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RESEARCH ARTICLE

Comparative effects of self-evaluated and test-based financial literacy on choosing life insurance policies in a multi-racial context

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Abstract: Background: This study investigates the relationship between financial literacy and the choice of life insurance policies in the multi-racial context of the United States. Both subjective and objective measures of financial literacy are considered important factors in shaping consumer behavior in the life insurance market. Methods: Logistic regression analyses were conducted using data from the 2022 Survey of Consumer Finance to explore how financial literacy is related to the ownership of different types of life insurance, including term insurance, cash value insurance, and a combination of both. The analysis controlled for demographic variables such as age, race, and marital status. Results: The results show that subjective financial literacy significantly influences the ownership of all types of life insurance, while objective financial literacy only affects ownership of term insurance. Demographic factors, such as belonging to Generation X, or being married, also have a positive impact on life insurance ownership. Higher levels of education and income are associated with a higher likelihood of owning life insurance, while unemployment has a negative impact. Conclusion: The findings highlight the central role of subjective financial literacy in motivating individuals to purchase life insurance. Confidence in one's financial knowledge appears to be more influential than actual knowledge when making insurance decisions. Therefore, financial education programs should aim to improve both financial knowledge and confidence to encourage wider adoption of life insurance, ensuring greater financial security for diverse populations.

Keywords: life insurance, term policy, racial disparities, financial literacy, consumer behavior

1 Introduction

The life insurance market in the United States is crucial for economic stability and personal financial planning because it provides a financial safety net against the economic risks of premature death. In 1998, more than 52 million policies with a face value of nearly $2.2 trillion were purchased, highlighting the industry's significance [1]. The market offers various products, such as term life insurance and cash value life insurance, to meet different consumer needs [2,3]. As of 2022, the market had total gross written premiums of $631.7 billion, with significant contributions from general annuity and life insurance products. This underscores the ongoing importance and growth of the sector, which achieved a compound annual growth rate (CAGR) of 2.5% from 2017 to 2022 [4,5].

Consumer preferences have evolved due to demographic shifts, improved financial knowledge, and the availability of alternative investment options. There is now a growing demand for term insurance instead of cash value insurance, driven by the benefits of tax-advantaged savings plans [6,7]. Regulatory frameworks ensure market solvency and fair practices, impacting the development and pricing of insurance products [7]. Technological advancements, particularly the Internet, have revolutionized the process of comparing prices and purchasing financial products, making them more accessible [8,9].

Research suggests that socio-demographic factors and financial literacy significantly influence the demand for life insurance [10–14]. Financial literacy can be measured objectively through tests and subjectively through self-assessment, with subjective literacy often being a stronger predictor of insurance purchases [12,14].

This study utilizes data from the 2022 Survey of Consumer Finance to investigate whether subjective financial literacy has a greater impact on life insurance demand compared to objective measures. This pilot research aims to gain insights that could enhance financial education and marketing strategies within the U.S. life insurance market.

Addressing the disparity between subjective and objective financial literacy and its influence on life insurance purchasing behavior, the main question is whether subjective financial literacy, as measured by confidence, has a more substantial effect on purchasing decisions than objective knowledge. This investigation could significantly contribute to our understanding of financial decision-making and have implications for financial education and marketing efforts. By understanding these dynamics, we can better design educational programs that improve both financial knowledge and consumer confidence, ultimately leading to better financial outcomes and increased life insurance adoption.

2 Background

2.1 Context and Historical Overview

The concept of life insurance has existed since ancient times but was not formalized until the 17th century in England. The first life insurance policies were underwritten in the early 1700s, mainly by marine insurance companies. These early policies were basic and relied on a limited understanding of risk and mortality rates. The development of life insurance mathematics in the latter half of the 17th century marked a significant advance, introducing more systematic approaches to risk assessment and premium calculation [15]. By the 19th century, life insurance had become more common, especially in the United States and Europe, driven by industrialization and the growing middle class. The American life insurance industry experienced significant growth during this period, with companies like New York Life and MetLife gaining prominence. The industry's expansion was supported by better actuarial data and more sophisticated risk assessment models, enabling a wider range of life insurance products [16–20].

The historical context of life insurance is complex and rich, shaped by changing cultural definitions of risk, gambling, and the value of life. In the early 19th century, life insurance was viewed skeptically and often associated with gambling, making it a speculative venture. However, as the century progressed, shifts in religious and economic morality facilitated the acceptance and legitimization of life insurance [21]. The industry's marketing techniques evolved to address the dual goals of business and altruism, with agents navigating the tension between being salespeople and seeing themselves as missionaries [22]. The transformation of life insurance from a controversial concept to an accepted financial instrument reflects broader sociological dynamics. The industry's growth was influenced by ideological resistance in various cultures. Additionally, the development of life insurance in the United States differed from other types of insurance, such as fire and marine insurance, which were more readily accepted due to their clear economic rationale [22]. The resistance to life insurance stemmed from a value system that opposed the financial valuation of human life, challenging the idea of establishing monetary equivalents for sacred aspects of the social order [22].

2.2 Literature review

The literature on life insurance extensively explores various aspects of consumer behavior, market dynamics, and the impact of financial literacy on insurance purchasing decisions. Significant studies have provided insights into how demographic factors, economic conditions, and consumer knowledge influence the uptake of life insurance.

Research has shown that demographic variables such as age, income, and family structure significantly affect the demand for life insurance. For example, younger adults often perceive less need for life insurance, while older adults with dependents see it as essential for financial planning [23, 24]. Studies conducted by the Insurance Studies Institute have also highlighted how improvements in life expectancy influence consumer perceptions and the market demand for life insurance products [25].

The demand for life insurance in the United States has historically varied significantly among different racial groups due to a range of economic, cultural, and systemic factors. In the past, life insurance was predominantly marketed towards white Americans, who generally had greater access to it through their employment. This pattern reflects the broader context of employment and economic opportunities that historically favored white individuals over other racial groups [26].

The 2022 Survey of Consumer Finance presents a compelling visualization (Figure 1) of life insurance coverage among diverse racial groups in the United States. The data is divided into four main categories: no life insurance, concurrent enrollment in term and cash value life

insurance, reliance on term insurance only, and exclusive commitment to cash value insurance. The bar graphs derived from the survey data reveal significant racial disparities in life insurance uptake, highlighting uneven coverage distribution among different racial demographics. All figure sources are from my analysis.

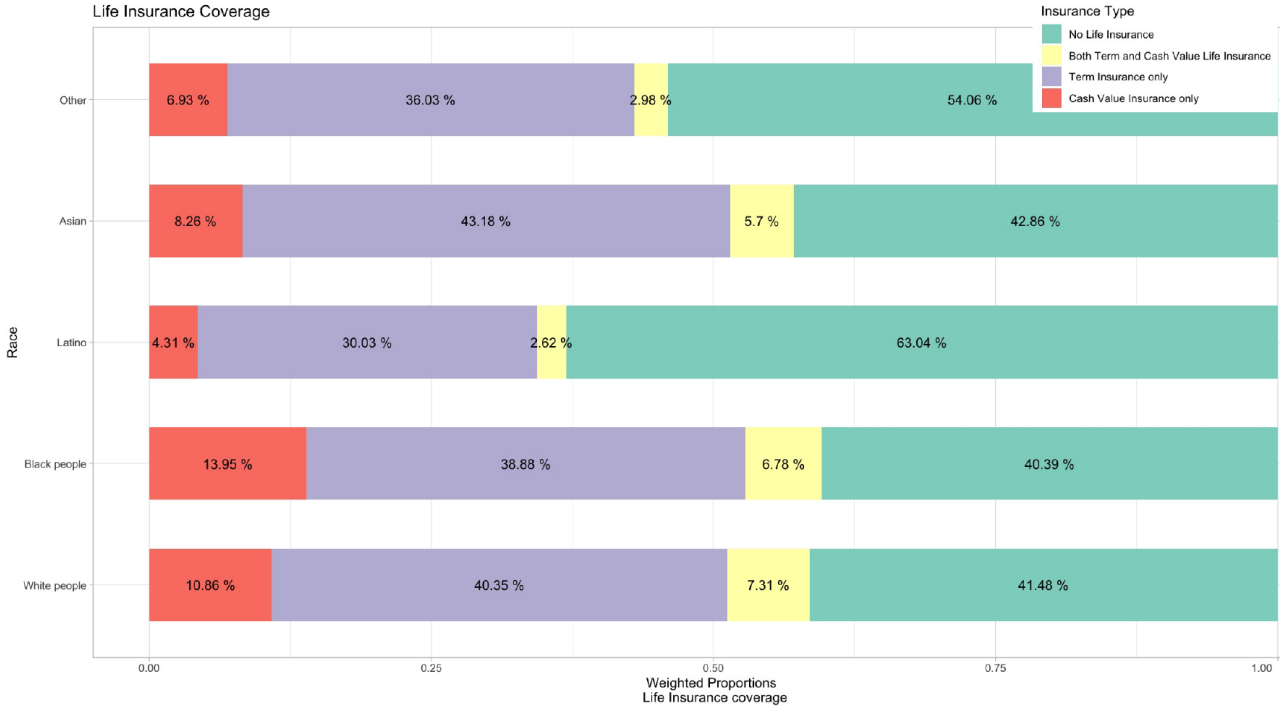

Figure 1 Relative proportion: life insurance type by race. (Source: Author's analysis)

The data shows that among Latinos, a significant 63.04% do not have any form of life insurance coverage, which is the highest percentage among the groups studied. Asians follow closely with 42.86% lacking life insurance, while the proportion of uninsured White individuals is slightly lower at 41.48%. Black individuals have a slightly higher insurance coverage rate, with 40.39% lacking life insurance.

When examining preferences for term life insurance, Asians show a particularly high preference for this type of coverage, at 43.18%, closely followed by White individuals at 40.35%. These percentages indicate significant engagement with term life insurance policies within these communities, reflecting a specific value placed on the straightforward, time-bound nature of this insurance form.

Conversely, cash value life insurance, which focuses on investment, sees its highest relative uptake within the Black community, with 13.95% choosing this insurance type. This indicates a preference for policies that provide a death benefit and a savings accumulation feature. White individuals also show a notable affinity for cash value insurance at 10.86%, suggesting that a significant segment within these racial categories values the growth potential inherent in these policies.

Additionally, the survey highlights that White individuals lead in securing a combination of both term and cash value life insurance policies, with a rate of 7.31%. This indicates a comprehensive approach to financial planning regarding life insurance. Black individuals are not far behind, with 6.78% also choosing to diversify their life insurance strategies with both types of policies.

The survey's findings clearly indicate the presence of racial disparities in the life insurance market, with varying levels of coverage adoption across different groups. This suggests the need for a nuanced understanding of the socio-economic factors that contribute to these disparities, as well as a potential reevaluation of how life insurance products are marketed and made accessible to each racial demographic.

Income and the demand for life insurance are closely linked, as demonstrated by research [27–29]. The life insurance industry is of great importance, with millions of policies being bought every year, and it serves as a financial safety net for households [30]. The rise in premium income from life insurance companies, which experienced a substantial increase from

2001 to 2010, indicates an increasing demand for life insurance products that correlates with income levels [30]. This growth is also evident in the number of new policies sold, suggesting that as incomes increase, there is a greater tendency to seek life insurance.

A more detailed analysis of the 2022 Survey of Consumer Finance, using a scatter plot (Figure 2), provides valuable visual insight into how income affects the demand for life insurance. The plot shows that the White demographic has a wider range of income levels, indicating greater income variability. Asian individuals exhibit the next highest level of income variation. These patterns suggest that income levels have different effects on the demand for life insurance among these groups. Contrary to the previous figure (Figure 1), which suggested that cash value life insurance is particularly important to Black individuals, Figure 2 reveals that this preference does not seem to be directly linked to income. Black individuals, regardless of the life insurance product they choose, have a narrower range of income levels. This suggests that income has less variability in its influence on the demand for life insurance among Black individuals compared to White, Asian, and Latino groups.

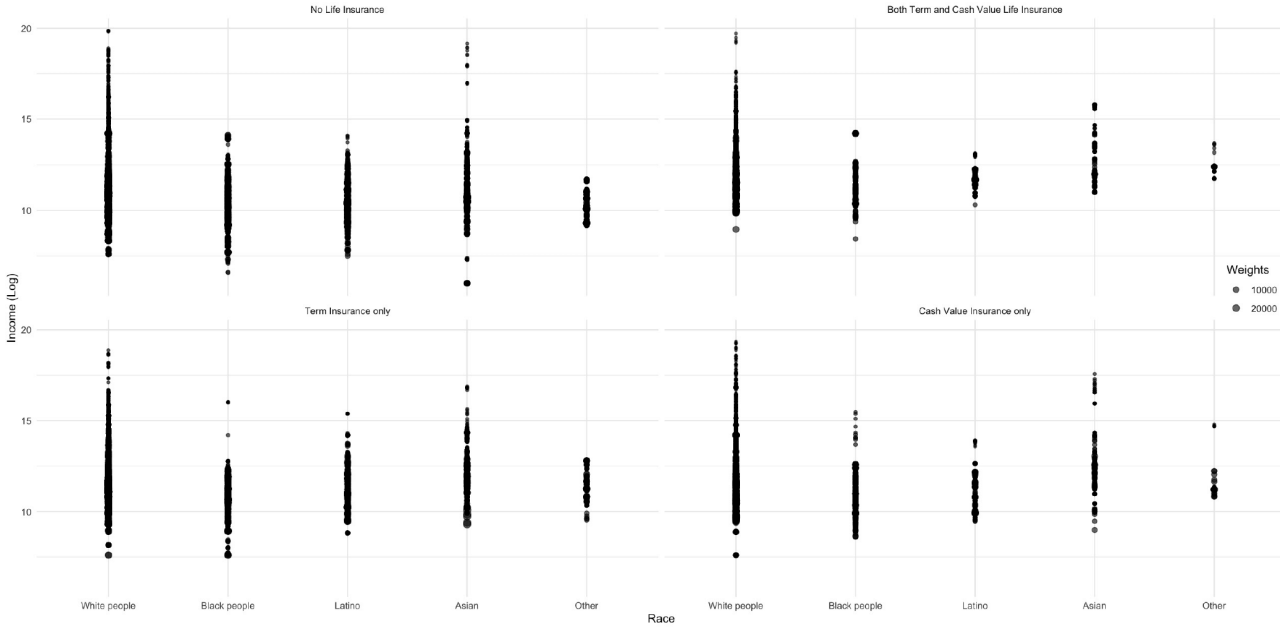

Figure 2 Weighted scatter plot: Race and life insurance types. (Source: Author's analysis)

These findings have significant implications, indicating that factors other than income may contribute to the demand for different types of life insurance. Cultural preferences, perceptions of risk, access to financial information, and the perceived value of life insurance offerings are all potential factors influencing this demand. Societal norms, historic trust in financial institutions, targeted marketing efforts, and differential access to financial advisors and resources may also shape decisions regarding life insurance.

The observed variations among racial groups suggest that complex socio-economic dynamics influence the types and levels of life insurance coverage chosen by individuals. To fully understand these patterns of consumer behavior, further research is necessary that goes beyond income as a predictive factor. Such research should explore the cultural, educational, and social factors that shape the demand for life insurance within diverse communities. This expanded analysis will be crucial for insurers looking to effectively tailor their products to meet the specific needs of their customers.

Figure 3 examines the relationship between income levels and life insurance status among different racial groups in detail. Using a logarithmic scale for weighted mean income allows for a clear comparison of income disparities within each category of life insurance coverage: no life insurance, both term and cash value life insurance, term insurance only, and cash value insurance only. Among White individuals, the graph shows a wide range of income levels, indicating a broad variation among those with and without life insurance. The peak for this group suggests that individuals with both term and cash value life insurance tend to have higher incomes. Asian individuals exhibit a broader variability in income with a higher peak, indicating a direct correlation between income levels and the possession of life insurance.

The plot for Black individuals shows a narrower income range across the different types of

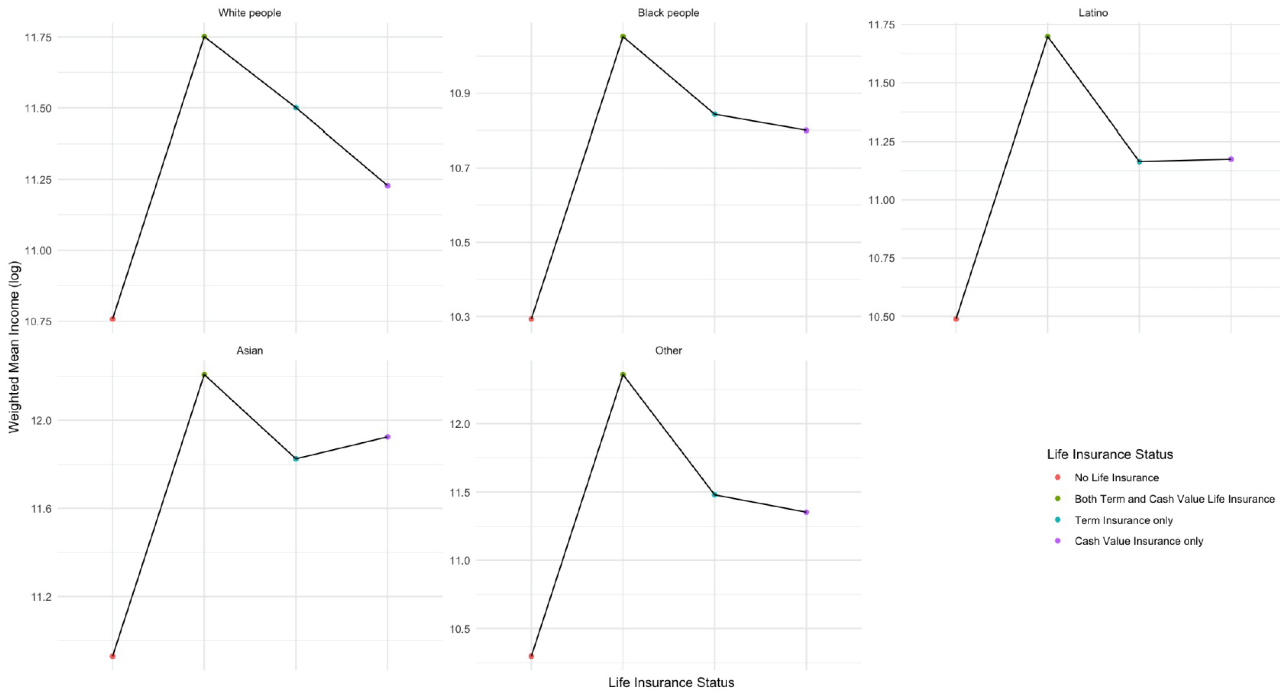

Figure 3 Interaction plot: Race by life insurance types. (Source: Author's analysis)

life insurance, suggesting that income might not be the sole or most significant factor driving life insurance coverage within this group. For Latino individuals, there is a sharp increase to the peak for those with both term and cash value life insurance, followed by a decrease, and then a slight rise for those with cash value insurance only. This pattern suggests that while income does play a role in life insurance coverage for Latinos, particularly for those investing in both types of policies, other factors may also be influential.

The overall analysis suggests that while there is an income effect on life insurance demand among racial groups, the degree to which income influences life insurance choices varies. Income appears to be a more significant factor for White and Latino individuals when opting for both term and cash value life insurance, while for Black and Asian individuals, the influence of income is less pronounced. This variation points to the possibility that cultural, social, or systemic factors may also play a role in determining life insurance coverage choices in addition to income.

The life insurance market has undergone significant changes, with shifts in product offerings reflecting broader economic and regulatory trends. The emergence of flexible products like universal life insurance and the growing use of digital platforms for distribution demonstrate how the market adapts to evolving consumer needs and technological advancements [31, 32]. Comparative studies of different markets, such as those in Ukraine and Romania, have revealed how regional economic conditions and consumer preferences drive market development [33].

Despite extensive research, there are still gaps, particularly in understanding the nuanced impacts of subjective versus objective financial literacy on life insurance purchasing behavior. Most studies have not adequately distinguished between these types of literacy or delved deeply into their interaction with socio-economic factors. Additionally, while the impact of demographic shifts on life insurance demand is well-documented [23, 34], less is known about how these shifts intersect with changes in financial education and consumer confidence over time.

One of the challenges in the existing literature, which this research also encounters, is the use of cross-sectional data. While this approach provides a valuable snapshot of financial literacy and life insurance purchasing behavior at a specific moment, it does not allow for the analysis of long-term trends or the establishment of causality. Despite this limitation, cross-sectional studies are helpful in identifying correlations and can inform hypotheses for future research. Cross-sectional studies are excellent for descriptive analysis, providing a detailed overview of a population, including the distribution of variables such as behaviors, attitudes, and conditions at a specific point in time [35, 36]. Furthermore, these studies are useful for generating hypotheses that can later be tested with more rigorous experimental or longitudinal methods. By identifying

associations between variables, researchers can develop hypotheses about causal relationships that might be explored in future studies.

2.3 Key definitions and terminology

Life insurance is a crucial financial tool that provides financial support to dependent when the policyholder passes away. By entering into a contract with an insurer, the policyholder ensures that a predetermined sum will be paid to their beneficiaries upon their death, in exchange for regular premium payments. Life insurance is important for estate planning and offers a sense of security while maintaining the financial stability of the survivors [37, 38].

Term insurance, a type of life insurance, is characterized by its specified coverage period and the provision of a death benefit if the insured passes away within that time frame. Known for its simplicity and affordability, term insurance is a popular choice for those who need temporary coverage without an investment component [23, 39, 40].

On the other hand, cash value life insurance is a permanent insurance option that includes an investment component. A portion of the premiums paid contributes to a cash reserve, which has the potential to grow and can be accessed through loans or withdrawals. This type of insurance offers long-lasting coverage and the opportunity for financial growth, although it is more complex and expensive. Cash value life insurance includes various products such as whole life, universal life, and variable life insurance, each with unique features [24, 41, 42]. Cash value life insurance, in particular, stands out for its flexibility. Policyholders can adjust premiums and death benefits according to their changing circumstances. It also earns interest tied to market trends but guarantees a minimum rate. This flexibility makes cash value life insurance an essential component of long-term financial planning [39].

2.4 Significance and impact of the research

The study suggests that personal evaluations of financial knowledge may sometimes provide a more accurate reflection of consumer behavior than objective assessments from standardized tests. The hypothesis is based on the observation that subjective literacy often reflects immediate financial concerns and is directly linked to everyday financial decision-making [43–45]. The study considers variables such as race and socioeconomic status to understand how these factors interact with financial literacy to impact consumer choices in the life insurance market.

This research has practical implications in the financial services industry. It can inform the development of products and educational programs tailored to the needs of diverse consumer populations. By addressing a critical gap in existing literature and incorporating controls for demographic variables, the study improves theoretical models of consumer behavior in financial markets. It also provides actionable insights for policymakers and industry professionals who aim to promote financial well-being and increase engagement with life insurance products. The findings could lead to more effective financial education strategies and marketing tactics that are responsive to the diverse financial perceptions and realities of consumers across different demographic groups.

2.5 Scope of the study

The scope of this study is limited to the United States. It examines how subjective and objective financial literacy affect life insurance purchasing behaviors across the racially diverse population of the country. The research utilizes data from the 2022 Survey of Consumer Finance and incorporates a weighting mechanism to account for the racial demographics of the U.S. population. This methodological choice is important to ensure accurate representation of the national landscape and understand the interplay between financial literacy and consumer behavior in a diverse societal context.

The study specifically focuses on U.S. life insurance and excludes international markets and other insurance products. By setting these boundaries, the research avoids complexities associated with varying international regulations, economic conditions, and cultural factors that could obscure the relationships under investigation. This focused approach allows for a deeper exploration of the variables within the context of the U.S., providing valuable insights directly applicable to the American life insurance industry and its consumers.

2.6 Theoretical framework

The theoretical framework of this study is grounded in the concept of bounded rationality, which posits that individuals make decisions based on limited information and cognitive constraints [46, 47]. Bounded rationality is critical for understanding consumer behavior in

complex financial markets, particularly in the context of life insurance. This theory suggests that subjective financial literacy significantly influences purchasing decisions, as individuals often rely on their perceived financial knowledge rather than objective understanding [48,49].

Recent studies have expanded on this concept, emphasizing the role of cognitive biases and information overload in financial decision-making. In today's information-rich environment, consumers are often overwhelmed by the volume of available data, which impacts their ability to process information effectively and make optimal decisions [50,51]. This reality underscores the importance of examining how subjective financial literacy affects life insurance choices, given the increasing complexity and availability of financial products.

Bounded rationality helps explain why individuals with higher subjective financial literacy may feel more confident in their financial decisions, leading to an "emboldening effect". This effect occurs when decisions are driven by confidence rather than accurate knowledge, which can result in suboptimal financial choices [52–55]. This study focuses on whether perceived financial literacy outweighs objective financial knowledge in influencing life insurance purchasing behavior. To address the gap between subjective and objective financial literacy, this research investigates whether self-assessed financial knowledge has a more substantial impact on life insurance decisions than standardized measures of financial literacy. Objective financial literacy involves quantifiable knowledge of financial principles, assessed through tests, while subjective financial literacy refers to individuals' self-assessment of their financial understanding and confidence [56,57].

This study's hypotheses aim to empirically test these theoretical propositions, providing evidence on the relative influence of subjective versus objective financial literacy on life insurance purchases. By integrating these theories, the research contributes to academic discourse on financial literacy and consumer behavior, offering practical insights for developing more effective financial education programs and marketing strategies tailored to consumer perceptions and needs [58,59].

2.7 Hypotheses development

The conceptual model of this research aims to clarify the relationships between financial literacy, both objective and subjective, and the uptake of life insurance products. The model takes into account various socio-economic and human capital variables. According to the model, both forms of financial literacy have an impact on an individual's likelihood of purchasing life insurance products. The dependent variables in the model include the uptake of life insurance products in general, term insurance uptake, cash value life insurance uptake, and the uptake of both term and cash value life insurance.

Objective financial literacy is measured through standardized tests that evaluate an individual's knowledge of financial concepts and products. Based on previous research, it is expected that higher levels of objective financial literacy will correlate with a greater likelihood of life insurance uptake. This is because individuals with a better understanding of the products and their benefits are more likely to purchase life insurance. Subjective financial literacy, measured through self-assessment, is also expected to have a significant influence on life insurance uptake. In fact, it may have an even greater influence than objective financial literacy. This is because subjective financial literacy reflects an individual's confidence in their own financial decision-making, which can drive them to take action, such as purchasing insurance.

The model also includes controls for socio-economic status, such as age generation, marital status, and race, as well as measures of human capital, such as education level, income, and employment status. These controls are necessary to isolate the effects of financial literacy on life insurance uptake from other factors that may influence the decision. For example, age generation may affect life insurance uptake due to different life stages and financial needs, while marital status could influence the perceived necessity of life insurance to protect one's spouse. Race is included as a control to account for potential disparities in access to financial education and resources, which could impact insurance purchasing behavior. Human capital measures, such as education level, income, and employment status, are expected to be positively associated with life insurance uptake, as they often indicate greater financial resources and stability, making it easier to purchase insurance.

The rationale for these relationships is based on existing theories that suggest financial literacy plays a crucial role in helping individuals navigate complex financial markets and make informed decisions. Therefore, the conceptual model provides a framework for testing the research hypotheses and understanding the complex dynamics between financial literacy, socio-economic factors, and life insurance purchasing behaviors.

In this study, objective financial literacy is defined as an individual's level of knowledge about financial concepts, products, and services. This can be measured through standardized testing. The measurement of objective financial literacy is conducted using a set of questions that assess understanding of basic financial principles [60]. These questions are derived from validated financial literacy surveys used in previous research. Participants are asked to answer these questions, and their scores is calculated based on the number of correct responses, providing a direct measure of their financial knowledge. On the other hand, subjective financial literacy is defined as an individual's self-perceived ability and confidence in managing financial resources effectively. This is measured through self-assessment questions that ask participants to rate their own financial knowledge and confidence in making financial decisions. These questions will explore areas such as personal financial management, investment decision-making, and understanding of insurance products. The scale used for these assessments will be adapted from a financial literacy scale developed by researchers such as Hung et al. (2009) [61]. Responses are collected using a ten-point Likert scale.

Both measures are essential for this study as they provide a comprehensive view of financial literacy from both an objective and subjective perspective. This approach allows for a detailed analysis of how each type of financial literacy influences life insurance purchasing decisions, while also controlling for other socio-economic variables. This methodology aligns with previous research that emphasizes the importance of measuring both objective and subjective financial literacy to fully understand their impacts on financial behavior [62, 63]. Additionally, previous studies support the use of these operational definitions, demonstrating their validity and reliability in capturing the constructs of financial literacy as they relate to consumer financial decision-making [64, 65]. This approach ensures that the study can effectively test the proposed hypotheses regarding the differential impacts of subjective and objective financial literacy on life insurance uptake.

This research contributes to the theoretical landscape by critically examining the dual roles of objective and subjective financial literacy in the context of life insurance purchasing decisions. While existing theories and studies have established a clear link between objective financial literacy and prudent financial behaviors [23, 34], the role of subjective financial literacy remains contested. Some scholars argue that higher self-perceived financial literacy can lead to overconfidence, resulting in less optimal financial decisions, such as underinsurance or inappropriate product choices [66]. This study aims to extend this discussion by exploring the "emboldening effect" of subjective financial literacy. It hypothesizes that this self-assessment can sometimes be a more accurate predictor of consumer behavior than objective measures.

The theoretical contribution of this research lies in its nuanced approach to understanding how subjective perceptions of financial knowledge influence actual financial behaviors, particularly in the complex decision-making process involved in purchasing life insurance. By empirically testing the impact of subjective financial literacy, this study addresses a significant gap in the literature. It challenges the prevailing assumption that objective financial literacy is always the more reliable indicator of sound financial decision-making [24]. Instead, this research proposes that subjective financial literacy, through its emboldening effect, may lead individuals to engage more actively with financial products, including life insurance, potentially increasing uptake rates.

Furthermore, this study contributes to the broader discourse on financial education and consumer behavior by suggesting that enhancing subjective financial literacy could be as crucial as improving objective financial literacy. If the emboldening effect of subjective literacy proves to be significant, it could inform the development of targeted financial education programs. These programs would aim not only to improve objective understanding of financial concepts but also to boost confidence and perceived competence among consumers. This dual approach could lead to more engaged and informed decision-making, ultimately fostering better financial outcomes for individuals. Thus, the findings of this research could have important implications for policymakers, educators, and financial service providers, urging them to consider both dimensions of financial literacy in their efforts to enhance consumer financial well-being. The main purpose of this research is to test the hypothesis that subjective financial knowledge has a greater impact on the demand for life insurance products than objective financial knowledge. This hypothesis is based on the assumption that subjective financial literacy, which refers to an individual's self-assessment of their financial knowledge and confidence, is more strongly correlated with the decision to purchase life insurance, including term insurance, cash value life insurance, and combinations thereof.

To ensure the validity of the findings, the study controls for various socio-economic factors

such as age, generational cohort, race, education level, marital status, employment status, and income. These controls are necessary to isolate the effect of subjective versus objective financial literacy on life insurance purchasing behavior.

The hypotheses to be tested are as follows:

Hypothesis I: Subjective financial knowledge is positively related to the demand for life insurance products.

Hypothesis II: The influence of subjective financial knowledge on life insurance demand is greater than that of objective financial knowledge, even after considering socio-economic variables.

3 Methodology

3.1 Data source and sample design

The 2022 Survey of Consumer Finances (SCF) was conducted from March to December 2022 by the Board of Governors and executed by the National Opinion Research Center (NORC) at the University of Chicago. This comprehensive survey included 4,602 observations, covering various financial aspects such as net worth, income, and financial behaviors. To address missing data, the SCF uses a multiple imputation procedure, generating five values for each missing entry, resulting in a full dataset of 23,010 observations. This method enhances the robustness of the data by mitigating biases associated with nonresponse. Weights are applied to account for unequal probabilities of selection and nonresponse, ensuring that the results are representative and reliable despite the skewed nature of many financial variables. However, the 2022 SCF lacks detailed information on insurance selection factors, which could limit certain analyses. The survey aimed to capture a wide range of market segments, including various income levels, wealth brackets, and demographic groups, to provide a comprehensive picture of the financial conditions and behaviors of U.S. households.

The SCF uses a unique weighting approach to ensure that data collection accurately reflects the entire population. This method ensures that each participant's responses contribute equitably to the overall analysis, regardless of their probability of selection. By adjusting these weights meticulously, the SCF successfully captures the diverse demographics and intricacies of the population, accounting for variations in selection probabilities and potential non-responses. The SCF employs a complex weighting framework to further enhance the representativeness of survey results. This framework incorporates initial selection probabilities, supplemented with additional data and aggregate figures from the Current Population Survey. While this methodology is comprehensive, it is important to acknowledge the presence of diverse variables within the SCF data. Due to their infrequency or susceptibility to outlier values, some variables may impact the results. To mitigate this, logarithmic transformations are used during the analysis phase to address these disparities, especially for variables like income that are heavily skewed.

To address the issue of missing data, the SCF employs a strategy called multiple imputation. This involves generating five separate datasets for every missing value to closely mimic the original data distribution [67, 68]. This procedure expands the dataset to include 23,010 entries from the initial pool of 4,602 respondents, significantly improving the robustness and accuracy of the statistical analysis. In this context, the R "survey" package is crucial in managing the complexities of the augmented dataset resulting from multiple imputations. It ensures that the data remains appropriately weighted throughout the analysis process, even when adjusted by a factor of five for certain evaluations. This tool is essential for reducing bias and generating estimates that more accurately reflect the true characteristics of the population. Working in conjunction with the "mitools" package, the "survey" package is proficient in handling data with multiple imputations, facilitating accurate and minimally biased analyses [69].

3.2 Main variables

3.2.1 Dependent variables

The paper analyzes four main dependent variables that are associated with the uptake of life insurance. These variables are as follows:

(1) Overall life insurance ownership: This variable is measured by asking the survey question, "Do you (or anyone in your family living here) have any life insurance? Please include individual and group policies, but not accident insurance." It is a binary variable, with 1 indicating that the respondent has life insurance and 0 indicating that they do not.

(2) Term life insurance uptake: This variable is determined by the question, "Are any of your

(family's) policies term insurance?" It is also a binary variable, with 1 representing the presence of term life insurance and 0 indicating its absence.

(3) Cash value life insurance uptake: This variable is measured by asking, "Do you have any policies that accumulate a cash value or that you can borrow against? These policies are sometimes referred to as 'whole life', 'straight life', or 'universal life' policies." Once again, this is a binary variable, with 1 indicating the presence of cash value life insurance and 0 indicating its absence.

(4) Uptake of both term and cash value life insurance: The researchers created a new binary variable to identify individuals who have both term and cash value life insurance policies. It is coded as 1 if the respondent has both types of coverage, and 0 if they have only one type or no life insurance at all.

By examining these four distinct dependent variables, the study aims to provide a comprehensive understanding of how different dimensions of life insurance ownership are influenced by the key explanatory variables, particularly subjective and objective financial literacy. This approach allows the researchers to uncover potential differences in the factors driving the uptake of term versus cash value life insurance, as well as the factors associated with holding a combination of both policy types.

3.2.2 Independent variables

The key independent variables employed to explain life insurance uptake in this study encompass both objective and subjective measures of financial literacy. The objective measure is constructed from an index based on answers to three financial test questions: one on interest rates, one on inflation, and another on stock market risk. Each component is described below along with its integration into the index:

(1) Interest Rate Knowledge is assessed via the question: "If \$100 is deposited in a savings account with a 2% annual interest rate, what will the balance be after 5 years?" The possible answers are: "More than \$102," "Exactly \$102," and "Less than \$102."

(2) Inflation Knowledge is evaluated through the question: "With a 1% annual return from a savings account and a 2% inflation rate, what will the purchasing power be after one year?" Respondents can choose from: "More than today," "The same as today," and "Less than today."

(3) Stock Risk Knowledge is measured by the question: "Is buying a single company's stock usually safer than a stock mutual fund?" with the response options "True" or "False."

The three binary variables based on respondents' answers to these financial knowledge questions are defined as follows:

(1) For Interest Rate Knowledge (X_1):

$$X_1 = \begin{cases} 1 & \text{if answer is "more than \$102"} \\ 0 & \text{otherwise} \end{cases} \tag{1}$$

(2) For Inflation Knowledge (X_2):

$$X_2 = \begin{cases} 1 & \text{if answer is "less than today"} \\ 0 & \text{otherwise} \end{cases} \tag{2}$$

(3) For Stock Risk Knowledge (X_3):

$$X_3 = \begin{cases} 1 & \text{if answer is "False"} \\ 0 & \text{otherwise} \end{cases} \tag{3}$$

The Financial Literacy Index is then computed as:

$$\text{Financial Literacy Index} = X_1 + X_2 + X_3 \tag{4}$$

Potential values and their interpretations include:
0 – No Financial Knowledge
1 – Low Financial Knowledge
2 – Medium Financial Knowledge
3 – High Financial Knowledge

The subjective measurement of financial knowledge in this study is based on a self-assessment. Respondents rate their understanding of personal finance on a scale from 0 (no knowledge) to 10 (highly knowledgeable). This method of measuring subjective financial literacy is well-supported in the literature [70–72]. It provides valuable insights into individuals' perceptions of their financial abilities.

3.2.3 Control variables

A comprehensive set of variables is used to enhance the analysis of how objective and subjective financial literacy impact life insurance uptake. This methodological approach aims to include additional factors and demographic characteristics that may influence insurance purchasing decisions. Respondents' ages are categorized into six generational cohorts as of December 2022: Generation Z (born 1997 or later), Millennials (born 1981-1996), Generation X (born 1965-1980), Baby Boomers (born 1946-1964), the Silent Generation (born 1928-1945), and those aged 95 years and older. Marital status is divided into three categories: never married, married or cohabiting, and separated or widowed. The study also acknowledges racial diversity by classifying respondents into several racial groups: Asian, Black, Latino, White, and an aggregated category labeled "Other" for underrepresented races in the sample. This categorization helps examine the effects of race on financial decisions regarding life insurance. Additionally, the research incorporates various measures of human capital, such as education level, employment status, and income, to assess how these socioeconomic factors may influence the likelihood of purchasing life insurance. By incorporating this extensive array of variables, the research provides a detailed analysis of the interplay between financial literacy (both self-evaluated and test-based) and life insurance purchasing behaviors. This approach allows for a better understanding of how demographic and socioeconomic factors potentially shape these behaviors, offering valuable insights into the dynamics of financial decision-making across different population segments.

3.3 Data analysis

This study investigates the impact of objective and subjective measures of financial literacy on the demand for various life insurance products, including term insurance and cash value life insurance. Participants were surveyed about their current life insurance status, and logistic regression was employed for data analysis. Logistic regression is well-suited for this type of analysis as it enables the prediction of categorical outcomes, such as ownership of different types of life insurance, based on a set of predictor variables. These variables encompass both objective and subjective financial literacy.

To ensure the study's findings are representative, weights were applied in the logistic regression analysis. These weights were used to account for demographic differences within the sample. This methodological step is crucial to ensure that the sample accurately reflects the demographics of the broader population. It helps mitigate potential biases and enhances the validity of the findings.

The utilization of the "survey" package in R software was vital in this context. It provided the necessary tools to effectively incorporate these weights, thereby improving the accuracy and reliability of the study's outcomes. This approach allows for a more precise assessment of how different levels of financial literacy influence decisions regarding life insurance, providing a more comprehensive understanding of the population's behavior.

The logistic regression model can be expressed as:

$$\log\left(\frac{p}{1-p}\right) = \beta_0 + \beta_1 x_1 + \beta_2 x_2 + \cdots + \beta_n x_n \tag{5}$$

Where:

(1) p is the probability of the dependent variable equalling a case (e.g., 1);
(2) $\beta_0, \beta_1, ..., \beta_n$ are the coefficients;
(3) $x_0, x_1, ..., x_n$ are the independent variables.

And the probability p can be expressed as:

$$p = \frac{1}{1 + e^{-(\beta_0 + \beta_1 x_1 + \beta_2 x_2 + \cdots + \beta_n x_n)}} \tag{6}$$

In the realm of multiple logistic regression analyses, it is important to address the issue of multicollinearity. Multicollinearity occurs when predictor variables have high intercorrelations.

To ensure the validity and interpretability of the model, one must carefully monitor the Pearson correlation coefficient. A commonly accepted guideline suggests that correlation coefficients exceeding 0.7 indicate a strong connection between variables [73]. Following this threshold is crucial in identifying significant correlations that may distort the impact on the dependent variable, while also ensuring that informative variables are not unnecessarily excluded from the analysis. Striking this balance is essential to prevent multicollinearity from introducing instability in the regression coefficients. This preserves the robustness of the model and enhances its predictive accuracy and depth of insight. This approach aligns with best practices in statistical analysis, maintaining the model's integrity while retaining valuable data that enriches the model's analytical capabilities [74, 75]. Figure 4 presents the 2 by 2 correlation matrix of all the independent variables used in the models. The figure suggests that there is no significant intercorrelation in the model.

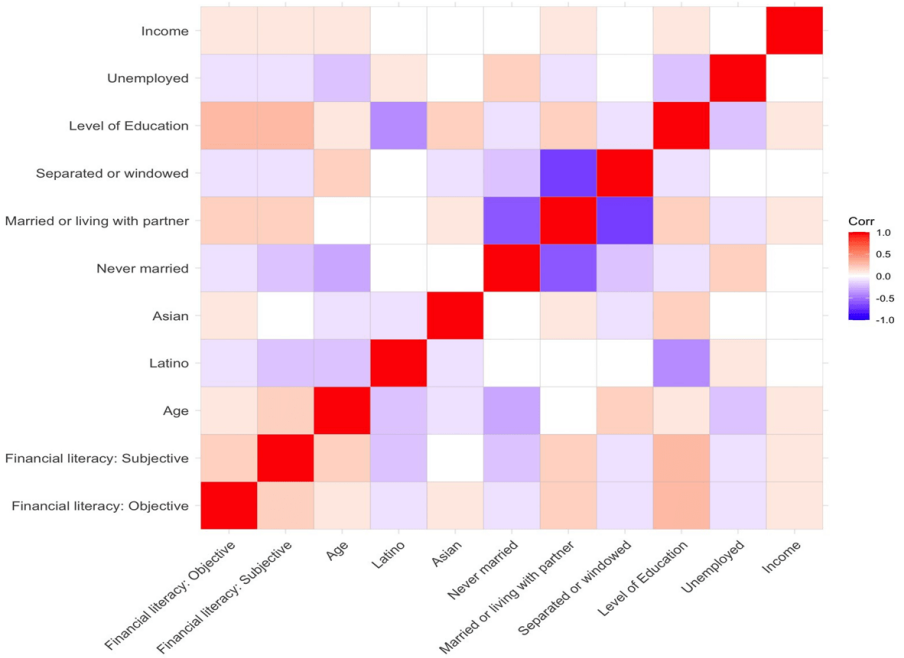

Figure 4 Correlation matrix: Independent variables. (Source: Author's analysis)

The Variance Inflation Factor (VIF) measures the impact of collinearity among the predictor variables in a regression model, reflecting how much the variance of an estimated regression coefficient is increased due to multicollinearity [76].

In the context of logistic regression, which models the log odds of a binary outcome based on predictor variables, the VIF for each predictor can still be calculated using the formula for linear regression, as it assesses multicollinearity independently of the model type. The formula for the VIF of the i^{th} predictor is given by:

$$VIF_i = \frac{1}{1 - R_i^2} \tag{7}$$

where R_i^2 is the coefficient of determination from regressing the i^{th} predictor on all other predictors. This R^2 value represents the proportion of variance in the i^{th} predictor that is predictable from the other predictors.

A Variance Inflation Factor (VIF) of 1 indicates no correlation between the i^{th} predictor and the other predictors in the model, meaning it has no impact on the variance. On the other hand, a VIF greater than 1 indicates the presence of multicollinearity, with higher values suggesting increased redundancy and potential complications in regression analysis.

The Generalized Variance Inflation Factor (GVIF) extends the use of VIF to models with categorical predictors, where a high GVIF value indicates greater multicollinearity. The term DF, which stands for degrees of freedom, varies depending on the type of predictor: it is greater than 1 for categorical variables, determined by subtracting one from the number of categories, and typically 1 for continuous variables.

The adjusted GVIF, represented as $GVIF^{\frac{1}{2 \cdot \mathrm{DF}}}$, normalizes GVIF by the degrees of freedom,

making it more comparable to the traditional VIF. This adjustment helps in interpreting the impact on the variance of model coefficients. Values close to 1 indicate minimal multicollinearity impact, while values significantly above 1 suggest high multicollinearity. Typically, values above 5—and in more lenient analyses, above 10—indicate substantial multicollinearity that may affect Ordinary Least Squares (OLS) estimates.

Table 1 displays the results of the Variance Inflation Factor (VIF) for the independent variables in four distinct Generalized Linear Models (GLMs). These models are designed for different categories of life insurance: overall life insurance, term insurance, cash value life insurance, and a combination of term and cash value life insurance. The VIF scores consistently remain low across all models, indicating that multicollinearity is not a significant concern in these analyses. Therefore, the stability of the VIF scores ensures that the regression coefficients derived from these models are reliable and robust, providing valuable insights into the factors that influence life insurance choices.

Table 1 VIF results for four models

Variable	Life Insurance			Term only			Cash Value only			Term & Cash Value		
	GVIF1	DF1	$GVIF1^{(1/(2\cdot DF1))}$	GVIF2	DF2	$GVIF2^{(1/(2\cdot DF2))}$	GVIF3	DF3	$GVIF3^{(1/(2\cdot DF3))}$	GVIF4	DF4	$GVIF4^{(1/(2\cdot DF4))}$
Financial Literacy: Objective	1.230	1	1.109	1.228	1	1.108	1.201	1	1.096	1.230	1	1.109
Financial Literacy: Subjective	1.221	1	1.105	1.200	1	1.095	1.240	1	1.114	1.221	1	1.105
Age Generation	1.343	5	1.030	1.339	5	1.030	1.469	5	1.039	1.343	5	1.030
Race	1.482	4	1.050	1.469	4	1.049	1.565	4	1.058	1.482	4	1.050
Marital Status	1.542	2	1.114	1.556	2	1.117	1.546	2	1.115	1.542	2	1.114
Education	1.575	1	1.255	1.585	1	1.259	1.579	1	1.257	1.575	1	1.255
Unemployment	1.114	1	1.056	1.116	1	1.057	1.151	1	1.073	1.114	1	1.056
Income	1.806	1	1.344	1.787	1	1.337	1.754	1	1.324	1.806	1	1.344

The 2022 Survey of Consumer Finances (SCF) provides valuable insights into the financial behaviors and conditions of U.S. households but does have some limitations. It relies on self-reported data, which can introduce biases like underreporting or overreporting due to memory recall issues or social desirability bias [77, 78]. The cross-sectional design captures data at a single point in time, which limits the ability to determine causality or observe changes over time [77]. Despite efforts to ensure a nationally representative sample, the SCF may not fully capture the diverse demographics of the U.S. population [79]. Additionally, the complexity and sensitivity of financial information can result in incomplete or inaccurate responses, which can affect the reliability of the data [80].

4 Results

The study utilizes logistic regression analyses to examine the correlation between financial literacy and ownership of various life insurance products. Table 2 displays the logistic regression coefficients, alongside their corresponding standard errors, for four dependent variables: possession of any life insurance, term life insurance only, cash value life insurance only, and both term and cash value life insurance. The intercepts of the models are significantly negative, indicating a generally low probability of owning life insurance when predictors are at baseline levels. Objective financial literacy has a modest impact, with statistical significance observed solely in the term life insurance model ($p < 0.05$), where coefficients range from 0.02 to 0.06. Conversely, subjective financial literacy consistently exhibits a significant positive correlation with life insurance ownership across all models ($p < 0.001$), with coefficients ranging from 0.04 to 0.13. The most significant effect is observed in the model evaluating ownership of both term and cash value life insurance. Figure 5 illustrates the predicted probabilities of selecting different types of life insurance based on individuals' self-rated financial knowledge. The graphs plot perceived financial knowledge against the likelihood of choosing life insurance, term insurance only, cash value insurance only, or both types. The x-axes quantify perceived financial knowledge on a scale from 0 to 10, while the y-axes represent the predicted probabilities of selecting insurance. Confidence intervals are visually depicted by shaded areas around the regression lines, demonstrating the precision of these predictions. The models reveal a positive correlation between perceived financial knowledge and the probability of selecting any form of life insurance, with all other variables held at their average values.

In terms of generational differences, all age groups, with the exception of those over 95, are more likely to own life insurance compared to Generation Z, as indicated in Table 2. Among the different generations, Generation X stands out as the most influential factor in predicting life insurance and term insurance ownership. When it comes to race, Black individuals are more inclined to own all types of insurance compared to White individuals. On the other hand, Latino and Asian individuals tend to have lower probabilities of obtaining life insurance. Marital status

Table 2 Logistic regression: Life insurance product uptake

Variable	Life Insurance	Term only	Cash Value only	Term & Cash Value
(Intercept)	-7.60***	-7.41***	-9.56***	-10.32***
	(0.30)	(0.32)	(0.51)	(0.68)
Financial literacy				
Objective Measurement	0.04	0.06*	0.02	-0.01
	(0.03)	(0.03)	(0.04)	(0.05)
Subjective Measurement	0.06***	0.04***	0.06****	0.13***
	(0.01)	(0.01)	(0.02)	(0.02)
Age generation (Gen Z)				
Gen Y (26-41)	0.37**	0.20	2.62***	1.62**
	(0.12)	(0.12)	(0.40)	(0.59)
Gen X (42-57)	0.60***	0.41***	2.89***	1.81**
	(0.12)	(0.12)	(0.40)	(0.59)
Baby Boomers (58-76)	0.35**	-0.13	3.58***	1.87**
	(0.12)	(0.12)	(0.40)	(0.59)
Silent Generation (77-94)	0.46***	-0.20	3.94***	1.12
	(0.14)	(0.15)	(0.41)	(0.61)
95+	0.82	0.87	-7.97***	-9.22***
	(0.67)	(0.66)	(0.51)	(0.65)
Races (White people)				
Black people	0.66***	0.55***	0.89***	0.23*
	(0.06)	(0.06)	(0.09)	(0.10)
Latino	-0.52***	-0.46***	-0.66***	-0.63***
	(0.06)	(0.06)	(0.13)	(0.17)
Asian	-0.26**	-0.20	-0.24	-0.40**
	(0.10)	(0.11)	(0.14)	(0.14)
Other	-0.20	-0.02	-0.31	-0.72*
	(0.14)	(0.15)	(0.31)	(0.36)
Marital Status (Never Married)				
Married or living with partner	0.64***	0.63***	0.60***	0.52***
	(0.06)	(0.06)	(0.10)	(0.14)
Separated or windowed	0.38***	0.31***	0.35**	0.49**
	(0.06)	(0.07)	(0.11)	(0.15)
Human Capital Measures				
Level of Education	0.05***	0.03***	0.07***	0.05**
	(0.01)	(0.01)	(0.01)	(0.02)
Unemployed	-0.77***	-0.86***	-0.25*	-0.65***
	(0.06)	(0.07)	(0.10)	(0.16)
Income (log value)	0.55***	0.55***	0.30***	0.36***
	(0.03)	(0.03)	(0.04)	(0.03)
Deviance	27322.62	22898.38	10481.90	10154.99
Dispersion	1.42	1.81	0.94	0.98
Num. obs.	22753	17904	12616	22753

Note: *** $p < 0.001$; ** $p < 0.01$; * $p < 0.05$

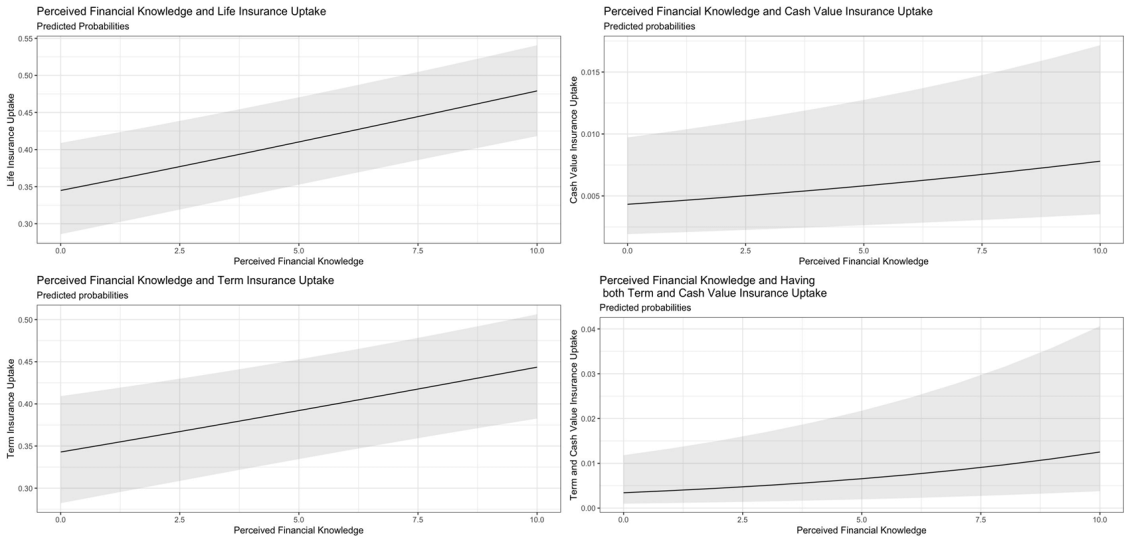

Figure 5 Predicted probabilities: Perceived financial knowledge by life insurance product. (Source: Author's analysis)

also has an impact on ownership, with married or cohabiting individuals showing a greater tendency to have life insurance compared to those who have never been married. Moreover, education level is positively correlated with life insurance ownership across all types. Employment status is also a significant factor, with unemployment being associated with lower chances of owning life insurance, especially term insurance. Finally, income level is a strong predictor for all types of insurance, emphasizing the connection between higher income and life insurance ownership.

5 Discussion

The findings of this study clarify the distinct roles of objective and subjective financial literacy in life insurance purchasing decisions. Subjective financial literacy, which refers to an individual's self-perceived understanding of financial matters, emerges as a more influential factor in these decisions. This observation is consistent with prior research suggesting that individuals' confidence in their financial knowledge, a component of subjective financial literacy, may be a better predictor of financial behaviors than objective measures of financial literacy [60,64,65]. The significant impact of subjective financial literacy on insurance uptake is likely due to its reflection of an individual's confidence in their financial knowledge, which may drive proactive financial behaviors such as the purchase of insurance [81]. This is particularly evident in the significant coefficient associated with the ownership of both term and cash value life insurance, suggesting that those with higher self-perceived financial knowledge are more likely to opt for more comprehensive insurance coverage.

Objective financial literacy, which is assessed through an individual's factual knowledge of finance, has a less consistent effect across the models. Its influence is significant only in the model predicting term life insurance ownership, indicating that while factual financial knowledge may impact the choice of simpler insurance products, it does not necessarily lead to more complex financial decisions, such as the purchase of combined insurance products. The analysis of predicted probabilities further illustrates the intricate relationship between perceived financial knowledge and the selection of life insurance products. Consistent with existing literature, the study finds that individuals' self-assessment of their financial expertise significantly impacts their insurance choices [62]. The steeper gradient observed in the graph for term insurance uptake suggests that individuals with higher perceived financial knowledge may prefer the affordability of term life insurance. This preference could arise from a more sophisticated understanding of risk and the benefits of diversifying insurance coverage.

Furthermore, the widening confidence intervals at higher levels of perceived financial knowledge for cash value life insurance uptake and combined insurance uptake may indicate variability in behavior among individuals with high self-assessed financial understanding, with some accurately assessing their financial capabilities while others may overestimate their knowledge.These insights underscore the importance of subjective financial literacy in financial decision-making and emphasize the need for financial education programs that enhance both knowledge and confidence in financial matters [59]. The study shows that the uptake of life insurance typically increases with age, reaching its peak among individuals in the Generation X demographic before sharply declining among the oldest age group. This trend could be attributed to changes in the availability, affordability, or perceived necessity of insurance as people get older.

When it comes to racial disparities in life insurance ownership, it has been observed that Black individuals have higher rates compared to White individuals. This difference may indicate cultural variations in the perception of financial security and the importance of life insurance. On the other hand, Latino and Asian individuals are less likely to have insurance, which could be influenced by factors such as limited access to financial products and cultural attitudes toward insurance. Another factor that seems to influence life insurance ownership is marital status. Married or cohabiting individuals are more likely to have coverage, possibly due to the financial responsibilities they have towards their dependents. Similarly, separated or widowed individuals show a higher propensity for insurance uptake, potentially due to an awareness of the financial vulnerability they face in the absence of a partner.

The positive relationship between education and insurance uptake aligns with research that suggests higher levels of education lead to more informed financial decision-making. Conversely, the negative correlation between unemployment and insurance uptake may indicate financial constraints or a decreased perceived need for insurance during periods of unemployment. The strong positive correlation between income and life insurance uptake confirms expectations, as individuals with higher incomes typically have greater financial means and consequently perceive a stronger need to protect their assets through insurance [27–29].

These findings underscore the importance of tailored financial literacy programs that take into account people's socio-demographic backgrounds in order to promote life insurance uptake. Furthermore, they draw attention to potential barriers to insurance access, particularly among certain racial and age demographics. In future research, it would be valuable to explore the causal mechanisms behind these associations and to examine the potential impact of financial literacy interventions in narrowing the gap in insurance uptake. The 2022 Survey of Consumer Finances (SCF) has some limitations that need to be acknowledged. These include relying on self-reported data, which can introduce biases like underreporting or overreporting due to memory recall issues and social desirability bias. Its cross-sectional design also limits the ability to make causal inferences. Additionally, the survey lacks detailed information on factors influencing insurance selection, which restricts the scope of analysis in this area. These limitations suggest policy implications, such as the need for improved data collection methods to capture more accurate information on insurance choices and the implementation of targeted financial literacy programs to address demographic disparities and enhance financial decision-making across diverse population segments.

6 Conclusion

This research examines the impact of financial literacy on acquiring life insurance, focusing on how subjective and objective knowledge influence insurance uptake. The findings demonstrate that an individual's perception of their financial knowledge is crucial in making insurance-related decisions, often overshadowing objective knowledge. Subjective understanding is particularly important in selecting term insurance, helping individuals choose coverage options that are both wise and affordable. For those who choose cash value insurance, their decision is influenced by a complex interplay of self-assessment and confidence in financial decision-making, reflecting a deeper engagement with concepts of financial security and legacy planning. The study also reveals generational trends in insurance demand, showing that the probability of insurance ownership increases with age, but then declines significantly for the oldest age group. This pattern reflects changing financial priorities at different stages of life. Racial disparities in insurance ownership suggest underlying societal dynamics. The higher inclination among Black individuals to obtain insurance may indicate a collective approach to mitigating financial vulnerabilities, while lower uptake among Latino and Asian populations could be attributed to cultural differences and access barriers. Marital status is closely linked to insurance ownership, with married or cohabiting individuals more likely to invest in life insurance, likely due to a shared concern for the financial well-being of partners and dependents. Similarly, separated or widowed individuals show a higher inclination towards insurance, possibly as a financial safeguard during more solitary phases of life. Educational attainment is positively associated with life insurance ownership, indicating that higher levels of knowledge facilitate navigating the complexities of financial products. Conversely, unemployment is linked to reduced insurance ownership, highlighting the financial challenges faced by those without employment. Income also plays a significant role, with higher earnings increasing the ability to afford insurance and enhancing the perceived need for financial protection. In conclusion, this study provides a comprehensive understanding of the relationship between financial literacy, demographic factors, and life insurance ownership. It emphasizes the importance of improving both subjective and objective financial literacy to enhance life insurance uptake, and suggests that tailored financial education programs could play a crucial role in addressing the observed disparities in insurance ownership among different demographic groups.

7 Future research

Future research should thoroughly investigate the causal mechanisms underlying the relationship between financial literacy and insurance purchasing decisions. This investigation should focus on how confidence derived from financial literacy influences consumer actions. Experimental designs or advanced statistical methods like structural equation modeling should be used to study this relationship. Additionally, it is necessary to assess how professional financial advice might complement or substitute for personal financial literacy in life insurance decision-making. Outcomes should be compared between individuals relying solely on their financial literacy and those seeking professional advice. Matched samples should be used to control for confounding variables.

Cultural factors impacting financial literacy and insurance behaviors, especially within diverse or minority populations, should be examined using qualitative methodologies. These methodologies will capture the nuanced ways cultural values and norms influence financial

decisions. This research will aid in the design of culturally sensitive financial education programs. Longitudinal studies tracking changes in financial literacy over time and their impact on life insurance uptake would provide insights into the long-term effects of financial education programs. Critical periods for effective interventions can be identified, and the stability of financial literacy's impact across different life stages can be observed.

Finally, with the rapid advancement of digital tools in finance, future research should explore how financial apps and online platforms influence the relationship between financial literacy and insurance purchasing habits. User interaction data should be analyzed to understand how technology-mediated education impacts insurance decision-making processes.

Conflicts of interest

The author declares that there is no conflicts of interest.

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