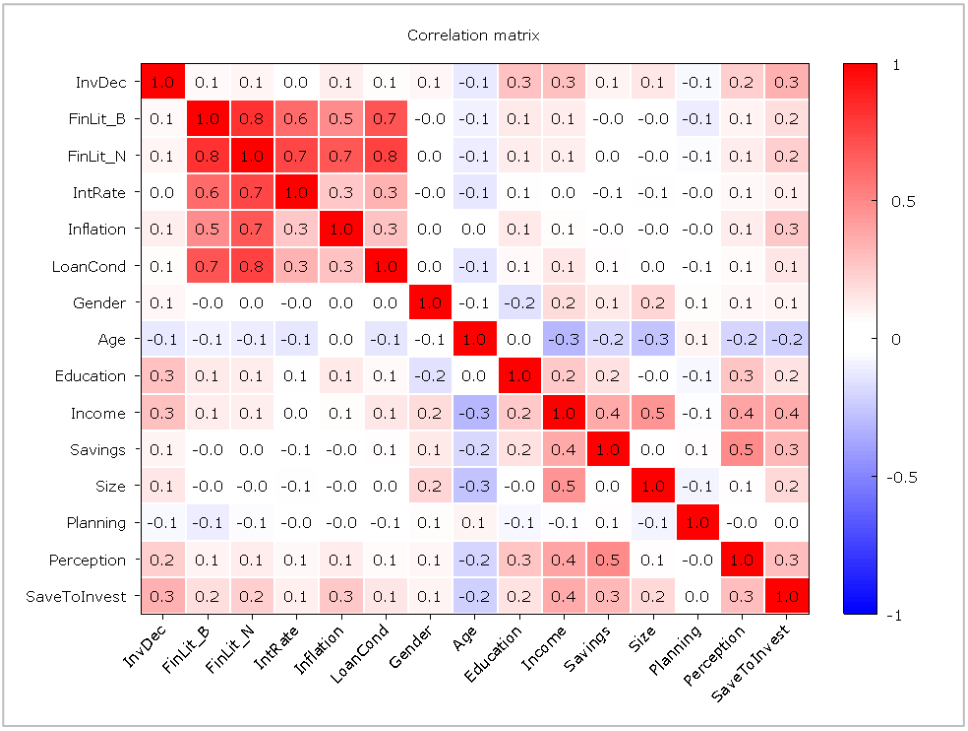
Note. Created by the author.

Appendix C

Investment Decisions Model

Figure C1

Correlation Matrix for the Decision to Invest Model



Note. Created by the author.

Table C1

Main Statistics for Variables used in Investment Decisions Model

Variable	Mean	Median	S.D.	Min	Max
InvDec	0.595	1.00	0.491	0.000	1.00
FinLit_B	0.415	0.00	0.493	0.000	1.00
FinLit_N	2.02	2.00	1.01	0.000	3.00
IntRate	0.662	1.00	0.473	0.000	1.00
Inflation	0.754	1.00	0.431	0.000	1.00
LoanCond	0.601	1.00	0.490	0.000	1.00
Gender	0.573	1.00	0.495	0.000	1.00
Age	2.43	3.00	0.656	1.00	3.00
Education	6.05	7.00	1.95	1.00	9.00
Income	3.07	3.00	1.24	1.00	5.00
Savings	3.08	3.00	1.47	1.00	6.00
Size	2.36	2.00	1.16	1.00	12.0

Planning	0.856	1.00	0.351	0.000	1.00
Perception	0.424	0.000	0.495	0.000	1.00
SaveToInvest	0.419	0.000	0.494	0.000	1.00

Note. Created by the author.

Table C2

Investment Decisions Model Logit Regression Model (with FinLit_B to Test Financial Literacy)

	Coefficient	**Std. Error**	**z**	**p-value**	
const	−1.56505	0.655814	−2.386	0.0170	**
FinLit_B	−0.158971	0.194291	−0.8182	0.4132	
Gender	0.399179	0.196901	2.027	0.0426	**
Age	−0.121817	0.151690	−0.8031	0.4219	
Education	0.275653	0.0523557	5.265	<0.0001	***
Income	0.235936	0.0995664	2.370	0.0178	**
Savings	−0.225198	0.0771224	−2.920	0.0035	***
Size	0.0181806	0.0960214	0.1893	0.8498	
Planning	−0.387837	0.271380	−1.429	0.1530	
Perception	0.491855	0.221029	2.225	0.0261	**
SaveToInvest	1.35129	0.210274	6.426	<0.0001	***

Note. Created by the author.

Table C3

Investment Decisions Model Goodness of Fit Measures (with FinLit_B to Test Financial Literacy)

Mean dependent var	0.594679	S.D. dependent var	0.491339
McFadden R-squared	0.171647	Adjusted R-squared	0.146148
Log-likelihood	−357.3479	Akaike criterion	736.6957
Schwarz criterion	785.7547	Hannan-Quinn	755.7392

Number of cases 'correctly predicted' = 452 (70.7%)
f(beta'x) at mean of independent vars = 0.236
Likelihood ratio test: Chi-square(10) = 148.095 [0.0000]

Summary for Confusion Matrix:

Actual *0*, Predicted *0*: 150
Actual *1*, Predicted *0*: 78
Actual *0*, Predicted *1*: 109
Actual *1*, Predicted *1*: 302

Note. Created by the author.

Table C4

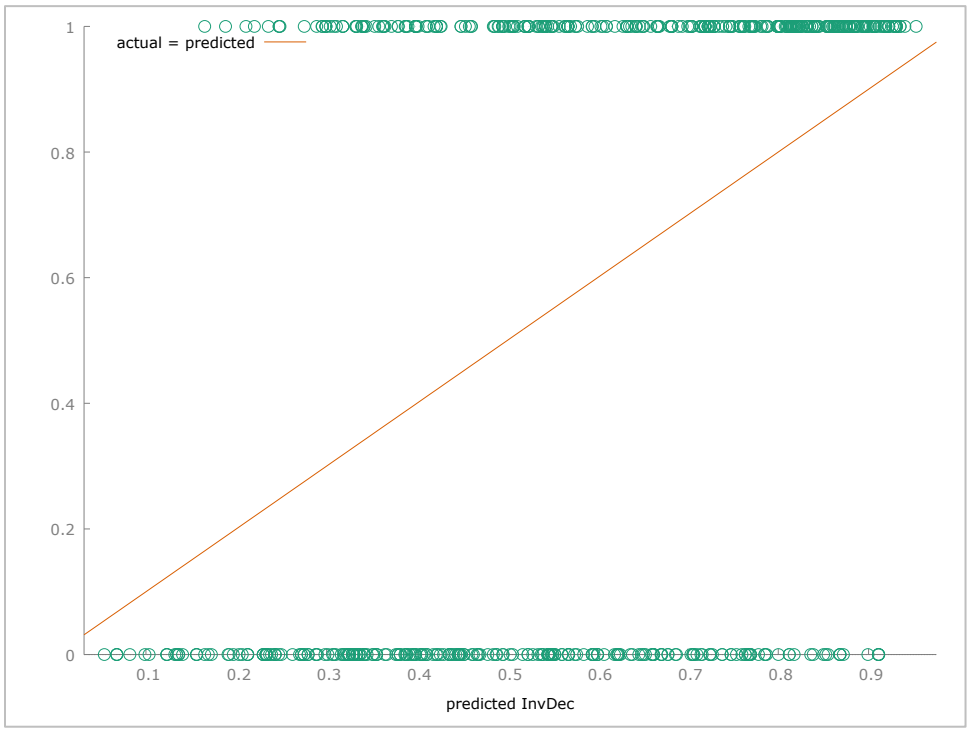
Investment Decisions Model Collinearity Check (with FinLit_B to Test Financial Literacy)

FinLit_B	1.093
Gender	1.119
Age_18_29	1.208
Education	1.210
Income	1.792
Savings	1.481
Size	1.424
Planning	1.050
Perception	1.489
SaveToInvest	1.277

Note. Created by the author.

Figure C2

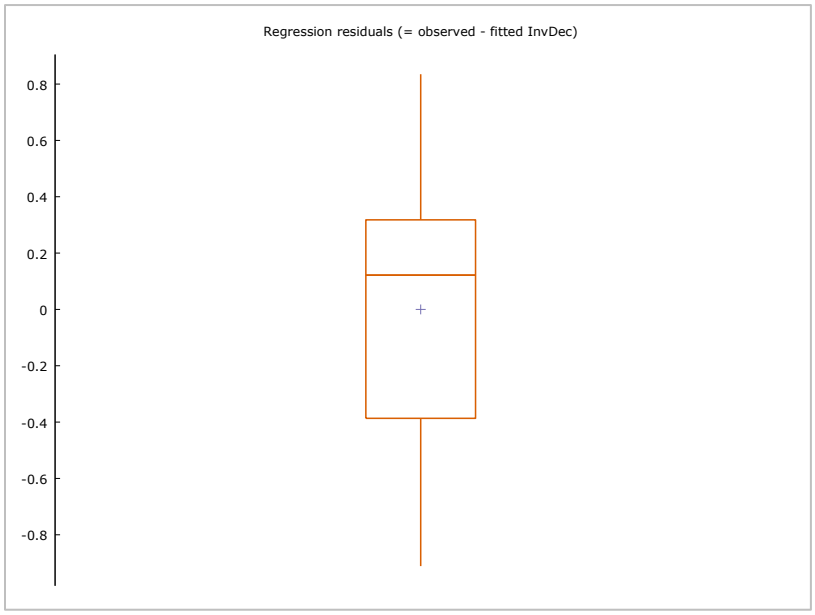
Investment Decisions Model Actual versus Predicted Observations (with FinLit_B to Test Financial Literacy)



Note. Created by the author.

Figure C3

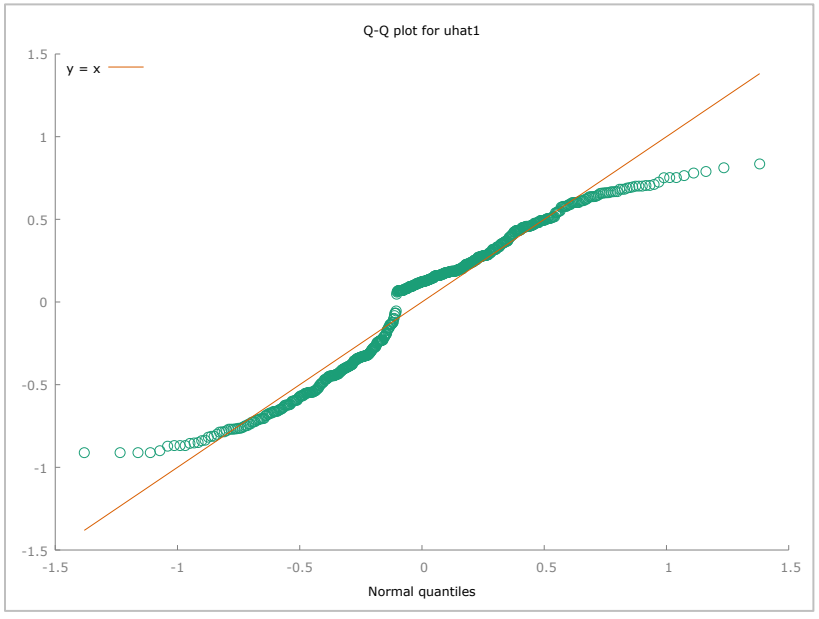
Investment Decisions Model Residuals Boxplot (with FinLit_B to Test Financial Literacy)



Note. Created by the author.

Figure C4

Investment Decisions Model Residuals Q-Q Plot (with FinLit_B to Test Financial Literacy)



Note. Created by the author.

Table C5

Investment Decisions Logit Regression Model (with FinLit_N to Test Financial Literacy)

	Coefficient	Std. Error	z	p-value	
const	−1.46609	0.676850	−2.166	0.0303	**
Gender	0.405832	0.197088	2.059	0.0395	**
Age	−0.123829	0.151832	−0.8156	0.4147	
Education	0.276398	0.0523514	5.280	<0.0001	***
Income	0.232517	0.0991724	2.345	0.0190	**
Savings	−0.226896	0.0771585	−2.941	0.0033	***
Size	0.0195858	0.0957462	0.2046	0.8379	
Planning	−0.375611	0.270027	−1.391	0.1642	
Perception	0.500790	0.221597	2.260	0.0238	**
SaveToInvest	1.36708	0.212737	6.426	<0.0001	***
FinLit_N	−0.0873383	0.0929877	−0.9392	0.3476	

Note. Created by the author.

Table C6

Investment Decisions Model Goodness of Fit Measures (with FinLit_N to Test Financial Literacy)

Mean dependent var	0.594679	S.D. dependent var	0.491339
McFadden R-squared	0.171896	Adjusted R-squared	0.146398
Log-likelihood	−357.2401	Akaike criterion	736.4802
Schwarz criterion	785.5391	Hannan-Quinn	755.5237

Number of cases 'correctly predicted' = 445 (69.6%)
f(beta'x) at mean of independent vars = 0.236
Likelihood ratio test: Chi-square(10) = 148.311 [0.0000]

Summary for Confusion Matrix:

Actual *0*, Predicted *0*: 149
Actual *1*, Predicted *0*: 84
Actual *0*, Predicted *1*: 110
Actual *1*, Predicted *1*: 296

Note. Created by the author.

Table C7

Investment Decisions Logit Regression Model (with IntRate, Inflation, and LoanCond Variables to Test Financial Literacy)

	Coefficient	Std. Error	z	p-value	
const	−1.39009	0.680810	−2.042	0.0412	**

Gender	0.406825	0.197248	2.063	0.0392	**
Age	−0.141027	0.154228	−0.9144	0.3605	
Education	0.274696	0.0524447	5.238	<0.0001	***
Income	0.231000	0.0996448	2.318	0.0204	**
Savings	−0.231722	0.0776638	−2.984	0.0028	***
Size	0.0144671	0.0963555	0.1501	0.8807	
Planning	−0.371220	0.269900	−1.375	0.1690	
Perception	0.513578	0.223253	2.300	0.0214	**
SaveToInvest	1.35215	0.216356	6.250	<0.0001	***
IntRate	−0.293974	0.211239	−1.392	0.1640	
Inflation	0.0163439	0.228101	0.07165	0.9429	
LoanCond	0.0207521	0.203074	0.1022	0.9186	

Note. Created by the author.

Table C8

Investment Decisions Model Goodness of Fit Measures (with IntRate, Inflation, and LoanCond Variables to Test Financial Literacy)

Mean dependent var	0.594679	S.D. dependent var	0.491339
McFadden R-squared	0.173287	Adjusted R-squared	0.143152
Log-likelihood	−356.6402	Akaike criterion	739.2805
Schwarz criterion	797.2592	Hannan-Quinn	761.7864

Number of cases 'correctly predicted' = 455 (71.2%)
f(beta'x) at mean of independent vars = 0.236
Likelihood ratio test: Chi-square(12) = 149.51 [0.0000]

Summary for Confusion Matrix:

Actual *0*, Predicted *0*: 156
Actual *1*, Predicted *0*: 81
Actual *0*, Predicted *1*: 103
Actual *1*, Predicted *1*: 299

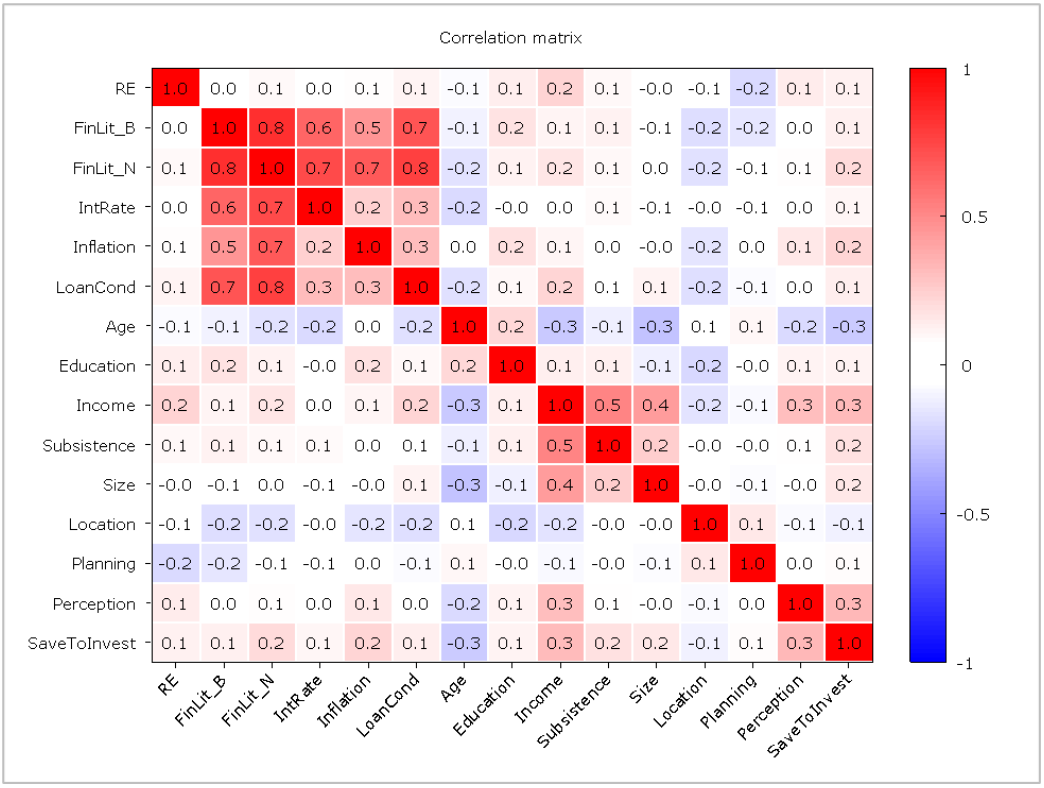
Note. Created by the author.

Appendix D

Real Estate Model

Figure D1

Correlation Matrix for the Decision to Invest to Real Estate Model



Note. Created by the author.

Table D1

Main Statistics for Variables used in Real Estate Model

Variable	Mean	Median	S.D.	Min	Max
RE	0.155	0.000	0.363	0.000	1.00
FinLit_B	0.445	0.000	0.498	0.000	1.00
FinLit_N	2.09	2.00	0.987	0.000	3.00
IntRate	0.668	1.00	0.471	0.000	1.00
Inflation	0.795	1.00	0.404	0.000	1.00
LoanCond	0.626	1.00	0.484	0.000	1.00
Age	2.36	2.00	0.657	1.00	3.00
Education	6.50	7.00	1.81	1.00	9.00
Income	3.36	3.00	1.17	1.00	5.00
Subsistence	1.81e+003	1.50e+003	1.07e+003	100.	6.00e+003

Size	2.49	2.00	1.27	1.00	12.0
Location	0.237	0.000	0.426	0.000	1.00
Planning	0.834	1.00	0.372	0.000	1.00
Perception	0.518	1.00	0.500	0.000	1.00
SaveToInvest	0.561	1.00	0.497	0.000	1.00

Note. Created by the author.

Table D2

Real Estate Logit Regression Model (with FinLit_B to Test Financial Literacy)

	Coefficient	**Std. Error**	**z**	**p-value**	
const	−2.98734	1.07744	−2.773	0.0056	***
FinLit_B	−0.338680	0.332927	−1.017	0.3090	
Age	−0.237687	0.268442	−0.8854	0.3759	
Education	0.204694	0.106723	1.918	0.0551	*
Income	0.675316	0.198897	3.395	0.0007	***
Subsistence	−0.000133514	0.000162293	−0.8227	0.4107	
Size	−0.384123	0.174571	−2.200	0.0278	**
Location	0.311813	0.400056	0.7794	0.4357	
Planning	−1.32158	0.373352	−3.540	0.0004	***
Perception	0.177113	0.359197	0.4931	0.6220	
SaveToInvest	0.372730	0.363137	1.026	0.3047	

Note. Created by the author.

Table D3

Real Estate Model Goodness of Fit Measures (with FinLit_B to Test Financial Literacy)

Mean dependent var	0.155263	S.D. dependent var	0.362633
McFadden R-squared	0.137774	Adjusted R-squared	0.070724
Log-likelihood	−141.4549	Akaike criterion	304.9098
Schwarz criterion	348.2517	Hannan-Quinn	322.1080

Number of cases 'correctly predicted' = 334 (87.9%)
f(beta'x) at mean of independent vars = 0.103
Likelihood ratio test: Chi-square(10) = 45.2058 [0.0000]
Summary for Confusion Matrix:

Actual *0*, Predicted *0*: 321
Actual *1*, Predicted *0*: 46
Actual *0*, Predicted *1*: 0
Actual *1*, Predicted *1*: 13

Note. Created by the author.

Table D4

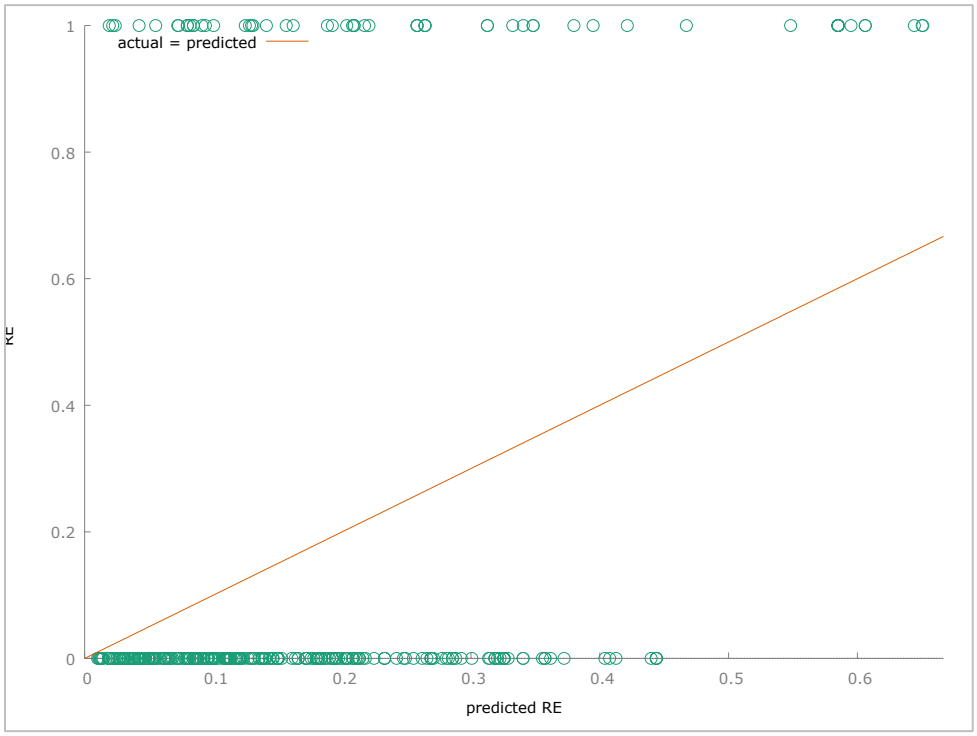
Real Estate Model Collinearity Check (with FinLit_B to Test Financial Literacy)

FinLit_B	1.123
Age	1.295
Education	1.208
Income	1.910
Subsistence	1.417
Size	1.380
Location	1.124
Planning	1.077
Perception	1.267
SaveToInvest	1.266

Note. Created by the author.

Figure D2

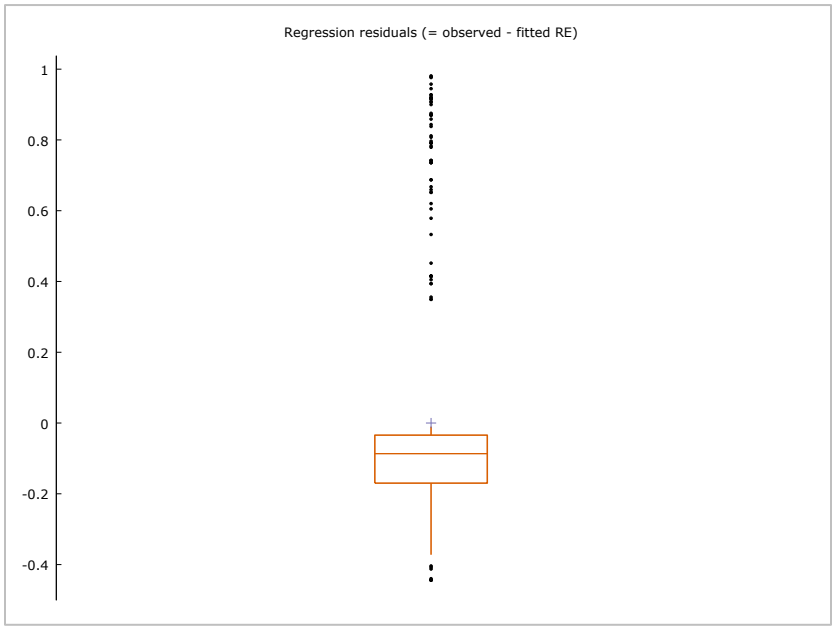
Real Estate Model Actual versus Predicted Observations (with FinLit_B to Test Financial Literacy)



Note. Created by the author.

Figure D3

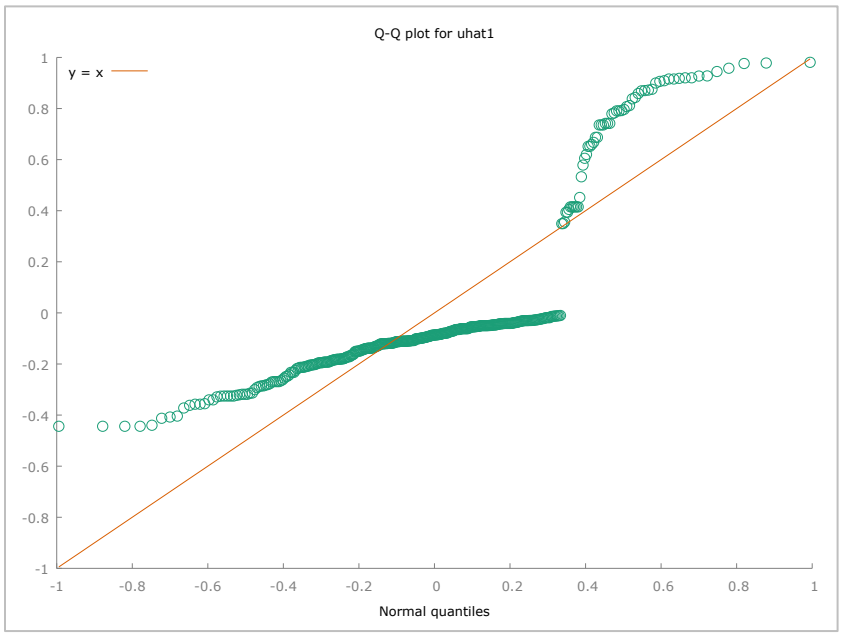
Real Estate Model Residuals Boxplot (with FinLit_B to Test Financial Literacy)



Note. Created by the author.

Figure D4

Real Estate Model Residuals Q-Q Plot (with FinLit_B to Test Financial Literacy)



Note. Created by the author.

Table D5

Real Estate Logit Regression Model (with FinLit_N to Test Financial Literacy)

	Coefficient	Std. Error	z	p-value	
const	−3.38482	1.14308	−2.961	0.0031	***
Age	−0.179178	0.270547	−0.6623	0.5078	
Education	0.196201	0.106927	1.835	0.0665	*
Income	0.668660	0.199622	3.350	0.0008	***
Subsistence	−0.000133426	0.000161521	−0.8261	0.4088	
Size	−0.369848	0.173548	−2.131	0.0331	**
Location	0.360088	0.401197	0.8975	0.3694	
Planning	−1.21129	0.365209	−3.317	0.0009	***
Perception	0.195701	0.357693	0.5471	0.5843	
SaveToInvest	0.312032	0.362343	0.8612	0.3892	
FinLit_N	0.0398799	0.170693	0.2336	0.8153	

Note. Created by the author.

Table D6

Real Estate Model Goodness of Fit Measures (with FinLit_N to Test Financial Literacy)

Mean dependent var	0.155263	S.D. dependent var	0.362633
McFadden R-squared	0.134743	Adjusted R-squared	0.067693
Log-likelihood	−141.9522	Akaike criterion	305.9044
Schwarz criterion	349.2463	Hannan-Quinn	323.1026

Number of cases 'correctly predicted' = 334 (87.9%)
f(beta'x) at mean of independent vars = 0.104
Likelihood ratio test: Chi-square(10) = 44.2111 [0.0000]
Summary for Confusion Matrix:

Actual *0*, Predicted *0*: 321
Actual *1*, Predicted *0*: 46
Actual *0*, Predicted *1*: 0
Actual *1*, Predicted *1*: 13

Note. Created by the author.

Table D7

Real Estate Logit Regression Model (with IntRate, Inflation, and LoanCond Variables to Test Financial Literacy)

	Coefficient	Std. Error	z	p-value	
const	−3.18533	1.16006	−2.746	0.0060	***
Age	−0.222142	0.283702	−0.7830	0.4336	
Education	0.193786	0.106521	1.819	0.0689	*
Income	0.645484	0.202679	3.185	0.0014	***

Subsistence	−0.000110785	0.000165394	−0.6698	0.5030	
Size	−0.396226	0.175644	−2.256	0.0241	**
Location	0.414025	0.405684	1.021	0.3075	
Planning	−1.23996	0.366582	−3.382	0.0007	***
Perception	0.161934	0.366912	0.4413	0.6590	
SaveToInvest	0.316076	0.365215	0.8655	0.3868	
IntRate	−0.399567	0.371513	−1.076	0.2821	
Inflation	0.154794	0.473132	0.3272	0.7435	
LoanCond	0.403141	0.387148	1.041	0.2977	

Note. Created by the author.

Table D8

Real Estate Model Goodness of Fit Measures (with IntRate, Inflation, and LoanCond Variables to Test Financial Literacy)

Mean dependent var	0.155263	S.D. dependent var	0.362633
McFadden R-squared	0.140483	Adjusted R-squared	0.061243
Log-likelihood	−141.0104	Akaike criterion	308.0208
Schwarz criterion	359.2430	Hannan-Quinn	328.3460

Number of cases 'correctly predicted' = 334 (87.9%)
f(beta'x) at mean of independent vars = 0.102
Likelihood ratio test: Chi-square(12) = 46.0947 [0.0000]
Summary for Confusion Matrix:

Actual *0*, Predicted *0*: 321
Actual *1*, Predicted *0*: 46
Actual *0*, Predicted *1*: 0
Actual *1*, Predicted *1*: 13

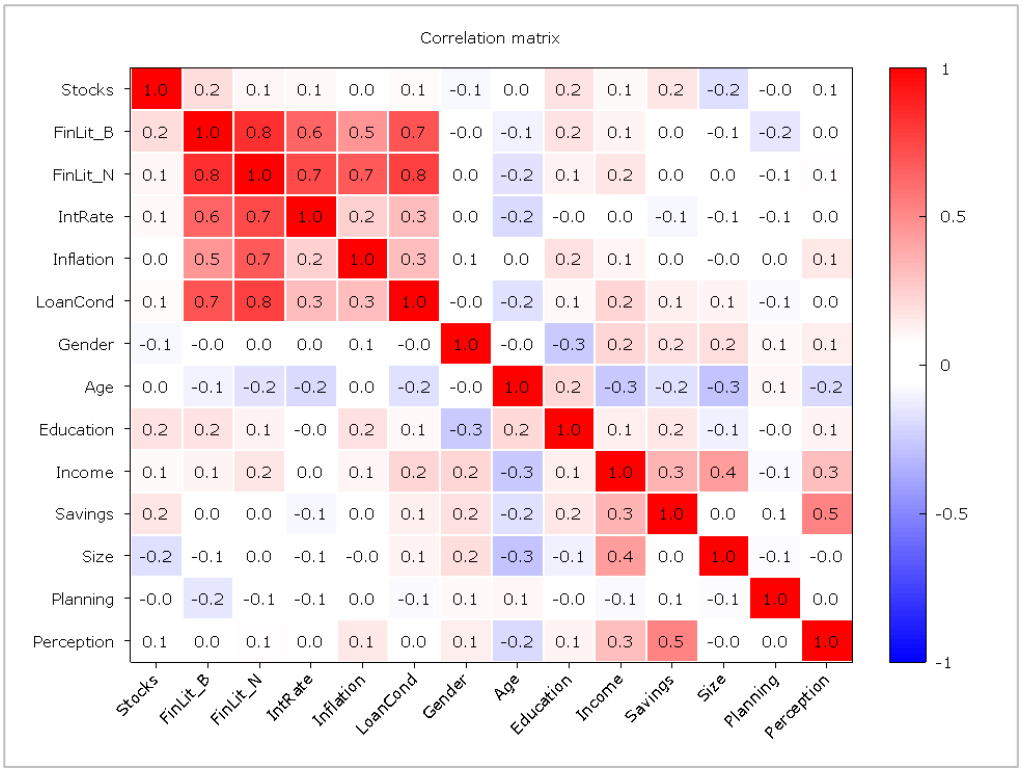
Note. Created by the author.

Appendix E

Stocks Model

Figure E1

Correlation Matrix for the Decision to Invest to Stocks Model



Note. Created by the author.

Table E1

Main Statistics for Variables used in Stocks Model

Variable	Mean	Median	S.D.	Min	Max
Stocks	0.111	0.000	0.314	0.000	1.00
FinLit_B	0.445	0.000	0.498	0.000	1.00
FinLit_N	2.09	2.00	0.987	0.000	3.00
IntRate	0.668	1.00	0.471	0.000	1.00
Inflation	0.795	1.00	0.404	0.000	1.00
LoanCond	0.626	1.00	0.484	0.000	1.00
Gender	0.605	1.00	0.489	0.000	1.00
Age	2.36	2.00	0.657	1.00	3.00
Education	6.50	7.00	1.81	1.00	9.00
Income	3.36	3.00	1.17	1.00	5.00

Savings	3.20	3.00	1.54	1.00	6.00
Size	2.49	2.00	1.27	1.00	12.0
Planning	0.834	1.00	0.372	0.000	1.00
Perception	0.518	1.00	0.500	0.000	1.00

Note. Created by the author.

Table E2

Stocks Logit Regression Model (with FinLit_B to Test Financial Literacy)

	Coefficient	**Std. Error**	**z**	**p-value**	
const	−5.47125	1.46973	−3.723	0.0002	***
FinLit_B	1.29886	0.405418	3.204	0.0014	***
Gender	−0.442792	0.406072	−1.090	0.2755	
Age	−0.0178278	0.312706	−0.05701	0.9545	
Education	0.304556	0.162996	1.868	0.0617	*
Income	0.808351	0.232591	3.475	0.0005	***
Savings	0.188559	0.151019	1.249	0.2118	
Size	−1.24067	0.295304	−4.201	<0.0001	***
Planning	0.393380	0.522521	0.7529	0.4515	
Perception	−0.668151	0.441536	−1.513	0.1302	

Note. Created by the author.

Table E3

Stocks Model Goodness of Fit Measures (with FinLit_B to Test Financial Literacy)

Mean dependent var	0.110526	S.D. dependent var	0.313958
McFadden R-squared	0.230857	Adjusted R-squared	0.155153
Log-likelihood	−101.5988	Akaike criterion	223.1976
Schwarz criterion	262.5993	Hannan-Quinn	238.8323

Number of cases 'correctly predicted' = 344 (90.5%)
f(beta'x) at mean of independent vars = 0.045
Likelihood ratio test: Chi-square(9) = 60.9893 [0.0000]
Summary for Confusion Matrix:

Actual *0*, Predicted *0*: 335
Actual *1*, Predicted *0*: 33
Actual *0*, Predicted *1*: 3
Actual *1*, Predicted *1*: 9

Note. Created by the author.

Table E4

Stocks Model Collinearity Check (with FinLit_B to Test Financial Literacy)

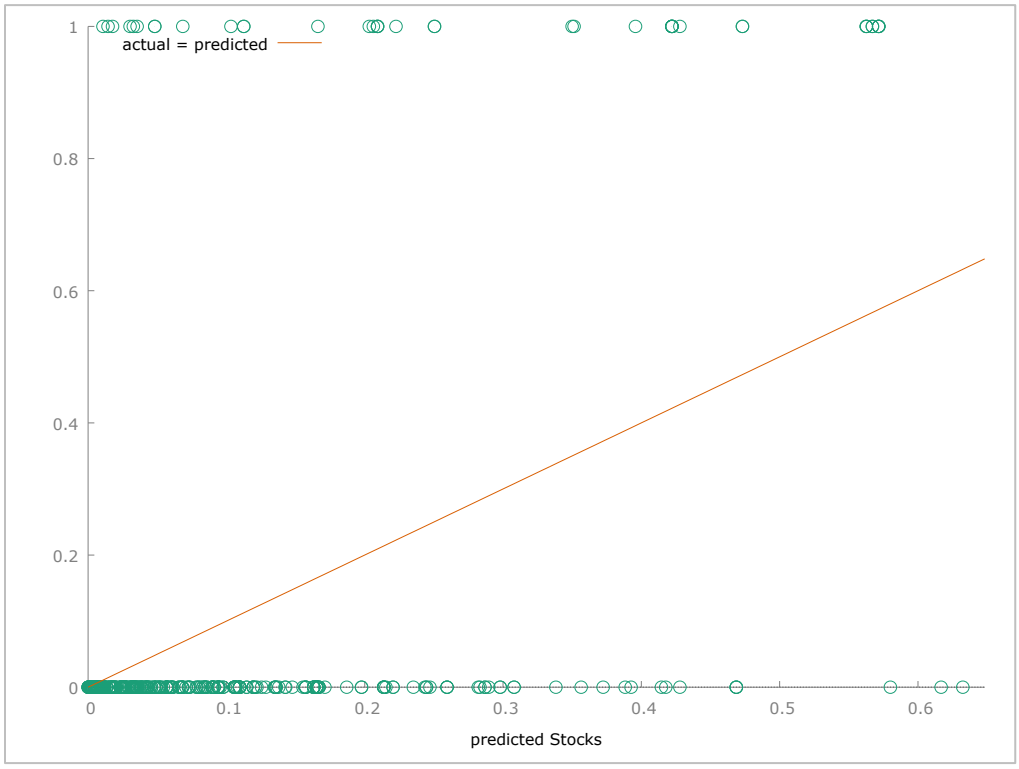
FinLit_B	1.099

Gender	1.231
Age	1.300
Education	1.309
Income	1.591
Savings	1.521
Size	1.408
Planning	1.057
Perception	1.450

Note. Created by the author.

Figure E2

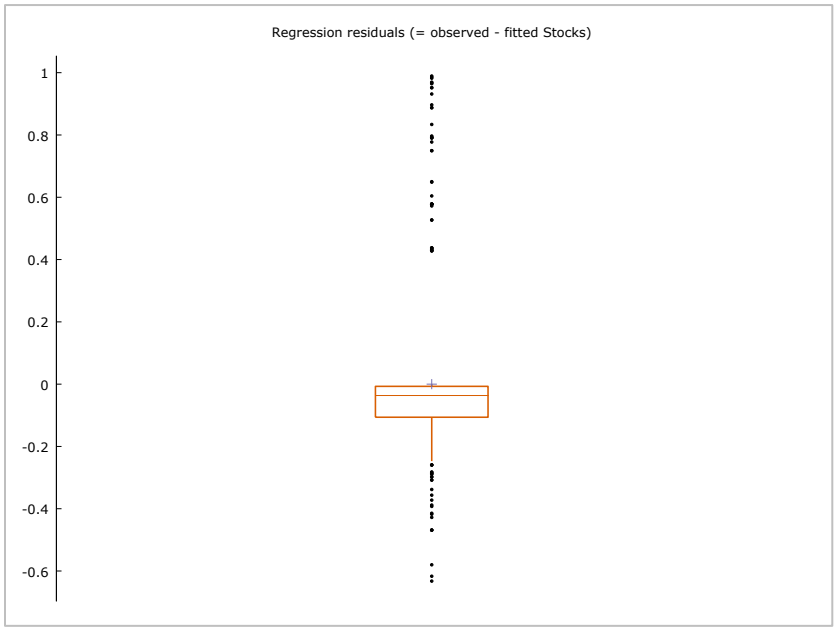
Stocks Model Actual versus Predicted Observations (with FinLit_B to Test Financial Literacy)



Note. Created by the author.

Figure E3

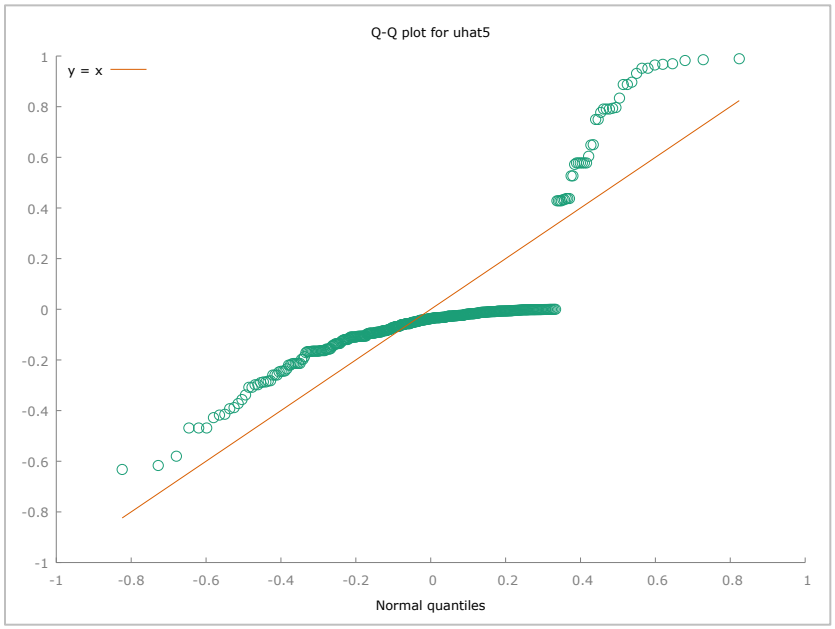
Stocks Model Residuals Boxplot (with FinLit_B to Test Financial Literacy)



Note. Created by the author.

Figure E4

Stocks Model Residuals Q-Q Plot (with FinLit_B to Test Financial Literacy)



Note. Created by the author.

Table E5

Stocks Logit Regression Model (with FinLit_N to Test Financial Literacy)

	Coefficient	Std. Error	z	p-value	
const	−4.91618	1.47559	−3.332	0.0009	***
Gender	−0.378911	0.398551	−0.9507	0.3417	
Age	−0.111833	0.303202	−0.3688	0.7122	
Education	0.323661	0.159782	2.026	0.0428	**
Income	0.735748	0.222612	3.305	0.0009	***
Savings	0.184063	0.146283	1.258	0.2083	
Size	−1.25236	0.293616	−4.265	<0.0001	***
Planning	0.175001	0.501813	0.3487	0.7273	
Perception	−0.620831	0.434347	−1.429	0.1529	
FinLit_N	0.319707	0.199508	1.602	0.1091	

Note. Created by the author.

Table E6

Stocks Model Goodness of Fit Measures (with FinLit_N to Test Financial Literacy)

Mean dependent var	0.110526	S.D. dependent var	0.313958
McFadden R-squared	0.198468	Adjusted R-squared	0.122764
Log-likelihood	−105.8771	Akaike criterion	231.7541
Schwarz criterion	271.1558	Hannan-Quinn	247.3889

Number of cases 'correctly predicted' = 342 (90.0%)
f(beta'x) at mean of independent vars = 0.051
Likelihood ratio test: Chi-square(9) = 52.4328 [0.0000]
Summary for Confusion Matrix:

Actual *0*, Predicted *0*: 336
Actual *1*, Predicted *0*: 36
Actual *0*, Predicted *1*: 2
Actual *1*, Predicted *1*: 6

Note. Created by the author.

Table E7

Stocks Logit Regression Model (with IntRate, Inflation, and LoanCond Variables to Test Financial Literacy)

	Coefficient	Std. Error	z	p-value	
const	−5.37350	1.53534	−3.500	0.0005	***
Gender	−0.352739	0.400232	−0.8813	0.3781	
Age	−0.0325289	0.308411	−0.1055	0.9160	
Education	0.355805	0.164047	2.169	0.0301	**
Income	0.745861	0.222987	3.345	0.0008	***

Savings	0.194708	0.148025	1.315	0.1884	
Size	−1.24225	0.298686	−4.159	<0.0001	***
Planning	0.184362	0.501194	0.3678	0.7130	
Perception	−0.567061	0.441562	−1.284	0.1991	
IntRate	0.847194	0.490565	1.727	0.0842	*
Inflation	−0.155889	0.529305	−0.2945	0.7684	
LoanCond	0.165467	0.455272	0.3634	0.7163	

Note. Created by the author.

Table E8

Stocks Model Goodness of Fit Measures (with IntRate, Inflation, and LoanCond Variables to Test Financial Literacy)

Mean dependent var	0.110526	S.D. dependent var	0.313958
McFadden R-squared	0.205019	Adjusted R-squared	0.114174
Log-likelihood	−105.0118	Akaike criterion	234.0236
Schwarz criterion	281.3057	Hannan-Quinn	252.7853

Number of cases 'correctly predicted' = 346 (91.1%)
f(beta'x) at mean of independent vars = 0.049
Likelihood ratio test: Chi-square(11) = 54.1632 [0.0000]
Summary for Confusion Matrix:

Actual *0*, Predicted *0*: 336
Actual *1*, Predicted *0*: 32
Actual *0*, Predicted *1*: 2
Actual *1*, Predicted *1*: 10

Note. Created by the author.