Financial Literacy and Home Ownership: A Quantitative Analysis of the German Real Estate Market

Gianfranco Marotta[1,2]*, Sebastian Kröger[2], Alexander Zureck[2]

[1]Universidad Católica San Antonio de Murcia, Spain, [2]FOM University of Applied Sciences, Essen, Germany.
*Email: Gianfranco.marotta@fom-net.de

ABSTRACT

Our work uses quantitative empirical analysis to examine the research question of whether a high level of financial literacy, proxied by numeracy, influences the purchase of real estate in Germany. Using a binary logistic regression analysis, a significant positive influence was identified based on a sample of 2149 people. The average financial literacy of the group examined was 3.78 out of 5 points. It is striking that owners in the sample have a higher numeracy score (average: 3.92) compared to non-owners (average: 3.54). The result shows that the probability of owning a home, c. p., increases by 4.58% points when the financial literacy score increases by one unit. Based on these results, policymakers are recommended to take action in order to develop a strategy to promote private pension provision in the form of home ownership.

Keywords: Financial Literacy, Real Estate, Personal Finance, Household Finance
JEL Classifications: G53, R21, D14, R31, C23

1. INTRODUCTION

The state retirement pension is secure. Hardly any other election campaign slogan resonates as long as the words of the then German Federal Minister of Labor, Dr. Norbert Blüm. In 1986, he campaigned for confidence in the statutory pension. Since then, Blüm's promise has always been the basis for discussions on the future viability of the statutory pension insurance scheme. Meanwhile, many Germans seem to have realized that the statutory pension is falling short. According to a YouGov study (n = 2089) from 2023, almost 50% of Germans are worried about poverty in old age (YouGov, 2023).

The question, therefore, arises as to how retirement provision can be promoted and how people can be empowered to take control of their finances. In this context, the authors emphasize that financial education in connection with real estate investment is a substantial ingredient for economic security in old age. A glance at the home ownership rate in Germany, however, shows that today, with around 49.1%, this rate is very low by international standards (Eurostat, 2023b). A potential reason might be insufficient financial literacy (FL) in Germany (Marotta and Zureck, 2024). FL has become a frequent subject of research in recent times when it comes to investigating financial investment predictors. Various studies have already shown a significant positive correlation between FL in stock market participation and retirement planning (van Rooij et al., 2012; Stolper and Walter, 2017; Thomas and Spataro, 2018). Yet, in Germany, the influence of FL on real estate acquisition is not represented in the current literature.

This leads to the hypothesis of whether FL is also a relevant determinant of real estate ownership in Germany:

H_1: Financial literacy has a significant favorable influence on private real estate ownership in Germany.

This research result is particularly relevant since the statutory pension is not secure as the sole retirement income.

2. SPECIFICS IN GERMANY

2.1. Demographics and Pensions

Demographic change, i.e., the change in the age structure, is progressing rapidly, particularly in Germany (Berlin-Institut für Bevölkerung und Entwicklung, no date). While society in Germany is ageing, birth rates are low. According to estimates by the Federal Statistical Office, there are currently around 84.3 million people living in Germany. While the number of adults aged between 20 and 66 was 65% in 1990 and the number of people over 66 was 13%, in 2022, the figure was 62% for people aged between 20 and 66 and 20% for people over 66. As early as 2035, 25% will be over 66 years old and, as things stand today, will no longer be working (Statistisches Bundesamt, 2022a). Whereas in 1957, there were 3.73 contributors for every retiree, in 2021, the figure is 2.12 contributors per retiree (Deutsche Rentenversicherung Bund, 2022).

With a steady retirement age, there will be continuously fewer working individuals and more retirees in the future. Due to increasing life expectancy, people are drawing pensions for longer and longer. The problem of the ageing social structure with regard to old-age provision is that the German pension system is based on a pay-as-you-go system (Börsch-Supan, 2015). This means that employees, subject to social insurance contributions, pay into the statutory pension system during their working life, and the money is paid out directly to pension recipients.

In fact, contributions from working people have not been sufficient to finance pensions for decades. As a result, the state makes up the shortfall with the help of taxpayers' money. Subsidies, contributions, and refunds from the federal budget support the statutory pension system. While federal funds accounted for around 18.7% in 2001, they amounted to around 24% in 2020 at EUR 80 billion (Bundeszentrale für politische Bildung, 2022). Currently accounting for around EUR 100 billion, the funds paid from the federal budget cover a solid 30% of the pension system expenditure (Bundesministerium für Arbeit und Soziales, 2023).

The retirement age has already been raised from 65 to 67. While the net standard pension was still around 48.1% in 2018, it is expected to be just 41.8% in 2045 (Grabka, 2022). Due to this demographic change, the pension gap is widening. It is unlikely that the current system will provide an adequate statutory income that ensures a standard of living, especially for the generation starting their careers.

2.2. Summary of Real Estate in Germany

An investment in real estate can be made as a direct or indirect investment. Indirect investments, also known as equity investments, are those acquired via the capital market in the form of real estate shares, open or closed-end real estate funds, or real estate investment trusts (REITs) (Brunner and Metz, 2009). These types of real estate investments are not discussed in this paper. This paper deals with the acquisition of real estate as a direct investment, irrespective of the type of use of the property.

The problematic baseline in this area of investment is evident in the fact that property ownership in Germany is considered low by international standards (Eurostat, 2022). In the EU, the average ownership rate is around 69.9% (Eurostat, 2023b). At around 49.1%, Germany also has a low ownership rate compared to other OECD countries, such as Sweden with 64.9% (Eurostat, 2023b), the United Kingdom with 65.2% (Eurostat, 2023b), the USA with 65.4% (U.S. Census Bureau, 2022), or Canada with 66.5% (Statistics Canada, 2022). Germany ranks second-to-last within the OECD. Only Switzerland has a lower home ownership rate, at around 42.2% (Eurostat, 2023b).

In 2021, there were around 40.68 million private households in Germany. It can be estimated that just under two people live in each household. Around 16.48 million households are one-person households. Of this group, more than 70% live in rented accommodation (Statistisches Bundesamt [Destatis], 2022b). In 2018, around 17.16 million households (46.5%) lived in owner-occupied properties. Around 80% of these live in a detached or semi-detached house. The remainder of owner-occupiers mostly live in owner-occupied apartments. The remaining 53.5% of households live in rented accommodation. At around 81%, owner-occupied apartments represent the largest proportion of rented residential properties (Krieger et al., 2021). The landlords are both private and professional landlords, such as municipal providers, cooperatives, private housing companies, or non-profit providers. However, small private landlords account for the largest share at around 60% (Sagner, 2020).

In 2021, around 41.66 million homes (approx. 97%) were in residential buildings, of which the largest quantity in Germany was to be found in NRW. Most residential buildings in Germany are single-family homes, with a total of around 12.94 million. However, with around 21.87 million, most residential units are multi-family houses. The number of multi-family houses is around 3.25 million. This means that not only has the total number of residential buildings increased by around 1.1 million since 2010, but the number of apartments has also increased by almost 2.4 million (Federal Statistical Office [Destatis], 2022c).

Statistics show that the higher the number of people in the household, the higher the percentage of owner-occupied properties. It is also statistically evident that the ratio of owners to tenants increases with age. The greatest age-related dynamic in the ownership rate is between the ages of 30 and 44. Around 20% of people between the ages of 30 and 34 live in their own homes. Around 32% of people between the ages of 35 and 39, already own their own homes. Among 40-44-year-olds, almost 44% live in their own home. This dynamic is due to the fact that income growth is at its highest during this period; as university graduates start their working lives, equity can be saved, and most families are started in this age group. In contrast, the home ownership rate under the age of 30 is very low at around 4% (as of 2017); as the average income is low, there is hardly any equity, and most people are single and childless (Sagner, 2020).

Apart from return expectations, there can be many motives for buying a property. Both rational and irrational circumstances can lead to the purchase of a property. Often, however, the reasons are emotional and lie in self-realization, the idea of freedom, or the desire for comfort (Sieper, 1994). Prestige is also a driver that

should not be underestimated (Brunner and Metz, 2009). Unlike other investments, owner-occupied property is an investment, which is mirrored in every level of Maslow's pyramid of needs.

2.3. State of Research

There has been a sharp increase in scientific publications surrounding the subject of financial literacy. In an international comparison, Germany achieves above-average arithmetic averages in terms of FL. However, the differences within Germany are considerable depending on socio-demographic factors (Bachmann et al., 2021). For example, the publication by Bucher-Koenen and Lusardi (2011) examines FL in Germany. The researchers concluded that women, the less educated, and people from eastern Germany have a lower FL than the national average (Bucher-Koenen and Lusardi, 2011). Studies in another publication also show that FL positively influences the retirement planning of Germans (Bucher-Koenen and Lusardi, 2011). In a further study by Lusardi et al. (2012), the positive correlation between FL and wealth accumulation was demonstrated in a Dutch study group.

According to the results of a study by Gathergood and Weber, the age of the test subjects is a significant criterion for purchasing a property. The two scientists were also able to show that, on average, owners have a higher FL than tenants. However, they emphasize that the FL only influences the purchase of property or young people up to the age of 45 and not for people who are older than 45 at the time of purchase (Gathergood and Weber, 2017).

These publications represent only a short extract of many studies on FL. Most publications focus on the USA. In contrast, the EU and Germany, in particular, are underrepresented in the publications (Stolper and Walter, 2017).

As Appendix Table 1 in the Appendix 1 shows, most of the studies used regression analysis in the form of a probit or logit method. The dichotomous questions in the studies justify this type of analysis. The two methods differ only marginally in their designs and are considered tried-and-tested means of investigating binary-coded questions (Gehrke, 2019).

3. DATASET AND METHODOLOGY

3.1. Analysis Approach

This study used a regression analysis using the logit method, given that the dichotomous question of whether real estate is

Table 1: Relevant variables

Variable	Min.	Median	Avg.	Max.
Age in years	47	70	70,76	98
Household size	1	2	1,86	6
Life satisfaction	0	8	7,95	10
Number children	0	2	1,98	11
Animal enumeration	0	23	23,13	72
Numeracy	1	4	3,78	5
Financial planning	1	3	2,68	5
Reading skills	1	2	2,07	5
Household income (monthly)	1	2.600	3.887	100.000
Years of apprenticeship	1	13	12,98	25

Own illustration

purchased can only be answered with "yes" or "no". The real estate acquisition represents the dependent variable (DV). The independent variable (IV) represents financial literacy. In addition, control variables (CV) are included based on existing studies with similar research questions.

Due to the logistic regression analysis, the maximum likelihood (ML) method is used instead of the ordinary least squares (OLS) method. An estimate with a sample size of 500 data points or more is unproblematic regardless of the distribution of the variables (Weiss, 2020). Various test procedures are used to check the goodness of fit (Gof) and the robustness of the results.

The following model represents an estimation model with exogenous variables. In terms of content, the null model has no explanatory power but merely serves as a comparative variable for the explanatory power of the fed model (Backhaus et al., 2021):

Formula 1: Regression Equation GLM1

$$\eta_1 \ (Ownership_i=1) = L(\beta_0 + \beta_1 \ age2020_i + \beta_2 \ Arealbd_i + \beta_3 \ Gender_i + \beta_4 \ Hhsize_i + \beta_5 \ LifeSatisfaction_i + \beta_6 \ Mstat_i + \beta_7 \ Nchild_i + \beta_8 \ Numberofanimals_i + \beta_9 \ Numeracy_i + \beta_{10} \ Planninghorizon_i + \beta_{11} \ Reading_i + \beta_{12} \ Riskaversion_i + \beta_{13} \ Totalhouseholdincomepermonth_i + \beta_{14} \ Yedu_i + \beta_{15} \ Typeofbuilding_i + \epsilon_i)$$

Where:

- η_1\eta_1η_1: The probability that DV "Ownership" takes the value of 1.
- L: Link function.
- β_0: Regression constant.
- β_{1-15}: Coefficients for the respective independent variables (IV).
- i: Index for the individual observation.
- UVx: Each independent variable.
- ϵ_i: Error term.

Own illustration

The alpha level is set at 5% and follows the usual scientific standard (Backhaus et al., 2021). For better interpretation, the logit coefficients are presented as effect coefficients or odds ratios. For this purpose, the coefficients are de-logarithmized. The odds ratio shows the average changed factor of the probability that results in c. p. with an increase or decrease by one unit of the respective exogenous variable. Furthermore, the coefficients are transformed in such a way that the "average marginal effects" (AME) are obtained, which are also easier to interpret. These express by how many percentage points the probability changes on average if the exogenous variable increases or decreases c. p. by one unit (Weiss, 2020).

3.2. Dataset

This analysis is secondary research that draws on existing data material. The data is derived from the "Survey of Health, Ageing and Retirement in Europe" (SHARE) panel study. The SHARE-ERIC project is coordinated by the research institute "Munich Center for the

Economics of Ageing" (MEA), which is funded for this project by the Federal Ministry of Education and Research (BMBF) and the Max Planck Society (Bergmann and Börsch-Supan, 2021). In their studies, the effects and changes of health, as well as social, economic, and environmental policy measures, are researched, particularly within Europe but also outside Europe. To this end, longitudinal data has been collected in 28 European countries and Israel since 2004 through interviews with test subjects (Börsch-Supan, 2022).

The field research of the eighth wave includes data from 39,919 households with 57,446 individuals. Of these, 2763 German households represent 3942 respondents (Bergmann and Börsch-Supan, 2021). After merging, the total number of respondents was 10,273. In the next step, the individual data sets of all respondents from Wave Eight were merged into one data set and adjusted for duplicates. This resulted in a total of 2878 respondents and 285 variables. 71 variables were then selected regarding the completeness of the responses to the variables. In the further course, it was recorded for all 2878 respondents whether they owned real estate and, if so, how it was acquired. Gifted people and heirs were removed. People living in a care facility were also removed from the data set. The data set ultimately consisted of 2149 test subjects and 23 different variables. Finally, 23 variables, consisting of DV, IV, and CV, were determined for the research.

Dependent variable – home ownership (yes/no)
The question related to home ownership represents the DV. An individual is considered to have acquired a residential property if they have purchased at least one property, regardless of whether this property is for owner-occupation, letting, or part-letting.
Independent variable – financial literacy
In the context of this paper, participants are not asked any direct questions on FL; instead, the numeracy score is used as a proxy. The relevant questions are listed in the Appendix 1. As is common in empirical research, the literacy level is determined using test questions (Hastings et al., 2013). Depending on the number of correctly answered questions, a score is given for the FL. The score can vary between one and five.
Control variables
In the data set, there are initially 21 variables. A stepwise regression was performed using hierarchically nested models. On this basis, the equation for the GLM was developed. In such a procedure, all variables of the data set are first included in the model and then removed individually. In this work, the Akaike Information Criterion (AIC), the log likelihood (LogLik), and the three different pseudo-R-squared values (McFadden; Cox and Snell) were used to determine which variables of the equation are retained and which are removed. In addition, a correlation matrix and the calculation of correlation values using Cramer's V and Pearson and Spearman were used to determine which variables correlate with each other. In the case of an increased correlation, the variable that showed the weaker AIC, LogLik, and pseudo-R-squared in the overall model was removed. As shown in Appendix Table 2, 14 variables were used in the equation. In the case of a nominal categorical CT, the dummy variables and the corresponding reference category are part of the model.

Own illustration

4. RESEARCH RESULTS

4.1. Descriptive Analysis

The SHARE data set comprises 2149 respondents. The study group consisted of 1138 female and 1011 male test subjects. The youngest person is 47 years old, and the oldest person is 98 years old. On average, the respondents are between 70 and 71 years old. The middle 50% of the people in this data set are between 64 and 78 years old. To provide a better overview of the above data, the following table 1 summarizes the position parameters' minimum, median, mean, and maximum, as well as the frequency distributions of the respective values of the variables:

As shown in table 2 of the 2149 people, 1352 own real estate, and the other 797 do not. This corresponds to a percentage distribution of 62.91% with property and 37.08% without property. Most of the respondents live in a village or rural area (761) or a small town (627). The number of people living in large cities is comparably lower. The average monthly household income in the survey group is EUR 2600 net, and the median is EUR 3887. Most of the respondents are satisfied or very satisfied with their lives. The majority of respondents (1511) are not prepared to take financial risks. However, 574 people are prepared to take average risks for average expected returns. In terms of FL, most people (959) in the data set achieved a numeracy score of four, which also corresponds to the median. The average is 3.779 points. The number of people with one or two points is low, at 27 and 188.

Next, the dependent variable correlations are presented in Table 3. At first glance, the correlation values show low to medium linear correlations. Of note is the variable for property type, which shows a correlation of 0.4953. The variable for marital status also shows a low to medium correlation of 0.3110. The variables for household size (0.2512), residential area (0.2171), and FL (0.2001) also show low correlations. All other variables show very low correlations between ±0.2.

The visual observation of illustration 1 below shows that the distribution of people with ownership increases as the numeracy score rises. Particularly around people with a numeracy score of four or five points, the distribution of people with property in the study group appears to increase. On the other hand, the distributions appear to be more significant for people without property.

The following table 4 shows the absolute distribution of owners and people without property in relation to the numeracy score:

Illustration 1: Homeownership and numeracy
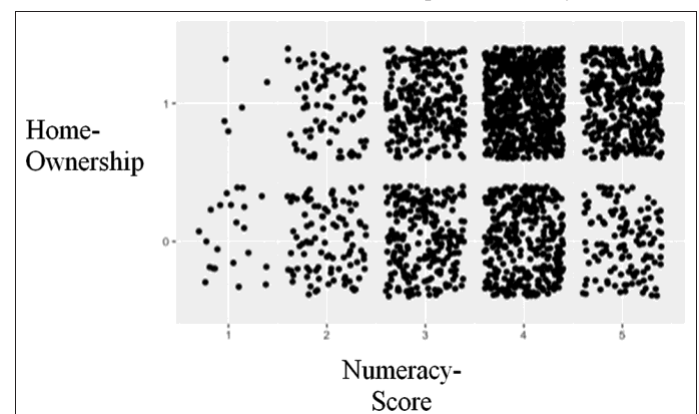
Own illustration

Most people with property have a numeracy score of four (47.19%). This is also evident among non-owners, for whom a score of four is also the most common (40.28%). The distribution shifts from a score of two. Only 47.87% of those still own property. The result is even more striking with a numeracy score of one. Only 18.52% of this group of people own at least one property. The average numeracy score of people without property is 3.54. The average numeracy score of owners is 3.92.

The illustration 2 uses boxplots to show the different distributions of numeracy score values divided into the groups of people with and without property. The boxplots show that people with property achieve a numeracy higher score. Over 50% of this group achieved scores of four or five points. In contrast, the middle 50% of the comparison group without property only achieved values of three and four points.

4.2. Logistic Regression

Next, the logistic regression results for the model (GLM1) are outlined in table 5. For this purpose, the logits, odds ratios, AMEs, and P-values for the individual variables are listed before the significant variables, and their direction and strength of effect are explained in more detail. For the following 15 of the 29 variables listed, a significant influence on the DV can be stated at an alpha of 5%. The following table 5 shows the results, whereby the rows with significant variables are printed in bold for better visualization.

The above can be interpreted as follows: The logits show the direction of the effect. In the case of "Marital status – married, not living with partner," the logit is negative. This indicates that a person who is married but not living with their partner has, on average, a lower probability of owning property compared to a person who is married and living with their partner, all else being equal. In terms of the odds ratio, the result shows that, on average, this person has 0.3972 times the likelihood of owning property. The Average Marginal Effect (AME) reveals that the probability

Illustration 2: Boxplot numeracy and homeownership

Own illustration

of property ownership for a married person who is not living with their partner is, on average, 15.95% lower compared to someone who is married and living with their partner. The P-value is 0.025, indicating that the effect is significant. A similar pattern is observed for individuals who have never been married or are divorced. Again, the reference group should be considered for interpretation. The logits are also negative, and the P-values show highly significant results. On average, the likelihood of owning property is 16.80% lower for individuals who have never been married and 16.97% lower for divorced individuals compared to the reference group.

The logit for the variable "Number of children" is also negative and shows high significance. This means that with each additional child, the likelihood of owning property decreases on average by 2.22% points. In terms of the financial planning horizon, a positive effect is observed. The longer the financial planning horizon, the higher the probability of owning property. Specifically, choosing a longer planning horizon increases the likelihood by 2.27% points, with a P-value of <0.01. An adverse effect was observed regarding self-assessment of reading ability. Since grades were assigned in this case, it shows that with each one-point decrease in grade, the likelihood of owning property decreases on average by 2.36% points. The P-value for this is 0.014.

For the categorical variable "Risk Tolerance – Average," a positive logit is observed. The odds ratio shows that a person with an average risk tolerance has, on average, 1.46 times the likelihood of being a property owner compared to the reference group (individuals with no risk tolerance). This corresponds to a 5.86% point higher probability. A positive effect is also seen in monthly household income. With an increase of one unit in monthly household income, i.e., 1,000 EUR, the probability of owning property increases, on average, by 4.05% points.

Meanwhile, for the categorical variable "Property Type," the probability of property ownership decreases, c. p., when the person resides in a semi-detached house or an apartment in a multi-family house. Specifically, the probability of owning property is 6.24% lower for residents of a semi-detached house/terraced house compared to the reference group, which includes individuals living in detached or two-family houses. People living in an apartment in a multi-family house with three to eight units have, on average, a 42.71% point lower probability of being property owners. A similar trend is observed for residents of apartments in multi-family houses with more than nine units and fewer than nine floors, with a 44.62% point decrease, and for residents of apartments in multi-family houses with more than nine floors, with a 39.72% point decrease. These values are highly significant. For residential properties with eldercare facilities, the probability of property ownership is, on average, 62.43% points lower compared to the reference group.

Regarding the number of years of apprenticeship, a positive logit is observed with highly significant values. With the completion of an additional year of apprenticeship, the probability increases, on average, by 0.88% points. In terms of the "Numeracy" variable, a positive logit is also recorded. The P-value is 3.80e-6, indicating that
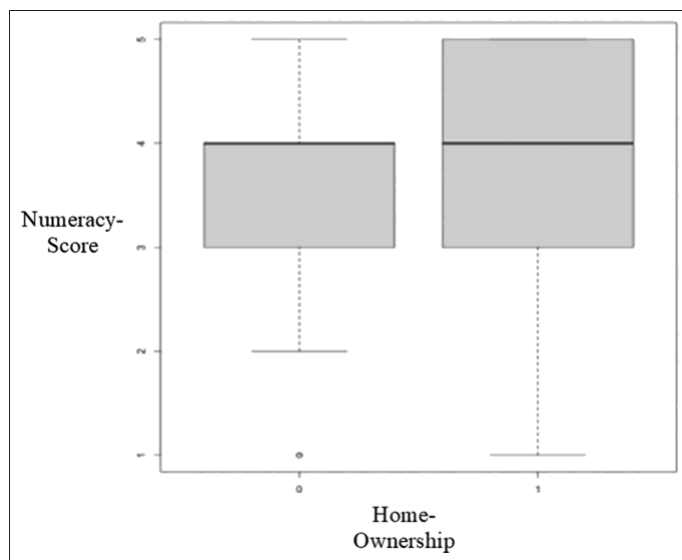
Table 2: Frequency of variables

Variable	Frequencies						
Object Type	Detached House	Semi-detached House	Multi-family house 3-8 apartments	MFH >9 Apartments, <9	MFH >9	Residential propierty with elderly care	Farm-house
	982	366	443	233	42	16	67
Characteristic area	Village	Suburbs of large city	Small town	Larger town	Metropolis		
	761	222	627	202	337		
Marital Status	Married, living together	Married, living separately	Never married	Widowed	Divorced		
	1.463	37	108	342	194		
Numeracy	1	2	3	4	5		
	27	188	497	959	478		
Risk tendency	No	Average	Above-Average	High			
	1.511	574	46	18			
Ownership	Yes			No			
	1.352			797			
Sex	Male			Female			
	1.011			1.138			

Own Illustration

Table 3: Correlations between variables

IV and control variables	DV: Ownership
(IV) Numeracy (FL)	0.2001
(CV) Age	−0.0943
(CV) Marital Status	0.3110
(CV) Financial Planning Horizon	0.1952
(CV) Gender	0.0269
(CV) Household Income	0.1244
(CV) Household Size	0.2512
(CV) Number of Children	0,0014
(CV) Life Satisfaction	0.1379
(CV) Years of Apprenticeship	0.1711
(CV) Reading Ability	−0.1607
(CV) Property Type	0.4953
(CV) Risk Tolerance	0.1522
(CV) Pet Ownership	0.1648
(CV) Residential Are	0.2171

Own illustration

Table 4: Distribution of numeracy-score and homeownership

DV	Numeracy-Score					
Home-Ownership		1	2	3	4	5
	0	22	98	232	321	124
	1	5	90	265	638	354

Own Illustration

high significance. With an increase in the score by one unit, the probability of owning property increases, on average, by 4.58% points. Under these conditions, the likelihood of property ownership increases by 1.34 times when the score value increases by one unit.

4.3. Model Quality and Diagnostics

In the next step, the model is used to predict the DV for the study group, and the classification table 6 is created. The classification table is as follows:

The model correctly identified 1178 property owners and 495 non-owners. However, it incorrectly predicted 405 non-owners as property owners and 174 property owners as non-owners.

The logistic regression model demonstrates high explanatory power. The AUC, with a value of 83.22, shows an excellent result. In particular, the recall of 87.1%, the precision of 79.6%, and the accuracy of 77.9% indicate strong predictive performance. Additionally, the pseudo-R^2 values demonstrate satisfactory goodness-of-fit, with values exceeding 0.2 and 0.4, respectively (Louviere et al., 2000). Furthermore, the model's explanatory power was confirmed to be statistically significant at the 5% significance level through Fisher's exact test, the Chi-square test, and the Hosmer-Lemeshow test. The model and dataset were also verified for the necessary assumptions for applying logistic regression analysis, confirmed through tests and visual inspection. Therefore, the required groundwork is in place for interpreting the model and dataset.

The null hypothesis (H_0), which assumes that financial literacy (FL) does not significantly positively affect property acquisition in Germany, can be rejected with a significance level of 5%, or in this case, with an error probability of <0.1%. Therefore, the alternative hypothesis (H1), which states that FL significantly positively impacts residential property acquisition in Germany, is accepted.

4.4. Embedding in Literature Results

Numerous factors influence the likelihood of a private property purchase. These include age, level of education, household size, marital status, wealth, employment status, municipality size, building type, and geographical location (Sagner & Voigtländer, 2019; Krieger et al., 2021; Voigtländer and Sagner, 2021). In addition, reasons for the low home ownership rate were also presented, such as high transaction costs, lack of tax deductions for mortgage interest on owner-occupied properties, social housing requirements, high purchase prices and recent sharp increases in mortgage interest rates (Krieger et al., 2021; vdpResearch GmbH, 2023).

Table 5: Results of logistic regression

Variables	Logits	Odds Ratios	AMEs	P-Values
Age	−0.007267	0.99275934	−0.0011	0.286200
Marital Status – Married, not living with partner	**−0.934637**	**0.39272846**	**−0.1595**	**0.025232***
Marital Status – Never married	**−0.981892**	**0.37460180**	**−0.1680**	**0.000428***
Marital Status – Registered partnership	−0.653588	0.52017594	−0.1094	0.527589
Marital Status – Widowed	−0.350925	0.70403630	−0.0573	0.050475.
Marital Status – Divorced	**−0.991311**	**0.37108978**	**−0.1697**	**7.46e−06***
Financial Planning Horizon	**0.145864**	**1.15703935**	**0.0227**	**0.002603***
Gender – Male	−0.196596	0.82152222	−0.0305	0.095331.
Household Size	0.206703	1.22961786	0.0321	0.065382.
Number of Children	**−0.142608**	**0.86709416**	**−0.0222**	**0.001641***
Years of Apprenticeship	**0.056859**	**1.05850653**	**0.0088**	**0.000582***
Reading Ability	**−0.151573**	**0.85935489**	**−0.0236**	**0.014092***
Life Satisfaction	0.024672	1.02497859	0.0038	0.440558
Monthly Household Income	**0.260521**	**1.29760645**	**0.0405**	**0.032022***
Numeracy	**0.294539**	**1.34250762**	**0.0458**	**3.80e-06***
Property Type – Farmhouse	−0.259176	0.77168690	−0.0401	0.400883
Property Type – Semi-detached house (RH/DHH)	**−0.391922**	**0.67575708**	**−0.0624**	**0.017951***
Property Type – Apartment in a multi-family house with 3 to 8 units	**−2.196371**	**0.11120602**	**−0.4271**	**< 2e-16***
Property Type – Apartment in a multi-family house with more than nine units and fewer than nine floors	**−2.293639**	**0.10089858**	**−0.4462**	**< 2e-16***
Property Type – Apartment in a multi-family house with more than nine floors	**−2.048269**	**0.12895800**	**−0.3972**	**1.05e-07***
Property Type – Residential property with eldercare facilities	**−3.396647**	**0.03348535**	**−0.6243**	**0.001413***
Risk Tolerance – Above Average	0.693609	2.00092336	0.1037	0.104021
Risk Tolerance – Average	**0.378997**	**1.46081938**	**0.0586**	**0.004590***
Risk Tolerance – Substantial	0.180453	1.19775940	0.0285	0.749445
Pet Ownership	0.013428	1.01351828	0.0021	0.127746
Residential Area – Suburb of a major city	0.385067	1.46971208	0.0581	0.076260.
Residential Area – Small town	0.071469	1.07408474	0.0111	0.628705
Residential Area – Large city	−0.035210	0.96540280	−0.0055	0.871895
Residential Area – Metropolitan city	0.085070	1.08879320	0.0132	0.659286

bold values = significant with Alpha: ***0.001; **0.01; *0.05; 0.1
Own Illustration

Table 6: Results forecast classification table

Home-owner	Predictions about ownership		
	Yes	No	Total
Yes	1.178 (TP)	174 (FN)	1.352
No	302 (FP)	495 (TN)	797
Total	1.480	669	2.149

TP: True positive, FP: False positive, TN: True negative, FN: False negative
Own Illustration

A more detailed comparison of the studies and their results regarding the residential real estate asset class nevertheless reveals differences. For example, the study by Almenberg and Widmark (2011) using a Swedish study group shows that FL does not influence the purchase of real estate, whereas numeracy has a positive influence. The empirical analysis by Gathergood and Weber from 2017 shows, based on a Welsh study group, that the average FL is higher for owners than for tenants. However, the study shows that the positive influence of the FL only applies to young households up to the age of 44. The FL, therefore, does not influence older households. The results do not contradict the findings of this study. As the time of purchase of the property is not questioned in this study, no further differentiation can be made here. The results of this study also clearly show that increased FL increases the likelihood of a person owning property.

The research results of Doorley and Nolan from 2019 also show a significant positive influence on the acquisition of investment properties based on an Irish test group of employees aged 54 and over. Whether this also applies to owner-occupied property cannot be conclusively clarified. The result, therefore, appears to be consistent with our study. The research results of Mata from 2021, in which a Mexican study group is used to demonstrate a significant positive influence of FL on real estate investments, are also comparable with the results of this study. However, Mata's study examined test subjects between the ages of 18 and 35. A data set with a higher age structure, such as ours, may be considered favorable since most of the test subjects are at an age at which they have already decided for or against ownership. It is, therefore, less likely that a person who did not own property at the time of the study will change this status again.

A comparison shows that the results are essentially in line with the results of existing studies. However, a closer look reveals some differences in the approach, the study group, or the DV. The methodological approach used in this research is comparable to the methods used in the scientific studies described above. Probit or logit methods are preferably used in these studies, and the latter method is also used in the present study.

5. CONCLUSION

Regarding the research question on whether numeracy scores, as a proxy for financial literacy (FL), significantly impact real estate purchases in Germany, the statistics reveal a highly

significant P-value. Logistic regression analysis confirms a positive effect, showing that as the numeracy score increases by one unit, the likelihood of owning at least one property increases by 1.34 times or 4.58% points. Our result stresses that the FL has a significantly positive influence on property acquisition on average.

Our findings are particularly relevant given that the current statutory pension system in Germany is inadequate for sufficient old-age provision. With the growing risk of poverty in retirement, private savings, mainly through real estate, are becoming increasingly important. While a detailed exploration of real estate as a retirement solution warrants a separate dissertation, the authors recognize its significance at this stage. We follow the argumentation of Marotta and Zureck and argue that a comprehensive understanding of the real estate market, which involves knowledge of equity release options, can fundamentally change and enhance retirement considerations (Marotta and Zureck, 2024). The German state should intensify efforts to raise the currently low homeownership rate to shield the population from the risk of poverty in old age and prevent additional burdens on public finances. Concrete measures must be identified and implemented to enhance the average FL within the German population.

REFERENCES

Almenberg, J., Widmark, O. (2011), Numeracy, financial literacy and participation in asset markets. SSRN Electronic Journal. https://doi.org/10.2139/ssrn.1756674

Bachmann, R., Rulff, C., Schmidt, C.M. (2021), Financial competencies and deficits in Germany-a current review. List Forum fur Wirtschafts- und Finanzpolitik, 47(2-4), 111-132.

Backhaus, K., Erichson, B., Gensler, S., Weiber, R., Weiber, T. (2021), Multivariate Analyse Method. Wiesbaden: Springer Fach-Medien Wiesbaden.

Bergmann, M., Börsch-Supan, A. (2021), Share Wave 8 Methodology: Collecting Cross-National Survey Data in Times of COVID-19. München: Munich Center for the Economics of Aging.

Berlin-Institut für Bevölkerung und Entwicklung. (no date), Demografischer Wandel. Available from: https://www.berlin-institut.org/themen/national/demografischer-wandel [Last accessed on 2023 Feb 19].

Börsch-Supan, A. (2015), Lehren aus den Rentenreformen seit 1972. Wirtschaftsdienst, 95(1), 16-21.

Börsch-Supan, A. (2022), Share, Share-ERIC. Available from: https://share-eric.eu/fileadmin/user_upload/other_publications/2022_share-flyer_evidence-based_policy_making.pdf [Last accessed on 2023 Apr 16].

Börsch-Supan, A. (2022), Survey of Health, Ageing and Retirement in Europe (SHARE), Wave 8. Release Version: 8.0.0. SHARE-ERIC Data Set.

Brunner, M., Metz, M. (2009), In: Brunner, M., editor. Kapitalanlage Mit Immobilien. Wiesbaden: Gabler.

Bucher-Koenen, T., Lusardi, A. (2011), 'Financial literacy and retirement planning in Germany. Journal of Pension Economics and Finance, 10(4), 565-584.

Bundesministerium für Arbeit und Soziales. (2023), Gesetzliche Rentenversicherung. Available from: https://www.bmas.de/de/soziales/rente-und-altersvorsorge/fakten-zur-rente/gesetzliche-rentenversicherung/gesetzliche-rentenversicherung.html [Last accessed on 2023 May 28].

Bundeszentrale für Politische Bildung. (2022), Einnahmen und Ausgaben der gesetzli-chen Rentenversicherung (GRV). Bundeszentrale für Politische Bildung [Preprint].

Deutsche Rentenversicherung Bund. (2022), Rentenversicherung in Zeitreihen 2022. Berlin: DRV-Schriften Band.

Doorley, K., Anne, N. (2019) Retirement Planning Determinants Within Irish Couples: The Role of Financial Literacy. Germany: IZA – Institute of Labor Economics.

Eurostat. (2023), Housing in Europe – 2023 edition. Publications Office of the European Union. Available from: https://ec.europa.eu/eurostat/web/interactive-publications/housing-2023

Gathergood, J., Weber, J. (2017), 'Financial literacy: A barrier to home ownership for the young? Journal of Urban Economics, 99, 62-78.

Gehrke, M. (2019), Angewandte empirische Methoden in Finance and Accounting. Berlin: De Gruyter Oldenbourg.

Grabka, M.M. (2022), 'Löhne, Renten und Haushaltseinkommen sind in den vergange-nen 25 Jahren real gestiegen. DIW Wochenbericht, 89(23), 329-337.

Hastings, J.S., Madrian, B.C., Skimmyhorn, W.L. (2013), 'Financial literacy, financial education, and economic outcomes. Annual Review of Economics, 5, 347-373.

Krieger, S., Kortmann, K., Kott, K., & Schöneich, C. (2021), 'Wohnen', in Auszug aus dem Datenreport 2021. Germany: Statistisches Bundesamt, p259-269.

Louviere, J.J., Hensher, D.A., Swait, J. (2000), 'Choosing a choice model'. In: Stated Choice Methods. Cambridge: Cambridge University Press, p34-82.

Lusardi, A., Mitchell, O.S. (2011), Financial literacy around the world: an overview. Journal of Pension Economics and Finance, 10(4), 497-508.

Marotta, G., Zureck, A. (2024), Enriching real estate and financial literacy: Exploring Real estate use-cases for blockchain technology. Scientia Moralitas Journal, 9(1), 48-61.

Mata, O.G. (2021), The effect of financial literacy and gender on retirement planning among young adults. International Journal of Bank Marketing, 39(7), 1068-1090.

Sagner, P. (2020), Verbreitung von Wohneigentum in Deutschland. Germany: Springer.

Sagner, P., Voigtländer, M. (2019), Sozio-Ökonomische Determinanten der Wohneigentumsbildung. Köln: IW-Gutachten.

Sieper, H. (1994), Immobilien, Immobilien. Wiesbaden: Gabler Verlag.

Statistics Canada. (2022), 'To buy or to rent: The housing market continues to be reshaped by several factors as Canadians search for an affordable place to call home. The Daily - Component of Statistics Canada catalogue No 11-001-X.

Statistisches Bundesamt (Destatis). (2022b), Bevölkerung und Erwerbstätigkeit', Haus-halte und Familien - Ergebnisse des Mikrozensus - Fachserie. Available from: https://www.destatis.de/fachserien

Statistisches Bundesamt (Destatis). (2022c), Fortschreibung der Wohngebäude-und Wohnungsbestand. Available from: https://www-genesis.destatis.de/genesis/online?opera-tion=abruftabelle bearbeiten&levelindex=1&levelid=1678290815367&auswahlop era- tion=abruftabelleauspraegungauswaehlen&auswahlverzeich nis=ord- nungsstruktur&auswahlziel=werteabruf&code=31231-0001&auswahltext=&werte- abruf=starten#abreadcrumb [Last accessed on 2023 Mar 08].

Statistisches Bundesamt. (2022a), 15. Koordinierte Bevölkerungsvorausberechnung, Bevölkerungsberechnung Statistisches Bundesamt. Available from: https://www.desta- tis.de/de/themen/gesellschaft-umwelt/bevoelkerung/bevoelkerungsvorausberech- nung/begleitheft.html?nn=208696#ergebnisse [Last accessed on 2023 Feb 20].

Statistisches Bundesamt. (2022b), Bevölkerungsstand. Available from: https://www.desta- tis.de/de/themen/gesellschaft-umwelt/ bevoelkerung/bevoelkerungsstand/tabel- len/zensus-geschlecht-staatsangehoerigkeit-2022.html?view=main[print] [Last accessed on 2023 Feb 19].

Stolper, O.A., Walter, A. (2017), Financial literacy, financial advice, and financial behavior. Journal of Business Economics, 87(5), 581-643.

Thomas, A., Spataro, L. (2018), Financial literacy, human capital and stock market participation in Europe. Journal of Family and Economic Issues, 39(4), 532-550.

U.S. Census Bureau. (2022), Home Ownership USA, 2021 American Community Survey 1-Year Estimates. Available from: https:// data.census.gov/table?q=home+owner-ship&tid=acsdp1y2021. dp04&moe=false [Last accessed on 2023 Mar 07].

van Rooij, M.C.J., Lusardi, A., Alessie, R.J.M. (2012), 'Financial literacy, retirement planning and household wealth. The Economic Journal, 122(560), 449-478.

vdpResearch GmbH. (2023), Trendwende Bei Immobilienpreisen Verfestigt Sich. Berlin: vdpResearch GmbH. Available from: https://www.pfandbrief.de/site/dam/jcr: db93886d-f4d9-4b65-a3f4-2d72bb551b56/vdp_index-broschuere_q4_2022_de_final.pdf [Last accessed on 2023 Mar 11].

Voigtländer, M., Sagner, P. (2021), Wohneigentum und Vermögensbildung: Aufgaben für die Sozial-und Regionalpolitik. In: Naumer, H.J., editor. Vermögensbildungspolitik. Wiesbaden: Springer Fachmedien, p135-146.

Weiss, F. (2020), Analyse binärer abhängiger Variablen. In: Fortgeschrittene Analyse-verfahren in den Sozialwissenschaften. Wiesbaden: Springer Fachmedien Wiesbaden, p45-73.

APPENDIX 1

Appendix Table 1: Literature review

Author (Year)	Research topic/sample and size/methodology	DV	IV
Almenberg and Widmark (2011)	Influence of Numeracy and Financial Literacy on the Acquisition of Stocks and Real Estate/1300 participants from the Swedish population/Probit	Stock market participation and real estate acquisition	Numeracy and Financial Literacy
Gathergood and Weber (2017)	Influence of Financial Literacy on Real Estate Acquisition/2000 English and Welsh households/Probit	Real estate acquisition	Financial Literacy
Doorley and Nolan, A. (2019)	Influence of Financial Literacy on Wealth, Retirement Planning, and Investment Assets/1346 Irish participants aged 54+but pre-retirement/OLS, Probit	Net wealth	Financial Literacy
Bucher-Koenen and Lusardi (2011)	Influence of Financial Literacy on Retirement Planning/1059 German households aged 25-65 years/OLS, Probit	Retirement planning	Financial Literacy
Lusardi and Mitchell (2011)	Influence of Financial Literacy on Retirement Planning/1042 US Americans aged 25-65 years/OLS, IV Regression	Retirement planning	Financial Literacy
Van Rooij et al. (2012)	Influence of Financial Literacy on Retirement Planning and Wealth/1091 Dutch households/OLS, IV Regression	Retirement planning; Wealth	Financial Literacy
Mata (2021)	Influence of Financial Literacy on Retirement Planning of Young People/4984 Mexican participants (ages 18-35 years)/Logit	Active retirement planning	Financial Literacy

Own illustration

Appendix Table 2: Control variables and reference category of the GLM equation

Control variables	Reference category
Age: Numeric	
Marital Status:	1. Married, living together 2. Married, living separately 3. Never married 4. Registered partnership 5. Widowed 6. Divorced
Financial Planning Horizon: Numeric	
Gender:	1. Female 2. Male
Household Size: Numeric	
Number of Children: Numeric	
Life Satisfaction: Numeric	
Years of Apprenticeship: Numeric	
Reading Ability: Numeric	Reading Ability: Numeric
Monthly Household Income: Numeric in thousands	Monthly Household Income: Numeric in thousands
Property Type:	1. Detached single-/two-family house, 2. Farmhouse, 3. Row house/semi-detached house, 4. Condominium in a multi-family house with 3-8 units, 5. Condominium in a multi-family house with more than 9 units but fewer than 9 floors, 6. Condominium in a multi-family house with more than 9 floors, 7. Residential property with eldercare facilities
Risk Tolerance:	1. Not willing to take any financial risks, 2. Willing to take above-average financial risks for above-average returns, 3. Willing to take average risks for average returns, 4. Willing to take substantial risks for substantial returns
Pet Ownership: Numeric	
Residential Area:	1. Rural area or village, 2. Suburb of a major city, 3. Small town, 4. Larger city, 5. Metropolitan city

Own illustration

Appendix Table 3: Measurement of Numeracy/Financial Literacy

Wenn die Wahrscheinlichkeit, eine bestimmte Krankheit zu bekommen, bei 10 Pro- zent liegt, wie viele von 1.000 (eintausend) Menschen werden die Krankheit dann wahrscheinlich bekommen (Börsch-Supan, 2022)?
1. 1.100
2. 2.10
3. 3.90
4. 4.900
5. Andere Antwort

Bei einem Schlussverkauf kosten in einem Geschäft alle Waren nur den halben Preis. Vor dem Schlussverkauf kostete ein Sofa 300 ^FLCurr;. Was kostet es beim Schlussverkauf (Börsch-Supan, 2022)?
1. 150^{FLCurr}
2. 600^{FLCurr}
3. Andere Antwort

Ein Gebrauchtwagenhändler verkauft ein Auto für 6.000 ^FLCurr;. Das sind zwei Drittel dessen, was der Wagen neu gekostet hat. Wie hoch war der Preis für den Neuwagen (Börsch-Supan, 2022)?
1. 9.000^{FLCurr}
2. 4.000^{FLCurr}
3. 8.000^{FLCurr}
4. 12.000^{FLCurr}
5. 18.000^{FLCurr}
6. Andere Antwort

Nehmen wir einmal an, Sie haben 2.000 ^{FLCurr}; auf Ihrem Sparbuch und Sie be- kommen dafür jedes Jahr 10 Prozent Zinsen. Wie viel Geld haben Sie nach zwei Jahren auf Ihrem Sparbuch (Börsch-Supan, 2022)?
1. 2.420^{FLCurr}
2. 2.020^{FLCurr}
3. 2.040^{FLCurr}
4. 2.100 ^{FLCurr}
5. 2.200^{FLCurr}
6. 2.400^{FLCurr}
7. Andere Antwort"