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The impact of Financial Knowledge and Digital Financial Services on Millennials' Financial Behaviour

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Master in Business Analytics

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ISCTE ESPP, Centre for Research and Studies in Sociology

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BUSINESS
SCHOOL

Department of Quantitative Methods for Management and Economics

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ABSTRACT

This dissertation investigated the impact of financial knowledge and the use of digital financial services on short-term and long-term financial behaviours of millennials in Portugal. Aiming to identify the explanatory factors of positive financial behaviours among millennials, primary data were collected through an online questionnaire. Financial knowledge was observed under two aspects: measured knowledge and perceived knowledge, and these were compared against one another. Two ordered logistic regressions were performed, and the presented results revealed that both financial knowledge and the use of digital financial services are related to higher odds of an individual being in a higher level of both short-term and long-term financial behaviour indices.

Keywords: Financial literacy • Financial Knowledge • Financial Behaviour • Digital Financial Services • FinTech • Millennials

RESUMO

Esta dissertação investigou o impacto do conhecimento financeiro e da utilização de serviços financeiros digitais sobre os comportamentos financeiros de curto e longo prazo de *millennials* em Portugal. Com o objetivo de identificar os fatores explicativos dos comportamentos financeiros positivos entre *millennials*, foram recolhidos dados primários através de um questionário online. O conhecimento financeiro foi observado sob dois aspectos: conhecimento medido e conhecimento percebido, e estes foram comparados entre si. Foram realizadas duas regressões logísticas ordenadas, e os resultados apresentados revelaram que tanto o conhecimento financeiro como a utilização de serviços financeiros digitais estão relacionados com maiores probabilidades de um indivíduo se encontrar em um nível mais elevado de índices de comportamento financeiro tanto a curto como a longo prazo.

Palavras-chave: Literacia Financeira • Conhecimento Financeiro • Comportamento Financeiro • Serviços Financeiros Digitais • FinTech • Millennials

INDEX

- INDEX OF TABLESix
- INDEX OF FIGURESxi
- ACRONYMS.....xiii
- 1 INTRODUCTION 1
 - 1.1 Research overview 4
- 2 LITERATURE REVIEW 5
 - 2.1 Review Process..... 5
 - 2.1.1 Study identification 5
 - 2.1.2 Search strategy and eligibility criteria 6
 - 2.1.3 Data synthesis..... 8
 - 2.1.4 SLR Conclusions 11
 - 2.2 Financial Literacy 12
 - 2.2.1 Discussion around the concept of Financial Literacy 13
 - 2.2.2 Financial Knowledge: Objective *versus* subjective measures 15
 - 2.2.3 Financial Behaviour 18
 - 2.2.4 Awareness of Financial Attitudes 20
 - 2.3 Digital finance..... 20
 - 2.3.1 What is ‘FinTech’? 21
 - 2.3.2 Digital Financial Services 22
 - 2.4 Practice of DFS in Portugal 25
- 3 RESEARCH MODEL AND METHODOLOGY 27
 - 3.1 Theoretical Framework and Hypotheses 27
 - 3.2 Methodology 30
 - 3.2.1 Data Collection 30
 - 3.2.2 Questionnaire 30
 - 3.2.3 Data Analysis 34

4	RESULTS DISCUSSION	37
4.1	Sample characterization	37
4.2	Descriptive Results	38
4.2.1	Measured Financial knowledge x Perceived Financial Knowledge	39
4.2.2	Awareness of Financial Attitudes	41
4.2.3	Use of Digital Financial Services	42
4.2.4	Financial Behaviour	44
4.2.5	Ordered Logistic Regression Results	45
4.3	Summary of results.....	48
5	CONCLUSIONS	51
5.1	Main conclusions.....	51
5.2	Study limitations.....	52
5.3	Contributions.....	53
5.4	Future research	53
6	REFERENCES	55
	ANNEXES	61
	Annex A: Questionnaire	61
	Annex B: Descriptive Statistics	64
	Annex C: Analysis Syntax.....	67

INDEX OF TABLES

Table 2.1: Inclusion and exclusion criteria.	6
Table 2.2: Articles included in the systematic review.	8
Table 2.3: Main findings of selected articles.	8
Table 2.4: Summary of relevant concepts addressed in the studies.	10
Table 2.5: Summary of predicted variables in the studies.	10
Table 2.6: Methods of analysis.	11
Table 2.7: Summary of content analysis.	12
Table 2.8: Financial Literacy questions designed by Lusardi and Mitchell (2011b).....	17
Table 2.9: Indicators of positive Financial Behaviour per authors.	19
Table 2.10: Digital Financial Services proposed by Gomber et al. (2017).	22
Table 2.11: DFS Opportunities and threats (OECD, 2018b).	24
Table 3.1: Proposed research dimensions.	29
Table 3.2: STFB variable with scale reversed.	31
Table 3.3: AwFA variables with scale reversed.	32
Table 3.4: Summary of variables.	33
Table 3.5: Internal consistency of dimensions.	34
Table 3.6: Testing for multicollinearity in the independent variables.	35
Table 3.7: Test of Parallel Lines.	36
Table 4.1: Sample characterization.	37
Table 4.2: Financial characteristics of millennials.	38
Table 4.3: Proportions of respondents in terms of combined Measured-Perceived FK.....	41
Table 4.4: Wilcoxon Signed Ranks Test.....	45
Table 4.5: Model fitting information.....	46
Table 4.6: Ordered logistic regression results of STFB and LTFB	46
Table 4.7: Tests of Model Effects.	48
Table 4.8: Validation of research hypotheses.	48

INDEX OF FIGURES

Figure 1.1: Percentage of adults who are financially literate (Source: S&P Global FinLit Survey, 2004)..... 1

Figure 1.2: Percentage of respondents shifting banking usage (Source: McKinsey, 2020) 3

Figure 2.1: SLR formulated query..... 6

Figure 2.2: Selection process of studies..... 7

Figure 2.3: Digital Finance Cube proposed by Gomber et al. (2017). 23

Figure 2.4: Percentage of adults who are Financially Literate. Source: S&P Global FinLit Survey 26

Figure 3.1: Research model..... 28

Figure 4.1: Correct responses per FK question. (Source: author own elaboration) 39

Figure 4.2: Number of correct FK responses. (Source: author own elaboration)..... 39

Figure 4.3: Self-evaluation of financial knowledge. (Source: author own elaboration) 40

Figure 4.4: Attitudes toward financial concerns. (Source: author own elaboration) 41

Figure 4.5: Known x used DFS. (Source: author own elaboration) 42

Figure 4.6: Number of used DFS. (Source: author own elaboration)..... 43

Figure 4.7: Frequency of DFS usage. (Source: author own elaboration) 43

Figure 4.8: Distribution of exhibited financial behaviours. (Source: author own elaboration) 44

ACRONYMS

BCG	-	Boston Consulting Group
BdP	-	Banco de Portugal
B2B	-	Business-to-Business
B2C	-	Business-to-Consumer
DFL	-	Digital Financial Literacy
DFS	-	Digital Financial Services
DL	-	Digital Literacy
US	-	United States
FB	-	Financial Behaviour
FK	-	Financial Knowledge
FL	-	Financial Literacy
INFE	-	International Network on Financial Education
OECD	-	Organisation for Economic Co-operation and Development
SLR	-	Systematic Literature Review
TPB	-	Theory of Planned Behaviour
TTM	-	Transtheoretical Model
UNESCO	-	United Nations Educational, Scientific and Cultural Organization

1 INTRODUCTION

Financial literacy plays an essential role in the financial well-being of individuals and in society, as it deeply affects the overall health of a country's economy. Financially educated individuals are better prepared to make informed choices when it comes to household budgeting and expenses, housing mortgages and other relevant types of debt, and finally, savings and investments for retirement preparedness.

While its concept may assume different definitions, it is usually described as the association of dimensions of knowledge, attitude, behaviour, and skills. Therefore, literacy goes beyond the knowledge regarding financial issues, and one's choices are going to have a direct impact on the individual's future. For this reason, it has been increasing the number of initiatives aiming to enhance the levels of financial literacy of individuals and to educate the population in financial matters, since it can help them face periods of financial instability that may occur, especially during economic crises.

In recent years, several studies have been conducted to measure financial literacy among individuals, indicating low levels of financial literacy around the world, from emerging to advanced economies, pointing out that financial illiteracy is particularly severe among women (Lusardi & Mitchell, 2011a). As an example, the S&P Global FinLit Survey (2004)¹ findings show that, worldwide, only 1-in-3 adults are financially literate as illustrated in Figure 1.1.

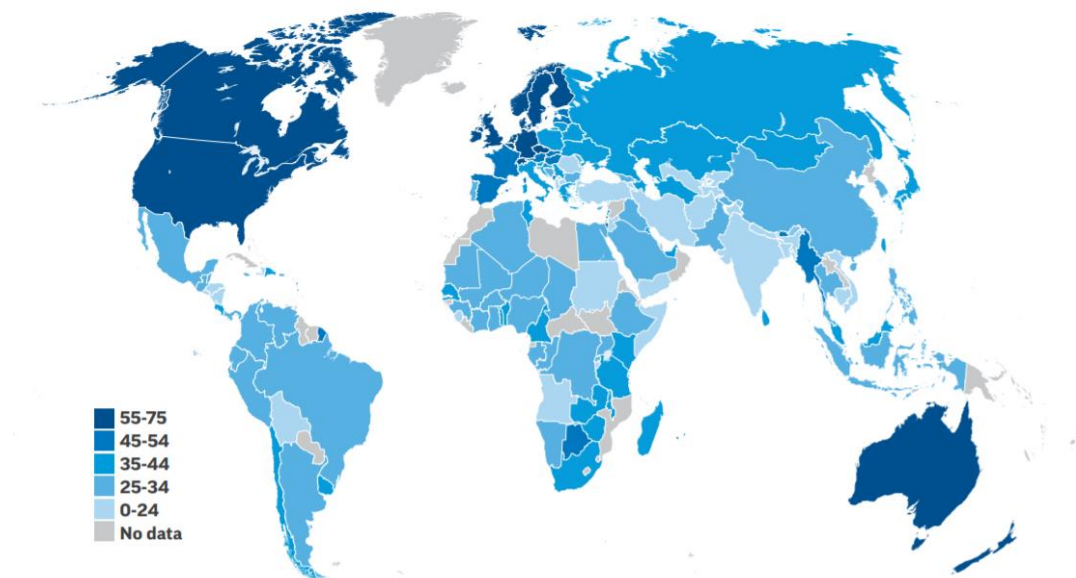


Figure 1.1: Percentage of adults who are financially literate (Source: S&P Global FinLit Survey, 2004)

¹ Standard & Poor's Ratings Services Global Financial Literacy Survey (2014).

Yet, for individuals to participate in today's economy, it is crucial they are financially literate. It is well known that governments have increasingly transferred the responsibility for saving and investing onto individuals, especially with the reduction of state-supported pensions, in a way that individuals must save to provide for their own financial security on retirement (Bottazzi & Lusardi, 2021). In the same direction, employers sponsored pension plans have also been shifting to a contribution structure, where the investment risk lies over the employee and no longer over the employer. Moreover, the increase in longevity will also affect financial security in retirement, and consequently, individuals are more responsible for their personal finances today than ever before.

While the literature on Millennials' financial lives is often alarming, Lusardi & Oggero (2017) relate their gap in financial literacy to the fact that financial choices made by young adults today are more challenging than they have been in the past, and, although more accessible due to globalization and digital technologies, financial services and products have become more complex:

“Decreasing generosity of welfare systems and increasing life expectancy have contributed to an environment in which it is more difficult to achieve financial security in retirement. Life expectancy is high and continues to increase, meaning that young people today will need to be able to support themselves for much longer than did past generations.” (Lusardi & Oggero, 2017, p.2)

At the same time, digital transformation is dramatically changing the offer of financial products and services, and more importantly, the ease of access to these tools. The rapid growth of financial technology, also known as FinTech, have an enormous impact on how people deal with their financial responsibilities, and it influences consumers' behaviour and choices. Online financial services are now becoming part of daily life as several new digital banking tools are being introduced to consumers (Augusto & Torres, 2018).

Technology is reshaping the world as we know it today, and FinTech is no exception. The way payments and investing operate, and equally important, how people make decisions and seek financial advice are examples of how disruptive FinTech is. While traditional banking struggles to provide innovative features, products, and services that match this new reality (Chiorazzo et al., 2018), FinTech is taking advantage of this gap and bypassing traditional intermediaries in the offering of financial services (Thakor, 2019). Such offer of tools not only benefits users, but also helps businesses to forecast trends and anticipate changes in consumer behaviour, allowing them to provide more value-added services to consumers.

Another key aspect to be highlighted is the increased use of such platforms with the COVID-19 outbreak since March 2020, that has boosted online purchases, online banking, and several other digital tools. The COVID-19 crisis has pushed companies towards technology, forcing them to adapt,

quickly and unexpectedly, to remote work, digital products, and services development, as well as new sorts of customer behaviour in a contactless world (see Figure 1.2).

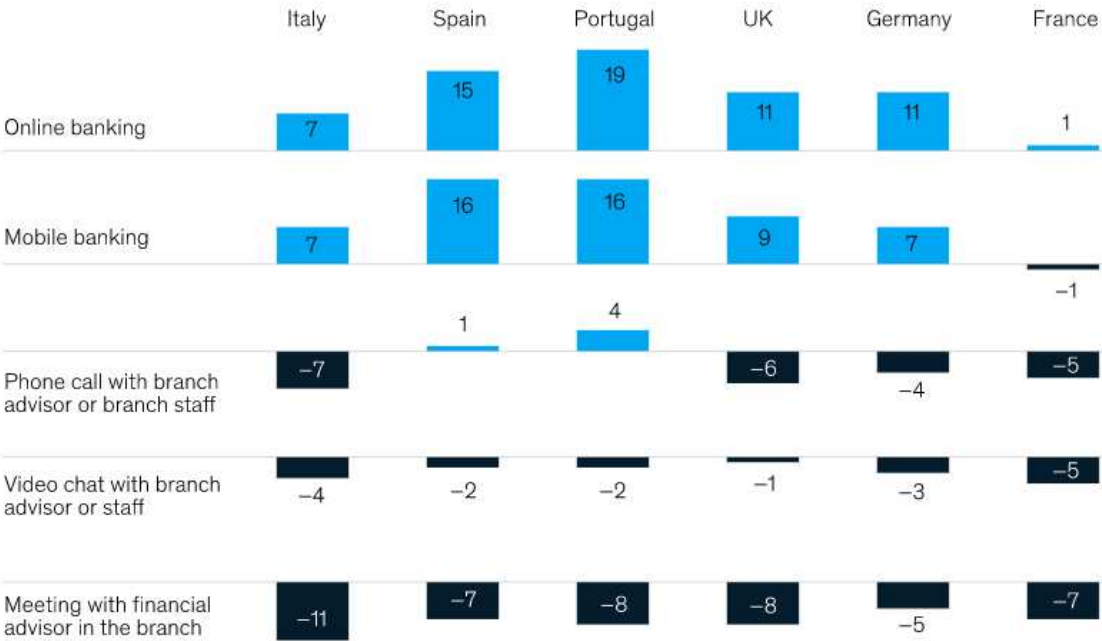


Figure 1.2: Percentage of respondents shifting banking usage (Source: McKinsey, 2020)²

Thakor (2019) affirms that innovation in payments systems is one of the aspects in which FinTech is creating the biggest impact in people’s lives. Digital wallets like *PayPal*, *Alipay*, *Apple Pay*, *MbWay* are an example of tools that facilitate the buying process and increase trust in online shopping, allowing consumers to complete a purchase without disclosing their card details. Studies on this matter suggest that consumers are more willing to switch from traditional to digital, and that age is a determinant variable on this matter (Boonsiritomachai & Pitchayadejanant, 2017).

Generation Y, also referred to as Millennials³, is a tech-savvy group, known as the first truly digital generation, and therefore is more inclined to adopt new technology and learn how to use it when compared to previous generations. Being more than 1.7 million people in Portugal⁴, these digital natives will soon make up a large share of the workforce around the globe, thus their financial behaviour will strongly affect the global economy (Lusardi & Oggero, 2017).

Research suggests that this group owns significantly lower levels of financial knowledge when compared to previous generations (Kim et al., 2019). This is particularly concerning as households with

² Based on the question “During the last 2 weeks, have you used the following bank services more often, less often, or same as before?”. Net change is calculated by subtracting the % of respondents stating they used less than before from the % of respondents stating they used more than before.

³ Broadly defined as those born between the early 1980s and 2000s, according to the Goldman Sachs Global Investment Research.

⁴ Resident population with ages between 25 and 40 (INE, 2020).

lower levels of financial knowledge are less likely to have savings (Smith et al., 2010), less likely to plan for retirement (Lusardi & Mitchell, 2014), more likely to default on mortgage payments (Gerardi et al., 2013), and more likely to use high-cost alternative financial services (Robb et al., 2015).

Therefore, the increasing complexity of financial responsibilities emphasises the importance of financial knowledge in people's lives, and, at the same time, the growth of FinTech may generate opportunities for better financial behaviours and an increase of financial inclusion.

1.1 Research overview

The overall purpose of this dissertation is to investigate the role of financial knowledge and the use of digital financial services on financial behaviours among millennials in Portugal.

To answer this research problem, the following specific objectives were defined:

1. Characterize financial behaviours among millennials within two dimensions: short-term and long-term financial behaviours
2. Compare perceived and effective financial knowledge
3. Identify the levels of usage of digital financial instruments
4. Identify the explanatory factors of positive financial behaviours among millennials

This study complements previous research by investigating the relationship between financial knowledge and financial behaviours within two dimensions (short-term and long-term financial behaviours), and by adding a new relevant aspect: the use of digital financial instruments.

This dissertation is divided into five chapters: Introduction, Literature Review, Research Model and Methodology, Results Discussion, and Conclusions.

The Literature Review consists of understanding and defining relevant concepts, and it will provide the theoretical background for the discussion on the relevant themes.

The Research Model and Methodology chapter will explain how the research is conducted, starting with the research problem, specific research objectives and proposed hypotheses, as well as the sample and methodological instruments used to collect data.

The fourth chapter will discuss the results obtained through the survey. Firstly, the results will be objectively described and only then interpreted and put into context by the discussed during the Literature Review.

Finally, the last chapter will present the findings and conclusions of this study, the main limitations, and possible recommendations for future research.

2 LITERATURE REVIEW

This study aims to investigate the impact that Financial Knowledge and the usage of Digital Financial Services have on millennials' financial behaviour in Portugal.

A Systematic Literature Review (SLR) is presented in the first section of this chapter to start the discussion of the theme and to summarise the existing evidence on how this subject has been addressed in the literature.

Following the SLR, the Literature Review is further elaborated and divided on three other sections: Financial Literacy, Digital Finance, and Practice of Digital Financial Services in Portugal. The concept of financial literacy and its ramifications are presented, its relevance and how it has been measured in previous studies. The following section discusses some relevant aspects of Digital Finance and explores how the Digital Financial Services have been addressed in the literature. Finally, relevant findings within the Portuguese context are presented.

2.1 Review Process

Aiming to initiate the discussion around the overall theme of Financial Literacy and the use of Digital Financial Services, this section intends to answer the following pertinent questions to this study:

1. Which concepts are usually discussed in conjunction with Financial Literacy and Digital Financial Services?
2. What are the dependent variables in recent studies?
3. What are the analysis methods commonly used in recent studies?

2.1.1 Study identification

The articles included in this literature review were first selected according to the relevant keywords and then were subject to an inclusion and exclusion criteria. The initial search was conducted in the scientific database Web of Science, an interdisciplinary, and human-curated database. It was selected for its comprehensiveness and its academic relevance (Goyal & Kumar, 2021).

The search terms were divided into two groups: (1) Financial Literacy and (2) Digital Financial Services. The terms within groups were combined through the Boolean operator OR, and groups were combined using the Boolean operator AND. In order to retrieve a higher number of articles of interest, the search was conducted through the studies' topic, identified as *TS*⁵. The formulated query is presented in Figure 2.1:

⁵ The Topic option performs searches on the title, abstract, author keywords, and keywords plus.

```

TS = (
1  ("financ* literacy" OR "financ* knowledge" OR "financ* education" OR "financ* capability")
2  AND ("digital financ* service*" OR fintech* OR "financial technolog*"
      OR "internet banking" OR "e-banking" OR "i-banking")
)

```

Figure 2.1: SLR formulated query.

The keywords used are endorsed by the SLR performed by Goyal & Kumar (2021), that have used a string with the following search terms: “financ* literacy” OR “financ* knowledge” OR “financ* education” OR “financ* capability”. The most interchangeably used terms in the literature are financial literacy, financial knowledge, and financial education (Huston, 2010). The term financial capability is also used as a synonym of financial literacy (Kempson et al., 2006), and while the concept of financial literacy is used in North America, financial capability is most used in the British English.

2.1.2 Search strategy and eligibility criteria

From the query defined, the preliminary search identified 56 potentially eligible studies, which were subjected to the inclusion and exclusion criteria as presented in Table 2.1. The search was refined to include only articles, written in English language, and published on or after 2017, which resulted in 37 studies.

Table 2.1: Inclusion and exclusion criteria.

Criteria	Description
Exclusion Criteria	Proceedings Papers, Review Articles, Editorial Materials, Book Chapters Written in language other than English Publication date before 2017
Inclusion Criteria	Work discusses financial literacy Work discusses digital financial services or financial technology Work provides detailed methodology

The literature review was performed as a multi-stage process. Following the application of the inclusion criteria detailed above, the articles were screened based on reading abstracts, what led to the exclusion of 18 articles. Subsequently, the articles were extracted, what led to the exclusion of 3

pieces that were not available. The following step included reading the introduction, methodology and conclusion of all extracted articles. At this stage, 8 articles were excluded because they did not combine Financial Literacy with any aspect of Financial Digital Services, or the research was conducted through a qualitative analysis. This process is summarised in Figure 2.2. Therefore, 8 articles were included in the final review, as shown in Table 2.2.

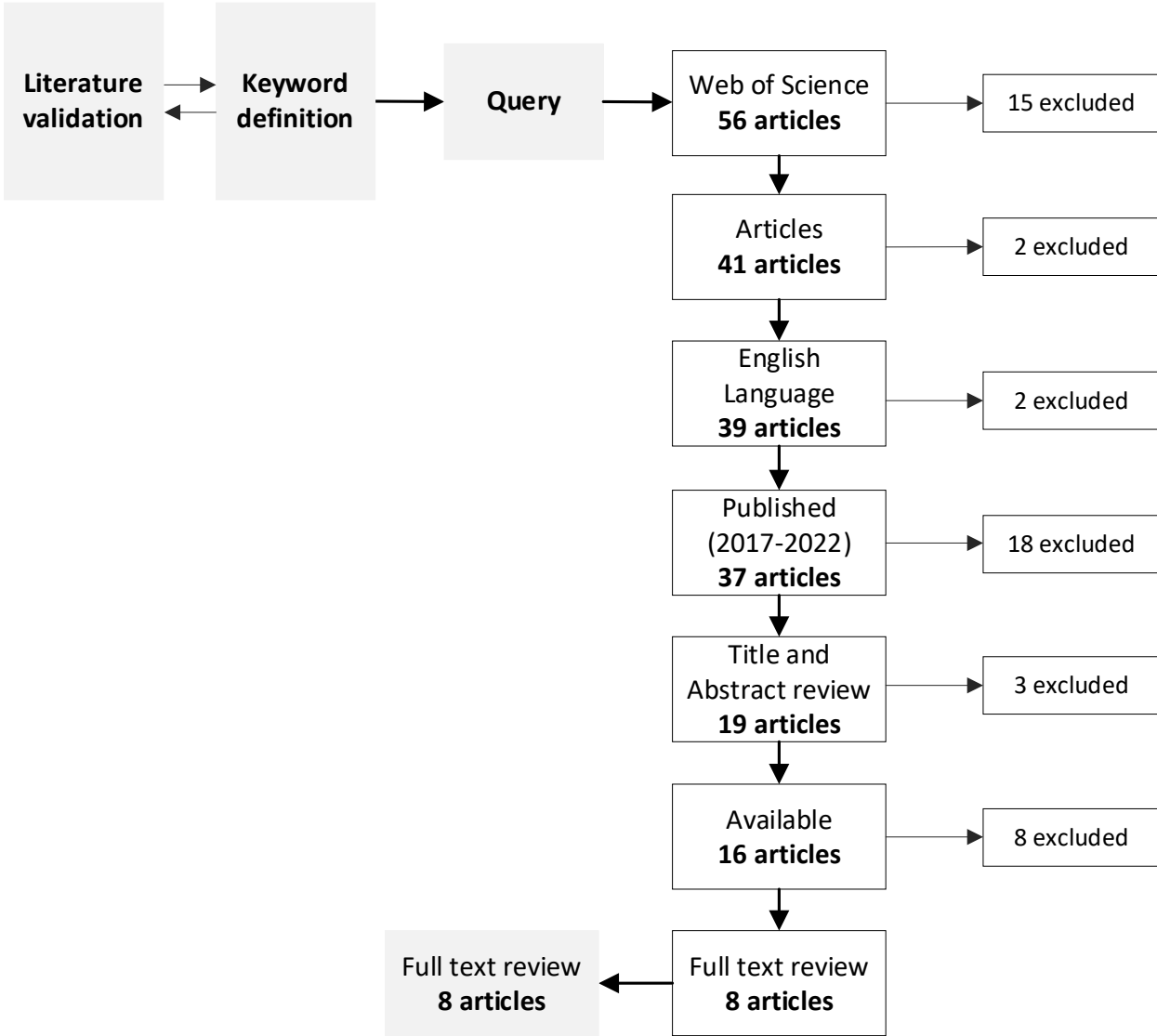


Figure 2.2: Selection process of studies.

Table 2.2: Articles included in the systematic review.

ID	Title of the study	Authors	Year	Citation
1	Banking goes digital: The adoption of FinTech services by German households	Jünger & Mietzner	2020	34
2	Financial education and digital asset management: What's in the black box?	Litterscheidt & Streich	2020	16
3	How does financial literacy impact on inclusive finance?	Hasan et al.	2021	11
4	Who Uses Mobile Payments: FinTech Potential in Users and Non-Users	Li et al.	2020	12
5	Financial literacy and its influence on internet banking behavior	Andreou & Anyfantaki	2021	5
6	Rural Consumers' Financial Literacy and Access to FinTech Services	Hasan et al.	2022	2
7	Competences in the Field of Finance - Results of a Population Survey	Szobonya	2021	-
8	An Analysis of Digital Financial Literacy among College Students	Raidev et al.	2020	-

2.1.3 Data synthesis

Overall, the articles address the importance of financial literacy on financial outcomes. Another consistent subject across studies was the use of different sorts of digital financial services (i.e. investment robo-advisors, mobile payments, and i-banking), and how these are associated with the financial concepts. The main findings of the selected articles are summarised in Table 2.3. The following sections provide the analysis of the studies based on the three questions previously raised: (1) usual concepts; (2) dependent variables; and (3) methods of analysis.

Table 2.3: Main findings of selected articles.

ID	Description
1	A household's level of trust and comfort with new technologies, financial literacy, and overall transparency impact its propensity to switch to a FinTech - households with low levels of trust, high financial education, and with a preference for transparency are characterized by a higher probability of adopting FinTech.
2	The results suggest that a financial education intervention increases the extent to which investors accept financial advice, in this case, delegate to a robo-advisor tool.

-
- 3 The empirical findings demonstrated that financial literacy had a positive effect on access to finance, and that financial knowledge was one of the most influential forces to enhance financial inclusion.
 - 4 It was found that age was negatively related to mobile payment use, and that males were more likely than females to use mobile payments. Additionally, the likelihood of using mobile payments increased with subjective financial knowledge and decreased with objective financial knowledge.
 - 5 The findings indicate that there is a statistically positive relationship between the levels of financial knowledge and the frequency of i-banking use. More importantly, financial illiterate consumers appear to report the lack of trust in i-banking, as well as a lack of self-confidence in financial and digital skills as the main reasons for not using this service.
 - 6 Financial knowledge contributes to fostering financial communication between rural low-income groups. Appropriate knowledge about different FinTech services were found to significantly impact getting FinTech access, particularly in the expansion to other financial services.
 - 7 Digital competences are significantly higher among respondents who benefit from digital services, who are typically young, more highly educated, have average or above-average income, and live in larger cities. The acquisition of essential knowledge through electronic means may help people being informed about services and may facilitate their decisions on using electronic financial instruments.
 - 8 It was found that there is significant difference in average Digital Financial Literacy score depending on age and education, but not gender. The results also indicated no significant relationship between actual usage of DFS and level of DFL, except on debit card usage.
-

2.1.3.1 Usual concepts

The concepts often discussed in conjunction with Financial Literacy and Digital Financial Services in the selected studies were reported in Table 2.4.

This summary allowed to identify in which articles each concept was addressed, but also which concepts were mostly used. It was also relevant to notice that Financial Literacy, Financial Knowledge, and Financial Behaviour were commonly studied together, and that these concepts were observed in most of the chosen articles. Other common topics were Financial Inclusion and Financial Advice.

An interesting finding was that, although the articles do not specifically mention Digital Financial Literacy, except for article 8, the association between Financial Literacy and Digital Financial Services was a common subject among all studies.

Table 2.4: Summary of relevant concepts addressed in the studies.

		Article ID							
		1	2	3	4	5	6	7	8
Financial Concepts	Financial Literacy (FL)	✓	✓	✓	✓	✓	✓	✓	✓
	Financial Knowledge (FK)	✓	✓	✓	✓	✓	✓	✓	
	Financial Behaviour (FB)	✓	✓	✓	✓	✓	✓	✓	
	Financial Inclusion (FI)			✓		✓	✓		
	Financial Advice (FA)	✓	✓			✓	✓		
Digital Concepts	Digital Literacy (DL)					✓		✓	
	Digital Finance (DF)			✓		✓			
	FinTech (FT)		✓	✓	✓		✓		
	Digital Financial Services (DFS)	✓		✓		✓	✓	✓	✓
DFL	Digital Financial Literacy (DFL)								✓

2.1.3.2 Dependent variables in recent studies

Although not all articles present a detailed conceptual framework, some similarities were found among the studies regarding the dependent variables. Most of the variables presented in the articles analysed are related to digital financial services or tools and are usually presented as continuous or categorical (dichotomous) variables (see Table 2.5).

Table 2.5: Summary of predicted variables in the studies.

Article ID	Dependent variable	Scale	Conceptual framework
1	Use of FinTechs	Dichotomous	
2	Amount delegated to robo-advisor	Continuous	
3	Banking access	Continuous/ Dichotomous	✓
	Microfinance	Continuous/ Dichotomous	
	Fintech	Continuous/ Dichotomous	
4	Use of mobile payments	Dichotomous	
5	Financial Knowledge	Continuous	✓
	Bank visit	Dichotomous	
	i-banking	Dichotomous	
6	FinTech access	Dichotomous	✓
7	Use of Digital financial tools	Non-specified	✓
8	Use of Digital Financial Services	Non-specified	✓

2.1.3.3 Methods of analysis commonly used in recent studies

The methods of analysis adopted in each study is described in Table 2.6. While most studies explored different types of regression models, articles 7 and 8 conducted the analysis through statistical hypothesis tests. Additionally, due to a high level of correlation between several survey items, articles 1 and 3 applied Principal Component Analysis (PCA) to reduce the number of components without much information loss.

The most used analysis methods were regression models, verified in articles from 1 to 6. Among these models, OLS regression and log-log regression were those reported less often. Both correspond to linear relationships, since OLS is a type of linear regression and log-log regression models the linear relationship between $\ln(x)$ and $\ln(y)$.

Logistic regression and probit regression were the most recurring models among the articles analysed, and they are estimation procedures used to predict the probability of an event occurring⁶. Both models are used when estimating categorical dependent variables, most commonly dichotomous, but these models' maximum likelihood estimators are not robust to outliers (Liao, 1994).

Table 2.6: Methods of analysis.

	Article ID							
	1	2	3	4	5	6	7	8
Principal Component Analysis	✓		✓					
Logistic regression	✓		✓	✓		✓		
Probit regression			✓		✓	✓		
Log-log regression			✓			✓		
OLS regression		✓			✓			
Hypothesis test							✓	✓

2.1.4 SLR Conclusions

Intending to identify the emerging themes related to Financial Literacy, as well as the usual approach to Digital Financial Services in recent years, this section has provided a systematic analysis of 8 identified articles according to the three questions proposed above: (1) usual concepts; (2) dependent variables; and (3) methods of analysis. Table 2.7 provides a summary of the content analysis performed.

⁶ Logistic regression or logit is used to model the odds of success of an event as a function of the independent variables, while the Probit model determines the likelihood that an event will fall into one of a range of categories by estimating the probability of that observation belonging to a particular category.

It was observed that Financial Literacy is a common subject among all studies, that is usually related to other financial concepts and outcomes. Additionally, the use of FinTechs or Digital Financial Services has been consistently linked to different financial constructs.

To conclude, among the studies analysed, the logistic regression and probit regression models were the most recurrent. It is important to highlight that logistic regression is adequate for categorical dependent variables, which can be dichotomous or not. For dichotomous dependent variables, which take one of the two values, i.e. Yes or No, True or False, a binary logistic regression will be used. However, if the dependent variable has more than two categories and they are presented in an ordered structure, the most appropriate model will be an ordered logistic regression.

Table 2.7: Summary of content analysis.

Study ID	Q1. Usual concepts ^a	Q2. Dependent variables	Q3. Methods of analysis ^b
1	FL, FK, FB, FA, DFS	Use of FinTechs	PCA, Logit
2	FL, FK, FB, FA, FT	Amount delegated to robo-advisor	OLS
3	FL, FK, FB, FI, DF, FT, DFS	Promoted inclusive finance	PCA, Log-log, Probit, Logit
4	FL, FK, FB, FT	Use of mobile payments	Logit
5	FL, FK, FB, FI, FA, DL, DF, DFS	Overall Financial Knowledge	OLS, Probit
6	FL, FK, FB, FI, FA, FT, DFS	FinTech access	Log-log, Probit, Logit
7	FL, FK, FB, DL, DFS	Use of Digital financial tools	Hypothesis test
8	FL, DFS, DFL	Use of Digital Financial Services	Hypothesis test

Note:

- a. FL=Financial Literacy, FK=Financial Knowledge, FB=Financial Behaviour, FA=Financial Advice, DL=Digital Literacy, DF=Digital Finance, FT=FinTech, DFS=Digital Financial Services, DFL=Digital Financial Literacy.
- b. PCA=Principal Components Analysis, OLS=Ordinary Least Squares

2.2 Financial Literacy

The existing research suggests the relevance of financial literacy, and more importantly, the factors and outcomes of such literacy, that drives people to make better informed financial decisions. In this context, many studies aim to assess levels of financial literacy to understand how well-equipped households are to make essential financial decisions. Despite its growing body of research, the field of financial literacy still has a major obstacle to overcome: the lack of a widely disseminated measure of financial literacy (Goyal & Kumar, 2021; Huston, 2010; Knoll & Houts, 2012).

2.2.1 Discussion around the concept of Financial Literacy

The ability to manage everyday expenses, plan for retirement and unexpected events, and have a knowledgeable use of financial products such as credit cards and loans are just a few topics among an extensive area covered by personal finances. Handling this combination of knowledge and attitude in an ever-changing and more complex financial world is an enormous challenge for individuals. At the same time, continuous changes in the structure of pension plans worldwide from Defined Benefits to Defined Contributions⁷ increase individuals' responsibilities for their own financial well-being more than ever before. This shift of responsibilities from Social Security and employers to employees requires people to decide how to save and invest, and more importantly, how to manage decumulation during retirement so as not to outlive their assets while meeting their needs (Lusardi & Mitchell, 2014).

In this context, it is important that individuals understand how financial products work, be able to obtain information and recognize risks, and know the regulatory environment, in order to maximise their profits, both now and in the future. Nevertheless, a growing body of research in this area found that most households lack basic financial knowledge and individuals are unable to perform very simple calculations (Lusardi & Mitchell, 2014).

Grohmann et al. (2018) argue that the effect of financial literacy not only increases individual's financial inclusion, but the benefits extend to real economy. Increasing consumer financial literacy is a public policy objective to improve welfare through better decision-making (Huston, 2010; Lusardi & Mitchell, 2014).

Higher levels of financial literacy lead individuals to make informed decisions and to better manage some fundamental aspects of their finances, such as budgeting, spending, savings, and future planning, as well as using financial products to obtain positive returns (ANZ, 2015). The ANZ Bank study suggests that financial literacy is closely linked to a person's age, gender, education, and socio-economic characteristics.

But what exactly is Financial Literacy?

There is no widely accepted definition for financial literacy, neither a standard measurement method adopted (Huston, 2010; Goyal & Kumar, 2021; Lyons & Kass-Hanna, 2021a).

Huston (2010) reviewed 71 individual studies published between 1996 and 2008 that aimed to assess financial literacy/knowledge measures, noting that nearly three-quarters of them did not provide a definition of financial literacy. In the same direction, a significant finding from the systematic

⁷ A Defined Benefit plan guarantees a specific monthly pension that an individual will receive in retirement. A Defined Contribution plan, in turn, is an investment account where both the employer and the employee contribute at an agreed rate. At retirement, the individual receives the accrued amount, which will vary according to market conditions, hence difficult to predict.

analysis conducted by Goyal & Kumar (2021) is that there is no unanimity on the conceptualisation of financial literacy and hence the terms financial literacy, financial education, financial capability, and financial knowledge are used by authors interchangeably.

Among the studies analysed that included both the concepts of Financial Literacy and Financial Knowledge, 76% have considered FL and FK as synonyms. Nonetheless, financial knowledge and financial literacy are different constructs, as the last has an additional dimension that implies that an individual must have the ability to use the financial knowledge to make financial decisions. This is a significant aspect to have in mind when developing an instrument to measure financial literacy, as it would be important to determine an individual's level of knowledge, but also if they can apply it appropriately (Huston, 2010).

While some of the definitions referred exclusively to financial knowledge, others provided a more extensive explanation, including financial knowledge and experiences as well as the capable use of this knowledge (Huston, 2010). Yet most definitions and metrics in the field of Financial Literacy have been consistent in assessing whether individuals possess sufficient awareness, knowledge, and skills to make well-informed financial decisions (Atkinson & Messy, 2011; Lyons & Kass-Hanna, 2021a).

One common definition that has been used in recent studies is that financial literacy is the ability to process economic information and make informed decisions about financial planning, wealth accumulation, pensions, and debt (Lusardi et al., 2010). Similarly, the Organization for Economic Cooperation and Development and the International Network on Financial Education (OECD, 2016) defined financial literacy as "... a combination of awareness, knowledge, skill, attitude, and behaviour necessary to make sound financial decisions and ultimately achieve individual financial well-being".

Recent studies in this area have come to associate financial literacy, or more specifically, financial knowledge, with other aspects of personal finances, such as financial well-being, financial behaviour, and even financial inclusion. Moreland (2018) found that obtaining financial advice is positively associated with financial behaviours. Furthermore, the results also indicated that the positive impact of financial advice is higher for those with less financial knowledge. Morgan & Long (2020) found that financial literacy has statistically significant effects on both financial inclusion and savings, and that individuals with higher financial literacy levels tend to save more than those with lower financial literacy levels. Their findings also suggest that higher financial behaviour scores, specifically on the holding of financial products and higher active consumption, are associated with higher overall financial inclusion. Financial knowledge, in turn, was found to be positively associated with performing positive short-term and long-term financial behaviours of millennials in the United States (Kim et al., 2019).

2.2.2 Financial Knowledge: Objective versus subjective measures

As discussed, financial knowledge and financial literacy are often used interchangeably in the literature (Goyal & Kumar, 2021; Huang et al., 2013; Huston, 2010), but for many authors literacy is more than simply a measure of knowledge. Financial Literacy reflects individual's ability to perform a range of money related tasks, including earning, protecting, and spending that money (Remund, 2010).

An important aspect to consider is that knowledge is not a unitary construct, but a concept that is partly fact-based, partly subjective. This suggests that individuals' perceptions of their own level of knowledge are distinct from objective knowledge, although usually related to it (Moorman et al., 2004).

In addition to objective financial knowledge, it is found that perceived financial knowledge is also valuable in determining financial behaviour (Henager & Cude, 2016a). Perceived, self-perceived or subjective financial knowledge reflects an individual's confidence in their ability to handle financial concerns, more specifically, the level of knowledge individuals believe they possess. On the other hand, objective, measured or effective financial knowledge corresponds to the real knowledge individuals have.

Many studies have opted to use subjective measures of financial knowledge and skills to complement objective financial knowledge questions, useful to identify if there is any mismatch between perceived versus actual knowledge (Lusardi & Mitchell, 2011b). Perceived financial knowledge has typically been measured through self-assessment questions such as "how would you assess your overall financial knowledge?" (NFCS, 2009)⁸.

Both objective and subjective financial literacy were found to have a significant positive impact on individual's retirement behaviour, including planning, saving and investment management (Hauff et al., 2020). Allgood & Walstad (2011) found that perceived financial literacy was a stronger predictor of recommended financial practices or behaviours than was actual financial literacy. Their findings include the positive impact of higher levels of perceived financial literacy on credit card habits, investment behaviour, loan rates comparison and seeking financial advice about saving and investing, regardless the level of real financial knowledge.

Henager & Cude (2016) found that while objective and subjective financial knowledge were both positively related with long-term financial behaviour, the impact of subjective knowledge on short-term financial behaviour was significantly higher when compared to objective knowledge.

⁸ The Financial Industry Regulatory Authority (FINRA) conducted a telephone survey in 2009 known as the National Financial Capability Study, aiming to map key indicators of financial capability and linking these indicators to demographic, behavioural, attitudinal, and financial literacy characteristics.

Correspondingly, Tang & Baker (2016) suggested that perceived financial knowledge has a significant impact on retirement planning and retirement investment management.

Yet some studies have found a positive association between perceived financial knowledge and financial behaviour, others have identified the presence of an overconfidence effect. According to the psychological literature, overconfidence can be defined as the “overestimation of one’s actual ability, performance, level of control, or chance of success” (Moore & Healy, 2008), and in finance it has been linked to risky behaviours (Xia et al., 2014). The difference between self-perceived and objectively measured financial knowledge has been suggested as a measure of an individual’s financial overconfidence (Lusardi & Mitchell, 2014; Xia et al., 2014; Porto & Xiao, 2016).

Overconfidence, like other psychological biases such as risk tolerance, attitude towards money, present bias, and future orientation, among others, can affect the relationship between financial knowledge and financial behaviour (Goyal & Kumar, 2021). As an example, overconfidence was found to be positively correlated to stock market participation, and the rate of participation of overconfident respondents was similar to that of respondents with a high objective financial literacy score (Xia et al., 2014).

2.2.2.1 Measuring Financial Knowledge

As discussed, financial knowledge is commonly measured through a composite score of perceived financial knowledge and actual financial knowledge, often using questions about topics like inflation, compound interest or investment types. Correct responses to objectively measured items in financial knowledge tend to be associated with better financial behaviours (Knoll & Houts, 2012; Lusardi & Mitchell, 2014).

The usual microeconomic approach used on financial literacy models to saving and consumption assume that a fully rational and well-informed individual will consume less than the income in times of higher earnings, thus saving to support consumption when income falls, especially after retirement (Lusardi & Mitchell, 2014). On this basis, Lusardi & Mitchell (2011b) propose three fundamental concepts when measuring financial literacy: (i) numeracy and capacity to do calculations related to interest rates; (ii) understanding of inflation; and (iii) understanding of risk diversification. The so-called “Big Three” questions developed to indicate one’s financial literacy have been used worldwide and were then updated to include two new questions. Concepts and the designed standard set of questions are summarized in Table 2.8.

The set of questions described below is relevant for different reasons. Firstly, the questions are simple and direct, providing an objective evaluation of individuals' financial abilities. In addition to that, it has been used extensively in various surveys in different countries in recent years, allowing the comparison of results. Even though the questions appear to be relatively simple, they have been found

to be challenging for many adults and have served as reliable and valid indicators of financial literacy in several surveys conducted in the US (Allgood & Walstad, 2016).

Table 2.8: Financial Literacy questions designed by Lusardi and Mitchell (2011b)

ID	Concept	Question
1	Measures numeracy or the capacity to do a simple calculation related to compounding of interest rates	<i>Suppose you had \$100 in a savings account and the interest rate was 2% per year. After 5 years, how much do you think you would have in the account if you left the money to grow: [more than \$102; exactly \$102; less than \$102; Do not know]</i>
2	Measures understanding of inflation, in the context of a simple financial decision	<i>Imagine that the interest rate on your savings account was 1% per year and inflation was 2% per year. After 1 year, would you be able to buy: [more than; exactly the same as; less than today; Do not know]</i>
3	Test of knowledge about stocks, stock mutual funds and of risk diversification	<i>Do you think that the following statement is true or false? 'Buying a single company stock usually provides a safer return than a stock mutual fund.' [True; False; Do not know]</i>
4	Test of knowledge about bonds	<i>If interest rates rise, what will typically happen to bond prices? [They will rise; They will fall; They will stay the same; There is no relationship; Do not know]</i>
5	Test knowledge about credit and the understanding of compounding of interest rates	<i>A 15-year mortgage typically requires higher monthly payments than a 30-year mortgage, but the total interest paid over the life of the loan will be less. [True; False; Do not know]</i>

Note: Table summarizes the “Big Five”. Source: gflec.org/education/questions-that-indicate-financial-literacy

Researchers often use a combination of these questions to calculate a FL score by either: (1) summing up the number of correct responses, with scores ranging from 0 to the maximum number of correct responses; or (2) calculating the percentage of correct responses to the total number of questions asked, with scores ranging from 0 to 100% (Lyons & Kass-Hanna, 2021a).

In addition to the “Big Five” set of questions described above, several surveys include questions related to self-assessed knowledge. Respondents may be asked to report on a Likert scale how “knowledgeable” or “capable” they perceive themselves to be when it comes to finance matters, usually on a scale from 1 to 7, ranging from “low” to “high”. Alternatively, they could also be asked to indicate how familiar they are or how much they know regarding personal finances matters (Lyons & Kass-Hanna, 2021a).

As previously addressed, these perception metrics are not essentially better measures than the test-based ones, as they can be subject to overconfidence bias. Respondents tend to be overconfident on their own financial knowledge and overestimate the knowledge they possess, regardless of the low levels of financial literacy objectively measured (Lusardi & Mitchell, 2014).

2.2.3 Financial Behaviour

Several researchers have assessed financial literacy levels and its positive impact on financial planning and behaviour (Ergün, 2018; Landerretche & Martínez, 2013), and it is found that improvements in financial literacy leads to increased savings, budgeting, financial planning, and smart usage of credit cards (Wann, 2017). Conversely, the lack of financial knowledge has also been associated with financial behaviours such as over borrowing, high interest rate mortgages, and limited saving and investment (Lusardi, 2008). Furthermore, low levels of financial knowledge impact the day-to-day management of finances as well as the ability to save money for the long term (Braunstein & Welch, 2002).

Although financial literacy measures are used as predictors of financial behaviours or outcomes, other aspects such as impulsiveness, behavioural biases, external circumstances (Huston, 2010) and variables such as influences of socialization agent, cultural influences and issues related to family and environment (Rai et al., 2019) may also contribute to financial decision-making. Fernandes et al. (2014) reported that controlling for psychological traits weakens the observed relationship between financial literacy and financial behaviour. Thus, for this dissertation it is important to point out that a financial literacy or even a financial knowledge measure do not ensure positive financial behaviours, however, it may identify necessary conditions individuals need to engage in appropriate financial behaviours.

Personal financial management has also been addressed in the literature as an important component in the definition of financial well-being. Behavioural assessments of personal financial management include (a) financial planning for long-term and short-term financial goals; (b) financial management of income and credit; (c) financial practices through the purchase of housing, insurance, automobile, and other durable and non-durable consumer goods and various services including banking, insurance, and investment; and (d) investment for the future (Garman & Fogue, 2014).

Financial behaviours include proper behaviour with various personal finances topics, including paying bills on time, spending less than you earn, knowing where your money goes, and investing some money for the future (Garman & Fogue, 2014). Similarly, establishing an emergency fund, checking one's credit report/score, avoiding bank overdrafts, saving for retirement, and paying credit card balances on time and in full are viewed as positive financial behaviours (Allgood & Walstad, 2016). Henager & Cude (2016) propose a Financial Behaviour index based on short-term and long-term behaviours, including indicators as having an investment account, planning the amount needed for retirement and setting financial goals. The different indicators of Financial Behaviour are summarized in Table 2.9.

As already stated, studies suggest that financial literacy plays a key role in influencing financial decision-making, and the causality goes from knowledge to behaviour (Lusardi & Mitchell, 2014).

Important benefits of greater financial knowledge include savvier saving and investment decisions, better debt management, retirement planning, higher participation in the stock market, and greater wealth accumulation.

Table 2.9: Indicators of positive Financial Behaviour per authors.

ID	Indicators of Financial Behaviour	Authors		
		Garman & Forgue (2014)	Allgood & Walstad (2016)	Henager & Cude (2016)
1	Paying bills on time	✓	✓	
2	Spending less than you earn	✓		✓ ST
3	Avoiding bank overdrafts		✓	✓ ST
4	Knowing where your money goes	✓		✓ ST
5	Checking one's credit report/score		✓	
6	Establishing an emergency fund		✓	✓ ST
7	Saving for retirement	✓	✓	✓ LT
8	Having investments			✓ LT
9	Planning the amount needed for retirement			✓ LT
10	Setting financial goals			✓ LT

Note: Henager & Cude's indicators are marked with ST (Short-term FB) or LT (Long-term FB).

Henager & Cude (2016) examined the relationship between financial literacy and financial behaviours by age groups in the US and found that financial literacy was positively associated with long and short-term financial behaviours. Each of the age groups was progressively more likely to engage in the long-term behaviours, and another key finding for the long-term behaviours was that the strongest relationship shifted from subjective knowledge for the younger age groups to objective knowledge for the older age groups.

In the same direction, Allgood & Walstad (2016) reported the beneficial effects of financial literacy on financial practices or behaviours. Their results show that financial knowledge, in combination with a high self-rated financial literacy (i.e. perceived financial literacy), has a great influence on positive financial behaviours.

Kim et al. (2019a) studied the impact of financial knowledge on short-term and long-term financial behaviours among millennials in the US, adopting the indicators for Financial Behaviour proposed by Henager & Cude (2016), and similarly to their discussion, financial knowledge was found to be positively associated with performing positive short-term and long-term financial behaviours.

2.2.4 Awareness of Financial Attitudes

As discussed in the previous section, the terms “financial literacy” and “financial knowledge” are often used interchangeably in the literature, but as the latter has indicators that are easier to collect, they often serve as a proxy for financial literacy (Nicolini & Haupt, 2019). Nevertheless, financial knowledge is not equivalent to financial literacy, but one of its dimensions (Huston, 2010). Even among those with sufficient knowledge, one’s financial attitudes will influence their financial decisions (OECD, 2020). Therefore, for the purpose of this dissertation, a second construct will be considered when investigating the financial behaviour of millennials: the Awareness of Financial Attitudes (AwFA).

Financial attitude can be understood as a personal inclination towards financial matters, and it is defined as a state of mind, opinion, and judgment of an individual about finances (Pankow, 2003). These values, such as self-control, patience, long-term thinking, and the ability to solve financial problems are deeply related to one’s environment and previous experiences, and it has been consistently linked to financial decision-making in the literature.

The Awareness of Financial Attitudes can be captured through a set of financial statements, where respondents should indicate how much they agree or disagree with, usually on a Likert scale (OECD, 2020). Statements can focus, as an example, on preferences for the short-term through ‘living for today’ and spending money. Respondents with higher scores on such preferences are less likely to engage in positive financial behaviours, that could lead to improved financial resilience and well-being.

Financial attitude was found to be positively associated with financial management behaviour and millennials with a better financial attitude and skills would demonstrate good financial behaviour in managing their money (Dewi et al., 2020). Furthermore, previous research has concluded that there is a link between financial attitudes and financial literacy among the youth (Heuberger et al., 2018) and that negative attitude towards money is significantly associated with poor financial decision-making.

2.3 Digital finance

The digital transformation process of the financial industry is not new, and it has been continuously expanding. Nevertheless, technological advances have dramatically increased in recent years, with the COVID-19 pandemic boosting it more than ever before. Financial technology in turn, improves the delivery of traditional tasks, but more importantly, it allows new business models and opportunities.

In this context, new usage patterns of digital devices and media, side by side with the increase of online channels for both financial information and financial transactions, are fundamental elements driving changes in this area. Additionally, the rapid growth of digital financial services (DFS), that intends to improve personal financial management and increase financial inclusion, raises the

challenge of linking financial literacy to digital literacy and assessing their effect on financial outcomes (Lyons & Kass-Hanna, 2021a).

Overall, Digital Finance comprehends the digitalization of the financial industry. The Digital Finance Institute (2015) describes Digital Finance start-ups as “companies that are creating innovation for integrating distributed digital banking, mobile solutions and delivery platforms, microfinance, payment solutions, peer-to-peer lending, and crowdfunding”. And in the past few decades, digital technologies in the field of finance have sparked revolutionary changes to financial services, making it easier for people worldwide to access and use a more convenient and affordable array of financial products and services.

The terms ‘Digital Finance’ and ‘e-Finance’ are frequently used as quasi-synonyms (Gattenio, 2002), and overall, Digital Finance, e-Finance, and FinTech describe the processes of change in the financial sector through the introduction and use of information and communication technology (Gomber et al., 2017).

2.3.1 What is ‘FinTech’?

Technology and digitalisation are rapidly transforming how the financial sector operates. In this context, innovative applications of digital technology for financial services emerge to improve and automate the delivery and use of financial services. According to EY’s 2019 FinTech Adoption Index, 64% of consumers utilize at least two or more FinTech services and those consumers are also increasingly aware of FinTech as a part of their daily lives. This average rate of FinTech adoption globally has increased from 16% and 33%, in EY’s studies from 2015 and 2019, respectively: “Awareness of FinTech, even among nonadopters, is now very high. Worldwide, for example, 96% of consumers know of at least one alternative FinTech service available to help them transfer money and make payments” (p.6).

Definitions of FinTech vary widely. According to the Board of the International Organization of Securities Commissions (IOSCO), FinTech comprehends “a variety of innovative business models and emerging technologies that have the potential to transform the financial services industry”. FinTech embraces the application of new digital technologies to financial services, but also the development of business models and products which rely on these technologies and more generally on digital platforms and processes.

FinTech is especially disruptive and valuable to millennials, who expect to use technology to access financial services. It increases trust in financial products as they become more accessible, transparent, and comprehensible; by improving data collection, personalization is explored; lastly, it encourages participation in financial decisions through education and gamification techniques (OECD, 2018a).

Another aspect to be highlighted is that the terms FinTech and start-up are not interchangeable. A FinTech company can be either a start-up, an established technology company, or an established service provider. The misleading assumption that FinTech businesses are start-up companies ignores the large number of well-established financial service providers using new digital technologies (OECD, 2018a). Nonetheless, the phenomenon of digital-only banking, and its adoption by (mostly) young adults, continues to rise.

2.3.2 Digital Financial Services

Digital Financial Services (DFS) are financial services whose delivery and use by consumers rely heavily on digital technologies. Recent research in this area explores DFS’ important role on financial inclusion, by facilitating daily financial transactions such as “government transfers and other public services, sending money home, paying a utility bill, or receiving wages - instead of using cash which is less efficient, riskier, and requires face-to-face interaction” (Pazarbasioglu et al., 2020).

The FinTech Control Tower is a research framework developed jointly by BCG and Expand Research, in which the FinTech landscape can be mapped across eight categories: payments, insurance, planning, lending and crowdfunding, blockchain, trading and investments, data and analytics, and security. This is also the framework adopted by IOSCO Research Report on Financial Technologies (2017), and it is similar to the Digital Finance Business Functions proposed by Gomber et al. (2017), although not equal to.

The concept of the “Digital Finance Cube” suggested by Gomber et al. (2017) systematises three central dimensions to structure the studies regarding Digital Finance. These dimensions are: (1) Digital Finance business functions; (2) relevant technologies and technological concepts; and (3) institutions providing Digital Finance solutions (see Figure 2.3). For the purpose of this study, the most relevant scope to address digital financial services and products is the dimension of the Digital Finance Business Functions. According to the Digital Finance Cube, this dimension comprehends six components in which FinTechs have a huge role, that are summarized in Table 2.10.

Table 2.10: Digital Financial Services proposed by Gomber et al. (2017).

ID	DFS	Description
1	Digital Financing	Traditionally, banks are the providers of financial resources. Digital Financing, on its hand, enables individuals, firms, and start-ups to become independent from these traditional ways, since the necessary financing can be acquired by using the internet. It is relevant to note that Digital Financing comprehends all digital types of making available financial capital, including various platforms that offer digitalized services in factoring, invoicing, leasing, and crowdfunding.

2	Digital Investments	Digital Investments support individuals and institutions in both investment decisions and investment transactions, by use of the respective devices and technologies. In the B2C context, it includes mobile trading, social trading, online brokerage, and online trading, while within the B2B area, high-frequency and algorithmic trading.
3	Digital Money	Digital or virtual currency, e-money and cryptocurrency are terms to describe types of currency that only exists electronically. Virtual currencies are non-regulated Digital Money, distributed and controlled by their creators, and based on a decentrally organized network. The best-known cryptocurrency is bitcoin, which was introduced in 2008, and it is not backed by assets or commodities nor controlled by any central institution.
4	Digital Payments	While Digital Money refers to digital currencies that are newly established, Digital Payments refer to electronic payments using traditional currencies that are issued and regulated by central banks.
5	Digital Insurance	Digital products and services in the area of insurance. As an example, platforms that follows the peer-to-peer concept, where individuals can partner to reduce insurance costs at a constant level of protection.
6	Digital Financial Advice	Review sites and comparison platforms provide (1) primarily financial product reviews, (2) financial product comparisons based on figures and features, or a union of both. In contrast to traditional financial advice, digital solutions based on algorithms provide investment recommendations based on parameters regarding investment goals, financial background, and risk aversion, with no or minimal human intervention. These robo-advisors focus on portfolio management services and investment strategies based on established theories such as modern portfolio theory.

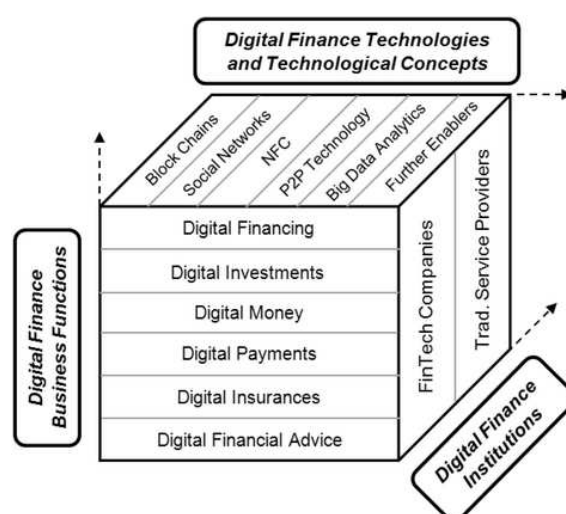


Figure 2.3: Digital Finance Cube proposed by Gomber et al. (2017).

The upgrowth of digital finance enables a wide range of new financial products and services, and the development of such tools helps individuals to better manage their personal finances, including saving, investing, payments, but also borrowing, acquiring insurance, and financial advice. Despite its unavoidable expansion, the COVID-19 pandemic and the need for social distancing have accelerated this process in unprecedented ways, as DFS offers consumers convenient alternatives to traditional in-person options.

The availability of DFS is advantageous to users in many ways. It allows consumers to save time (e.g. transactions can be carried out from anywhere and at any time), but also to save resources, as it is more cost-effective than traditional financial services. DFS can also increase financial inclusion by aggregating users who would otherwise be fully or partially excluded from the financial system, and this is one of the main reasons why emerging economies have focused on the digital financial landscape to drive economic growth. Nevertheless, the effective use of digital finance requires users to be knowledgeable of digital financial products and services (Morgan et al., 2019) and to have some reasonable level of digital literacy (Lyons & Kass-Hanna, 2021a, 2021b), as FinTech and digitalisation have made consumers prone to misinformed financial decisions and susceptible to financial fraud (Goyal & Kumar, 2021). For this reason, individuals need to have adequate financial knowledge to effectively participate in the financial marketplace, make informed decisions, and protect themselves from fraud.

Likewise, the OECD (2018) highlights the contradicting effect of the application of digital technologies to personal finance. While it has the potential to generate tangible benefits for users, at the same time, it carries new risks that may threaten one’s financial well-being. This set of opportunities and threats (see Table 2.11) may lead to unwanted consequences, such as (1) lack of trust in DFS; (2) new types of exclusion for certain groups of the population (e.g. the elderly and those on low incomes); (3) over-indebtedness among consumers who may be vulnerable; (4) increased customer vulnerability to possible mis-selling, phishing schemes, account hacking and data theft.

Table 2.11: DFS Opportunities and threats (OECD, 2018b).

Opportunities
1. Extending the potential reach and access of financial services
1. Offering more convenient, faster, secure and timely transactions
2. Providing services that are tailored to individual needs and facilitate their usage, thus creating opportunities to develop financial literacy competencies, confidence and experience with finance
3. Increasing opportunities for fruitful interactions between financial services providers and consumers through digital interfaces
4. Broadening the range of providers

Threats

1. Market driven
 2. Regulation and supervision driven
 3. Consumer driven
 4. Technology driven
-

While DFS are acknowledged for improving the financial health and well-being of individuals by reducing barriers and simplifying access to the financial marketplace, technology is only transformative if the user has the awareness, knowledge, and skills to know how to use and apply these technologies to their advantage (Lyons & Kass-Hanna, 2021a).

2.4 Practice of DFS in Portugal

Since 2010, three surveys were conducted by Banco de Portugal (BdP)⁹ to test the levels of financial literacy across Portuguese individuals. The overall results indicate that the population groups with the best financial literacy scores are aged between 25 and 54, have secondary or higher education, are workers and live in households with a net monthly income of more than 1,000 euros. In contrast, the population groups with the lowest levels of financial literacy are the oldest and those with the lowest levels of education and income (BdP, 2021b).

Most of the respondents show evidence of reflecting over their expenses as, on average, they agree with the statement "Before buying anything, I find out if I can afford it" (4.45) and disagree with the following statements "I find it more satisfying to spend money than to save it in the long run" (2.46) and "I tend to buy things impulsively" (1.70) (BdP, 2021b).

Social security contributions are the most frequently mentioned way to finance one's retirement, as the largest share of respondents (84.5%) state that they will finance through social security contributions or another compulsory contributory scheme. Around 24% intend to use savings, 17.6% say they will continue working, 15.2% indicate that they will finance their retirement through a private retirement savings plan and 13% mention the help of their spouse or partner. These results are particularly concerning given the share of individuals who count on Social Security. Among the millennial generation, only 7.1% states to be totally or very confident on their retirement planning (BdP, 2021b). Additionally, 23.4% of the respondents use the Internet to obtain information on financial products, a higher proportion than in 2015. The use of the internet for gathering information on financial products was most mentioned by respondents aged up to 39, with higher levels of education and with higher incomes (BdP, 2021b).

⁹ 1st Financial Literacy Survey of the Portuguese Population (BdP, 2010); 2nd Financial Literacy Survey of the Portuguese Population (BdP, 2015); and 3rd Financial Literacy Survey of the Portuguese Population (BdP, 2020).

Regarding financial knowledge, less than half of the respondents correctly calculate simple interest and less than a third correctly answers the question on compound interest. Most respondents understand the concept of inflation and the relationship between return and risk of an investment. The overall indicator of financial literacy decreased (from 68.3 in 2015 to 61.7 in 2020), reflecting the decreases observed in the indicators of financial knowledge (71.4 in 2015 to 57.1 in 2020) and financial behaviour (77.8 in 2015 to 66.7 in 2020), while the financial attitudes’ indicator remained unchanged (BdP, 2021b).

The report *Inclusão Financeira e Digital e Escolha de Produtos Bancários em Portugal* (Financial and digital inclusion and banking product choice in Portugal), published by Banco de Portugal, underlines that the Portuguese have a high level of financial inclusion. This report analyses data collected in 2020 as part of the Third Survey on Financial Literacy of the Portuguese population.

In terms of digital financial inclusion, it was found that nearly half of the respondents use the digital channels (home banking or mobile app) provided by institutions to access their account and other banking products and services. Nevertheless, there are significant differences between the various age groups, e.g. 74.7% of those aged between 25 and 39 use digital channels, compared to 8.1% among respondents aged 70 or over (BdP, 2021a).

The main reasons for not using digital channels are difficulty in dealing with technology (32.1%), preference for ATMs (20.3%), followed by preference for personal contact (16.8%) and mistrust of security conditions (16%) (BdP, 2021a). Although the young (aged between 16 and 24) have a higher level of digital financial inclusion, that decreases with age, their scores in other indices such as understanding of financial concepts or savings management are lower than in other age groups (BdP, 2021a). These findings are consistent with the S&P Global FinLit Survey, where for advanced economies, financial literacy rates are lowest among the youngest and oldest adults (Figure 2.4).

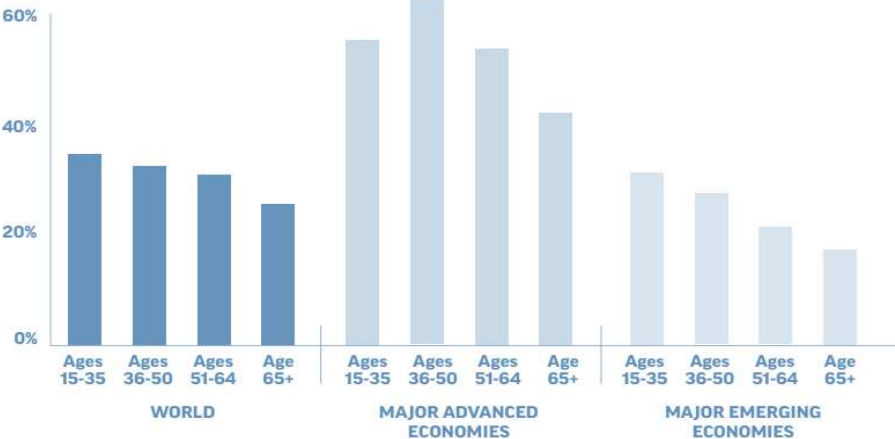


Figure 2.4: Percentage of adults who are Financially Literate. Source: S&P Global FinLit Survey

3 RESEARCH MODEL AND METHODOLOGY

The following section describes the research model of this dissertation and its methodological approach, based on the discussion presented in the previous chapter. The research problem and objectives, the model and hypotheses, the sample, the instruments used to collect the data and the process of data processing were the topics discussed.

3.1 Theoretical Framework and Hypotheses

As previously mentioned, Financial Literacy of individuals has been measured in several studies across different populations, and their results indicate low levels of financial literacy around the globe (Lusardi & Mitchell, 2011a). These findings represent an important concern to governments, as individuals are included in a context where financial products and services seem increasingly complex, while having more financial responsibilities than ever before. At the same time, the FinTech phenomenon, supported by a rapid and disruptive change in technology, has deeply affected lifestyle of individuals with the possibility of reducing barriers, thus facilitating access to financial tools and promoting financial inclusion.

That being said, understanding key aspects capable of directly impact positive financial behaviours is a strong tool to further improve individuals' financial well-being. Aiming to measure the combined impact of financial knowledge and the use of digital financial services on financial behaviours among millennials in Portugal, the following objectives were defined:

1. Characterize financial behaviours among millennials within two dimensions: short-term and long-term financial behaviours
2. Compare perceived and effective financial knowledge
3. Identify the levels of usage of digital financial instruments
4. Identify the explanatory factors of positive financial behaviours among millennials

Following the discussion presented in the previous section, financial knowledge measures one's ability to understand the financial environment and then evaluate best courses of action. Individuals with higher financial knowledge are expected to have better financial behaviours, and financial knowledge has been consistently positively associated with financial behaviours in the literature (Allgood & Walstad, 2016; Ergün, 2018; Henager & Cude, 2016a; Kim et al., 2019a; Landerretche & Martínez, 2013; Lusardi, 2008).

This study complements previous research by investigating the relationship between financial knowledge and financial behaviours within two dimensions (short-term and long-term financial behaviours), and by adding a new relevant aspect: the use of digital financial services. Hence, the following hypotheses are proposed in this dissertation:

H1: Financial knowledge is associated with positive short-term financial behaviours of millennials.

H2: Financial knowledge is associated with positive long-term financial behaviours of millennials.

H3: The use of digital financial services is associated with positive short-term financial behaviours of millennials.

H4: The use of digital financial services is associated with positive long-term financial behaviours of millennials.

Based on the information gathered from several authors and previous studies, four dimensions are considered in this dissertation as possible explanatory factors of positive financial behaviours, specifically among millennials in Portugal. The proposed research models are illustrated in Figure 3.1, and Table 3.1 presents a summary of each studied dimension and its indicators.

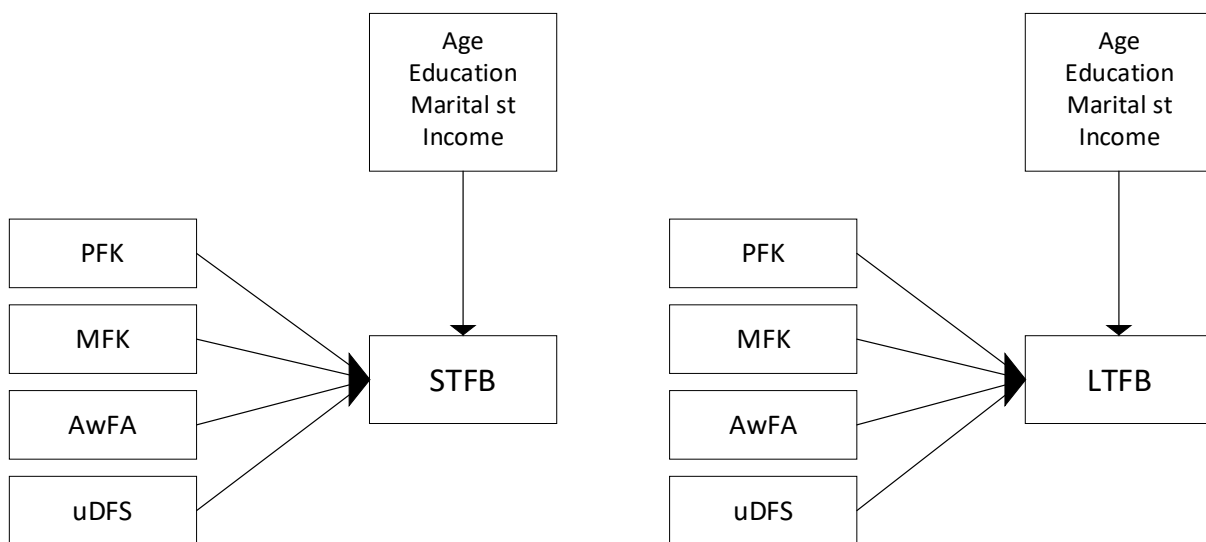


Figure 3.1: Research model

Table 3.1: Proposed research dimensions.

Dimension	Indicators	Author(s)
Short-term Financial Behaviour (STFB)	<ul style="list-style-type: none"> - Presence of an emergency fund - Spending in relation to income - Overdrawing a checking account - Use of a budget 	Henager & Cude (2016)
Long-term Financial Behaviour (LTFB)	<ul style="list-style-type: none"> - Planning the amount necessary for retirement - Ownership of retirement plans - Ownership of investments outside retirement accounts - Setting long-term financial goals 	Henager & Cude (2016)
Measured Financial Knowledge (MFK)	<ul style="list-style-type: none"> - Interest - Inflation - Bond price - Mortgage - Risk 	Lusardi and Mitchell (2011)
Perceived Financial Knowledge (PFK)	<ul style="list-style-type: none"> - Self-assessment using a Likert type scale 	Henager & Cude (2016); NFCS (2009)
Awareness of Financial Attitudes (AwFA)	<ul style="list-style-type: none"> - I find it more satisfying to spend money than to save it in the long run - Money exists to be spent - I always keep an eye on my finances - I set long-term financial goals and strive to achieve them - Before I buy something, I find out if I can afford it - I pay my bills on time - I tend to live for today and let tomorrow take care of itself 	OECD (2010)
Use of Digital Financial Services (uDFS)	<ul style="list-style-type: none"> - Digital Financing use - Digital Investments use - Digital Money use - Digital Payments use - Digital Insurance use - Digital Financial Advice use 	Yang et al. (2020); Gomber et al. (2017)

3.2 Methodology

3.2.1 Data Collection

A quantitative methodological approach was used to carry out the data analysis, and, to collect the necessary data for this research, a questionnaire was designed by the author (see Annex A) aiming to measure millennials financial behaviour and its explanatory factors. Data collection was carried out from May to August 2022, through an online survey. The target population for this study comprehends the so-called millennial generation, with ages ranging from 25 to 40 years old, and living in Portugal.

The online survey was developed in Google Forms in Portuguese language, and advertised on different social media as Facebook, Instagram, LinkedIn, and Reddit. Before filling out the survey, respondents were advised about the target ages of the study and that all questions were for academic purposes only, and that none of the provided data would be disclosed for any other reason.

The survey gathered 348 valid responses (n=348), however, due to limitations in data collection, the convenience sampling method used may not ensure the representation of the population.

3.2.2 Questionnaire

The first and second parts of the questionnaire are comprised of financial knowledge questions extensively used in the literature, aiming to measure the financial knowledge of the respondents with multiple choice factual questions, but also assessing individuals' self-perception of their own financial knowledge.

The third part consists of eight "yes or no" questions, in which respondents are asked to indicate whether they have engaged or not in each described financial behaviour, that are later used to compose two indices: short-term and long-term financial behaviours.

The fourth part of the survey intends to assess the awareness of positive financial attitudes, and respondents are asked to evaluate how much they agree or disagree with a set of financial statements related to spending, saving, and budgeting.

The following section comprehends questions related to awareness and usage of Digital Financial Services. Respondents are asked to indicate which of the presented digital financial platforms they know or have at least heard of, which they use, and at what frequency.

Additionally, a final section including a set of sociodemographic questions was included in the questionnaire. The complete set of questions is available in Annex A.

3.2.2.1 *Dependent Variables*

Short-term and long-term financial behaviours were used as dependent variables for this study and were measured via previously developed indices (Henager and Cude, 2016).

The short-term financial behaviour index (STFB) was constructed from four questions that related to the presence of an emergency fund, spending in comparison to income, overdrawing a checking account, and use of a budget. The long-term financial behaviour index (LTFB) was constructed of four questions related to planning the amount necessary for retirement, ownership of retirement plans, ownership of investments outside retirement accounts, and setting long-term financial goals.

All “yes” answers were computed as 1 and “no” as 0, except when the statement did not describe a positive behaviour towards money, and the code is reversed (see Table 3.2). Short-term and long-term financial behaviours were summed up separately, producing two scores: STFB and LTFB, respectively. Each score ranged from 0 (if the respondent has not engaged in any of the described behaviours) to 4 (when all behaviours have been performed).

Table 3.2: STFB variable with scale reversed.

Variable	Description	Score computed	
STFB3	“Do you overdraw your checking account occasionally?”	Yes	0
		No	1

Note: The summary of all questions is available in Annex A.

3.2.2.2 *Key Independent Variables*

For this analysis, the key independent variables were Perceived Financial Knowledge, Measured Financial Knowledge, Awareness of Financial Attitudes and Use of Digital Financial Services.

The Measured Financial Knowledge dimension (MFK), based on the “Big Five” designed by Lusardi & Mitchell (2011b) was computed as an overall score built by summing the five FK questions, ranging from 0 to 5.

Perceived Financial Knowledge (PFK) was assessed by a self-perception question on a Likert scale, ranging from 1 to 5, where 1 means “much lower than average” and 5 means “much above average”.

The Awareness of Financial Attitudes dimension (AwFA) was computed as the average of seven attitude statements and a higher score was given to those respondents that exhibit more positive attitudes towards the long-term and towards saving. Respondents were asked to rate, on a Likert scale ranging from 1 to 5, how much they disagree or agree with each indicator. Statements that do not stand for positive attitudes towards money had the scale reversed (see Table 3.3).

Table 3.3: AwFA variables with scale reversed.

Variable	Description	Score computed	
AwFA1	“I find it more satisfying to spend money than to save it in the long run.”	Strongly agree	1
		Agree	2
		Neither agree nor disagree	3
		Disagree	4
		Strongly disagree	5
AwFA2	“Money exists to be spent.”	Strongly agree	1
		Agree	2
		Neither agree nor disagree	3
		Disagree	4
		Strongly disagree	5
AwFA7	“I tend to live for today and let tomorrow take care of itself.”	Strongly agree	1
		Agree	2
		Neither agree nor disagree	3
		Disagree	4
		Strongly disagree	5

Note: The summary of all questions is available in Annex A.

Lastly, the Use of Digital Financial Services (uDFS) is an observed variable where respondents ranked the number of DFS they use. DFS refer to the six indicators proposed by Gomber et al. (2017): digital financing, digital investments, digital money, digital payments, digital insurance, and digital financial advice. This dimension was recoded into an ordinal variable, aiming to detect those who do not use any DFS (1), those who use one single DFS (2), and those who use more than one DFS (3).

3.2.2.3 Control Variables

As described during the Literature Review, a variety of demographic and socio-economic characteristics have been found to be associated with financial behaviours (Finke et al., 2017; Henager & Cude, 2016b; Lusardi & Mitchell, 2007). This study included the following sociodemographic control variables: age, gender, marital status, education, and household income.

Among the sociodemographic questions, a few alterations were made to simplify the inputs in the regression models. The marital status was recoded into a new binary variable to indicate whether the respondent is married, rather than the exact status (married, single, divorced/separated, widowed). Similarly, the education level (up to high school, bachelor’s degree, master’s degree, doctorate degree) was recoded to a new binary variable to report whether the respondent has any university degree. The categories of the variable income were grouped into three levels (less than 1001 €, between 1001 € and 2500 €, more than 2500 €).

Table 3.4 summarises the dependent variables, the key independent variables, and the control variables; how each score was computed; and the scale measure of each variable.

Table 3.4: Summary of variables.

Variable	How score is computed	Measure
<i>Dependent Variables</i>		
STFB	Sum of short-term financial behaviours (each short-term financial behaviour is coded individually as 1 if the behaviour is performed or 0 if not. STFB ranges from 0 [no STFB] to 4 [all 4 STFB])	Ordinal
LTFB	Sum of long-term financial behaviours (each long-term financial behaviour is coded individually as 1 if the behaviour is performed or 0 if not. LTFB ranges from 0 [no LTFB] to 4 [all 4 LTFB])	Ordinal
<i>Independent Variables</i>		
PFK	Self-perceived financial knowledge (coded 1 = Much lower than average, 2 = Below average, 3 = Equal to average, 4 = Above average, 5 = Well above average)	Numerical
MFK	Sum of the 5 FK questions (each FK questions is coded as 1 – correct answer, 0 – wrong/do not know, and MFK ranges from 0 to 5)	Numerical
AwFA	Average of 5 financial attitude questions (measured on a Likert scale as 1 = Strongly disagree, 2 = Disagree, 3 = Neither agree nor disagree, 4 = Agree, 5 = Strongly agree)	Numerical
uDFS	Number of digital financial services used by the respondent (coded 0 = no DFS is used, 1 = one DFS is used, 3 = more than one DFS is used)	Ordinal
<i>Control Variables</i>		
Age	Age of the respondent	Numerical
Gender	Gender identification (coded 0 = Male, 1 = Female)	Nominal
Married	Whether the respondent is married (coded 0 = No, 1 = Yes)	Nominal
UniDegree	Whether the respondent has completed any university degree (coded 0 = No, 1 = Yes)	Nominal
Income	Income level (1 = less than 1001€, 2 = 1001-2500€, 3 = more than 2500€)	Ordinal

Note: All nominal variables are dichotomous.

3.2.3 Data Analysis

Microsoft Excel 2010 and IBM SPSS (version 28) were used to perform the statistical analysis for this study. Specifically, the collected data were first treated and recoded in Excel, and the necessary analysis was conducted in SPSS. Excel was also used to prepare all graphs available at this dissertation.

Descriptive statistics techniques were used to characterize the data sample, and the internal consistency of the latent variables was evaluated and measured by Cronbach's Alpha and Kuder Richardson (KR-20) test to assess the reliability of each studied dimension. The syntax of the analysis conducted is provided in Annex C.

As previously detailed, the score of each dimension is the sum of all the responses composing the dimension, when the responses are collected as "Yes" or "No" (STFB, LTFB and MFK), or the result of the average of the responses collected on a Likert scale (AwFA). The reliability analysis for each dimension composed by a set of different indicators is reported in Table 3.5. Dichotomous variables were tested against the KR-20 validity test, whereas the Cronbach's alpha was calculated to measure the reliability of the Likert scale variable.

Table 3.5: Internal consistency of dimensions.

Dimension	N items	Score	Reliability test	Correlation	Scale
STFB	4	Sum (0-4)	Kuder Richardson (KR-20)	0.609	Dichotomous
LTFB	4	Sum (0-4)	Kuder Richardson (KR-20)	0.612	Dichotomous
MFK	5	Sum (0-5)	Kuder Richardson (KR-20)	0.561	Dichotomous
AwFA	7	Average (1-5)	Cronbach's Alpha	0.807	Likert

Regression models were the most used statistical methods in the studies analysed in the Systematic Literature Review, presented in the first section of this dissertation (Andreou & Anyfantaki, 2021; Hasan et al., 2021, 2022; Jünger & Mietzner, 2020; Li et al., 2020; Litterscheidt & Streich, 2020). Specifically, ordered logistic regressions¹⁰ are appropriate when the dependent variable is categorical and ordinal, and such models have been used to estimate short-term and long-term financial behaviours in previous studies (Henager & Cude, 2016b; Kim et al., 2019).

Both models aimed to predict the cumulative probability of a case being at or below a given level of financial behaviours, or above that level, based on the following key independent variables: measured financial knowledge, perceived financial knowledge, use of digital financial services, and awareness of financial attitudes.

¹⁰ Ordered logistic regression, ordered logit model or proportional odds model.

Before proceeding to the models described above, the numerical variables were converted into Z-scores¹¹. Those observations with z-scores > 3.29 or < -3.29, identified as extreme outliers (Tabachnick & Fidell, 2019) were excluded, resulting in a new total sample of 343 observations (n=343)¹².

A variance inflation factor (VIF) test was carried to check for multicollinearity in the independent variables (reported in Table 3.6). VIF values were inferior to 5 and close to 1, therefore there was no high correlation between the predictor variables and the assumption of no multicollinearity was met. Categorical variables with more than two categories (uDFS and Income) were recoded into new dummy variables specifically for the multicollinearity diagnosis.

Table 3.6: Testing for multicollinearity in the independent variables.

Variables	Collinearity Statistics	
	Tolerance	VIF
Perceived Financial Knowledge (PFK)	.663	1.509
Measured Financial Knowledge (MFK)	.580	1.724
Use of Digital Financial Services (uDFS)		
No DFS is used	.805	1.242
One DFS is used	.724	1.382
Awareness of Financial Attitudes (AwFA)	.552	1.813
Age	.779	1.283
Male	.859	1.164
Married	.775	1.290
UniDegree	.803	1.245
Income		
Income is less than 1001 €	.647	1.547
Income is between 1001 € and 2500 €	.708	1.412

Note: n=343.

For the ordered logistic regressions, the assumption of proportional odds¹³ was confirmed through the test of parallel lines, and the non-significant results suggested that the assumption of proportional odds is met in both cases (STFB and LTFB). Therefore, the effects of the independent variables on the cumulative probability of falling into a higher category does not vary across categories on the

¹¹ New variables with mean = 0 and std. deviation = 1.

¹² Observations 247, 248, 255, 312, and 316 were excluded from the analysis.

¹³ The assumption of proportional odds verifies, through the test of parallel lines, whether the effects of the predictors on the odds of falling into a higher (versus a lower) category on the dependent variable is the same across all categories.

dependent variable. The reported results (see Table 3.7) were $t(33) = 45.778$, $p=.069$ and $t(33) = 26.606$, $p=.777$, when testing for the dependent variables STFB and LTFB, respectively.

Table 3.7: Test of Parallel Lines

Dependent Variable	Model	-2 Log Likelihood	Chi-Square	df	Sig.
STFB	Null Hypothesis	690.004			
	General	644.226 ^b	45.778 ^c	33	.069
LTFB	Null Hypothesis	850.644			
	General	824.038 ^b	26.606 ^c	33	.777

The null hypothesis states that the location parameters (slope coefficients) are the same across response categories.

a. Link function: Logit.

b. The log-likelihood value cannot be further increased after maximum number of step-halving.

c. The Chi-Square statistic is computed based on the log-likelihood value of the last iteration of the general model.

4 RESULTS DISCUSSION

4.1 Sample characterization

The questionnaire has enabled to collect 348 valid responses to build the sample, reduced to 343 observations after the outlier's detection and removal. The study sampling did not need to be reduced due to age limitations, as it was designed to only accept respondents from the specific age range belonging to the Millennials' generation. It is important to underline that, due to data collection constraints, the sample is not representative of the Portuguese population.

The following aspects were selected for the sample characterization: Gender, Age, Marital status, Education and Household Income (see Table 4.1). The demographic analysis of the survey showed higher male participation (63.27%) compared with female participation (36.73%). For this research, all respondents have ages between 25 and 40 years old, and the age segment with more participation was the group of 25-29 (45.48%), followed by the age group 30-34 (29.45%) and 35-40 (25.07%).

Table 4.1: Sample characterization.

Variables	Respondents (N)	%
Gender		
Male	217	63.27
Female	126	36.73
Age		
25-29	156	45.48
30-34	101	29.45
35-40	86	25.07
Marital status		
Single	219	63.85
Married	116	33.82
Divorced/Separated	7	2.04
Widowed	1	0.29
Education		
Highschool	65	18.95
Bachelor's degree	129	37.61
Master's degree	132	38.48
PhD	17	4.96
Income		
Less than 500 €	3	0.87
Between 501 € and 1000 €	36	10.50
Between 1001 € and 2500 €	170	49.56
Between 2501 € and 3500 €	76	22.16
Between 3501 € and 5000 €	33	9.62
More than 5000 €	25	7.29

Note: n=343.

Regarding the respondents' marital status, the largest share is composed of single individuals (63.85%), followed by those who are married (33.82%), and divorced, separated, or widowed (2.33%). Considering the household monthly income, most of the participants report a family income between 1,001 € and 2,500 € (49.56%). The second larger group is integrated in a household that earns between 2,501 € and 3,500 € (22.16%), followed by the income segment between 501 € and 1,000 € (10.50%), between 3,501 € and 5,000 € (9.62%), and above 5,000 € (7.29%). Only 0.87% of the respondents have reported a household monthly income inferior to 500 €. In terms of educational background, most of the respondents holds a master's degree (38.48%), while 37.61% holds a bachelor's degree and only 4.96% holds a PhD. Among the sample, 18.95% of the respondents do not have any university degree.

4.2 Descriptive Results

Financial characteristics of millennials in the sample are presented in Table 4.2, and further descriptive information is available in Annex B. 1.

Table 4.2: Financial characteristics of millennials.

Variable	Mean (S.D.)	Yes		No	
		N	%	N	%
Short-term Financial Behaviours (0-4)	2.90 (1.168)				
Emergency funds		268	78.13	75	21.87
Spending less than income		278	81.05	65	18.95
No overdrafts		265	77.26	78	22.74
Budgeting		184	53.64	159	46.36
Long-term Financial Behaviours (0-4)	2.36 (1.274)				
Retirement planning (amount needed)		185	53.94	158	46.06
Retirement account (ownership)		136	39.65	207	60.35
Investments (ownership)		211	61.52	132	38.48
Financial goals		279	81.34	64	18.66
Measured Financial Knowledge (0-5)	3.65 (1.054)				
Interest		310	90.38	33	9.62%
Inflation		298	86.88	45	13.12%
Bond price		68	19.83	275	80.17%
Mortgage		281	81.92	62	18.08%
Risk		295	86.01	48	13.99%
Use of Digital Financial Services (0-6)	2.37 (1.116)				
Investment and savings		241	70.26	102	29.74
Financial advice		22	6.41	321	93.59
Insurance		57	16.62	286	83.38
Payments		307	89.50	36	10.50
Digital money		149	43.44	194	56.56
Loans		36	10.50	307	89.50

Variable	Mean (S.D.)
Perceived Financial Knowledge (1-5)	3.70 (0.940)
Awareness of Financial Attitudes (1-5)	3.87 (0.720)

Note: n=343.

4.2.1 Measured Financial knowledge x Perceived Financial Knowledge

As discussed in the Literature Review, a growing number of studies suggest that financial literacy plays a key role in influencing financial decision-making, and the causality goes from knowledge to behaviour (Lusardi & Mitchell, 2014).

In this dissertation, measured financial knowledge was assessed through five knowledge-based questions regarding basic financial concepts. The results show that 90.38%, 86.88%, 86.01%, 81.92%, and 19.83% of respondents have correctly answered the questions related to compound interest, inflation, risk, mortgage, and bond price, respectively. Of the five examined questions, the inverse relationship between bond prices and interest rates appears to be the concept that respondents had the most difficulty interpreting (see Figure 4.1).



Figure 4.1: Correct responses per FK question. (Source: author own elaboration)

The overall MFK score was obtained from the sum of all correctly answered questions, and among the studied sample, the average score of measured financial knowledge was 3.65 (SD=1.054), in a scale from 0 to 5. Whereas the maximum score of 5 was observed on 17.78% of the sample (61 respondents), nearly half of the respondents have correctly answered 4 out of 5 questions, and approximately a third of the sample (32.65%) got three or less questions right. The distribution of the number of correct responses is illustrated in Figure 4.2.

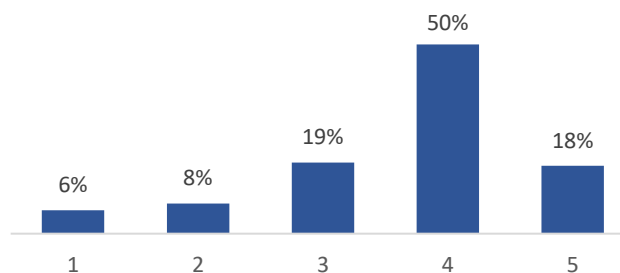


Figure 4.2: Number of correct FK responses. (Source: author own elaboration)

As discussed in the Literature Review section, many studies have opted to use subjective measures of financial knowledge to complement objective financial knowledge questions and found that perceived financial knowledge is also valuable in determining financial behaviour (Henager & Cude, 2016a). Therefore, perceived financial knowledge is not merely a proxy for actual financial knowledge, as there is often a mismatch between one's self-perceived and actual knowledge. Aiming to detect this overconfidence effect individuals tend to have regarding their own financial knowledge (Lusardi & Mitchell, 2014), an additional question asked respondents to indicate how they would assess their overall financial knowledge.

On average, respondents rated their own financial knowledge levels as 3.70 (SD=0.940), in a scale from 1 to 5. As shown in Figure 4.3, a minor percentage of respondents assess their financial knowledge level as below average (12.54%), whereas a higher share of the respondents believes to possess a level of financial knowledge above or well above average (64.14%).

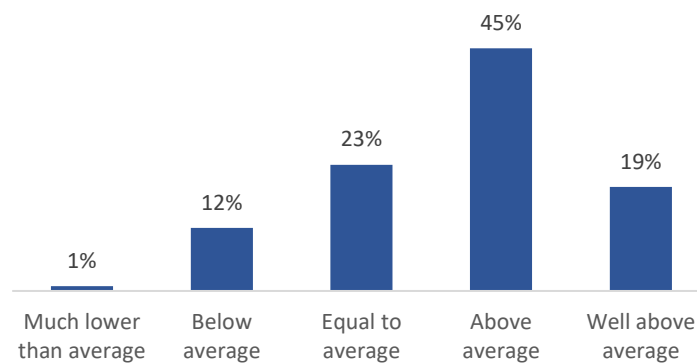


Figure 4.3: Self-evaluation of financial knowledge. (Source: author own elaboration)

The comparison between the self-rated financial knowledge and the observed level of financial knowledge is not straightforward. If we consider the median of the MFK score, more specifically, the half of the respondents who have responded less correct questions among the sample, this share would have reached 4 out of 5 questions. On the other hand, over half of the respondents have rated themselves 4 or higher in their financial knowledge level (of a 1 to 5 scale), but only around 18% of the sample could actually answer all the five questions correctly.

Therefore, the responses of both MFK and PFK were recoded into two new variables (MFK_oc and PFK_oc) and grouped within 3 categories: Low, Neutral and High (Lu, 2019; Porto & Xiao, 2016). Taking overconfidence as the positive difference between PFK and MFK, proportions of the three types of responses in terms of combined Measured-Perceived financial knowledge with an overconfidence effect are as follows: Low-Neutral (7.00%), Low-High (1.75%), and Neutral-High (9.62%). Thus, 18.37% of the surveyed sample believe to possess a level of financial knowledge higher than what was effectively observed (see Table 4.3).

Table 4.3: Proportions of respondents in terms of combined Measured-Perceived FK.

		MFK_oc					
		Low (0-2)		Neutral (3)		High (4-5)	
		N	%	N	%	N	%
PFK_oc	Low (1-2)	17	4.96	12	3.50	14	4.08
	Neutral (3)	24	7.00	20	5.83	36	10.50
	High (4-5)	6	1.75	33	9.62	181	52.77

Note: Combinations that indicate an overconfidence effect are highlighted in bold.

4.2.2 Awareness of Financial Attitudes

The data presented below reveal people’s awareness of positive attitudes. This dimension was collected through seven attitudinal statements regarding personal finances where respondents were asked to rate each indicator on a 5-point Likert scale. Figure 4.4 shows the average of each statement individually compared to this dimension’s mean value of 3.87 (SD=0.720).

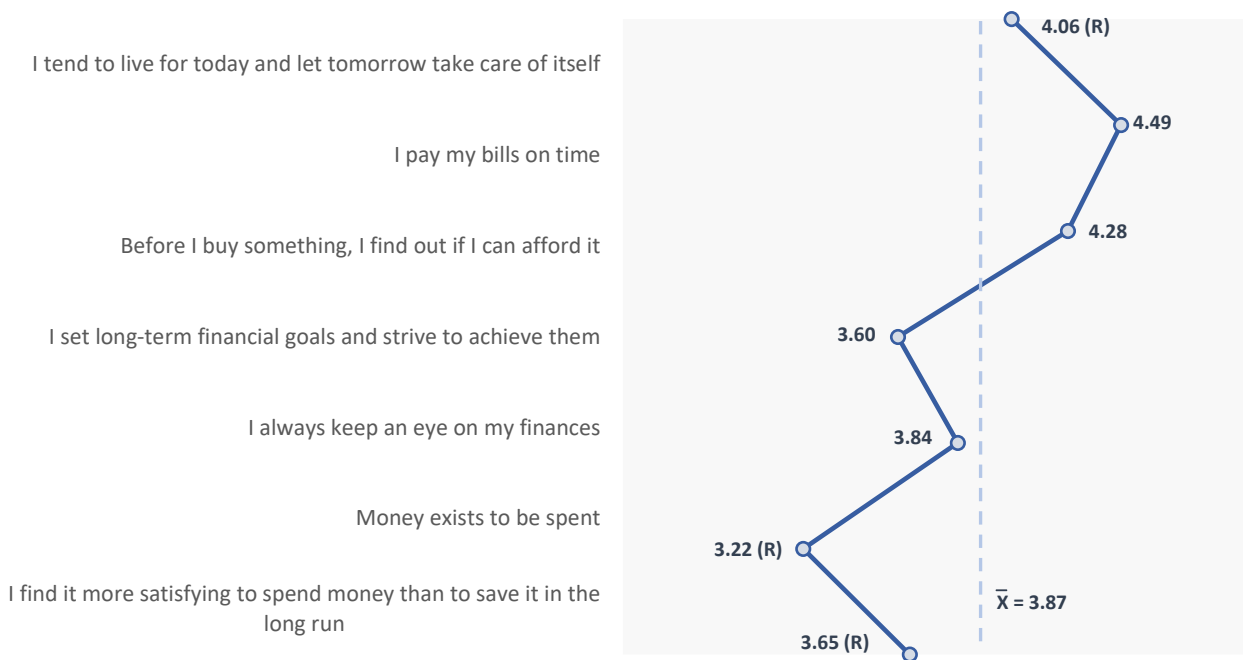


Figure 4.4: Attitudes toward financial concerns. (Source: author own elaboration)

First, the statements that represent short-sighted attitudes, as opposed to a long-term thinking, had the scale reversed so that the average score could be correctly computed. Low score values on attitudes such as “I tend to live for today and let tomorrow take care of itself”, “Money exists to be spent” and “I find it more satisfying to spend money than to save it in the long run” should actually represent positive attitudes towards money.

Paying bills on time (M=4.49, SD=0.802), checking financial capabilities before buying (M=4.28, SD=0.978), and not tending to live for today (M=4.06, SD=1.051) were the financial attitudes with which the respondents most agreed with. All three statements were reported to have a mean above the AwFA average of 3.87 (SD=0.720). Keeping an eye on your finances (M=3.84, SD=1.092), *not* finding it more satisfying to spend than save (M=3.65, SD=1.226), setting long-term goals, (M=3.60, SD=1.137), and disagreeing with money exists to be spent (M=3.22, SD=1.118) were the financial attitudes in which respondents reported to agree less, being below the AwFA average score. The distribution of responses for each indicator is presented in Annex B. 2.

4.2.3 Use of Digital Financial Services

When questioned about which digital financial services they have used in the last 12 months, most of the respondents revealed to use digital payments (89.50%), followed by investments and savings (70.26%), and digital money (43.44%). In contrast, the less utilized DFS are insurance (16.62%), loans (10.50%) and financial advice (6.41%).

Among the six Digital Financial Services proposed by Gomber et al. (2017), digital payments are the most used service by millennials in the sample. Digital Payments refer to electronic payments using traditional currencies that are issued and regulated by central banks, and this large difference in use when compared to other DFS is broadly justified by its established nature, many times produced by traditional banking. This is consistent with the BdP (2021a) report in which 74.7% of those aged between 25 and 39 use digital channels, like home banking or mobile app, provided by institutions to access their account and other banking products and services.

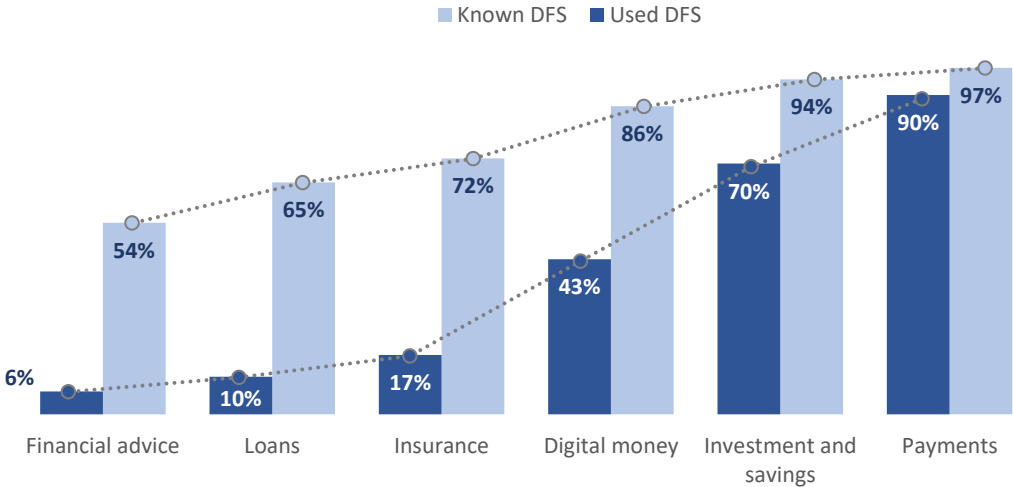


Figure 4.5: Known x used DFS. (Source: author own elaboration)

From Figure 4.5 is also possible to highlight the high awareness millennials in the sample seem to possess regarding the number of known available DFS, with all the six DFS categories being known by over half of the respondents. Nevertheless, there is a considerable large gap between knowing a DFS is available and effectively using it, mainly in financial advice, loans, insurance, and digital currencies.

In terms of number of digital financial services used, 51.60% of the respondents who less adopt DFS use up to two DFS categories. While almost 85% of the sample affirms to use between one and three DFS, only 3.50% do not use any DFS and 11.66% use four our more DFS. The most frequent scenario is that an individual uses three different digital financial services (see Figure 4.6)¹⁴. To this study, the comparison of most interest was between those who do not use DFS at all (3.50%), those who use one single DFS (20.12%), and those who rely on more than one DFS (76.38%).

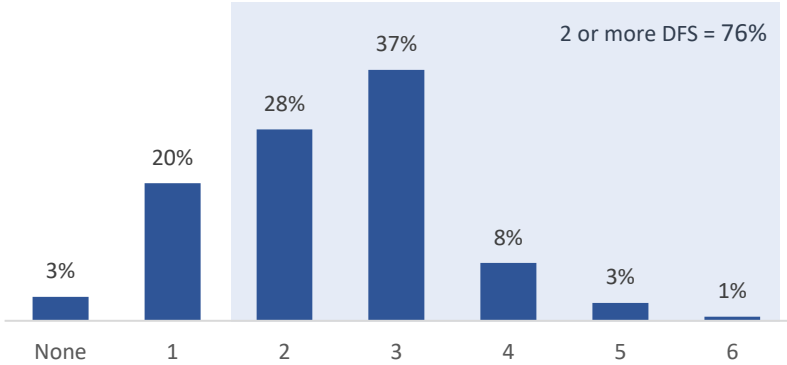


Figure 4.6: Number of used DFS. (Source: author own elaboration)

Another piece of information collected through the survey was the frequency of use of the most important digital financial service for each respondent. Figure 4.7 shows that while around 62% of respondents use at least one DFS once or more a week, approximately 24% of the sample relies on DFS on a daily basis.

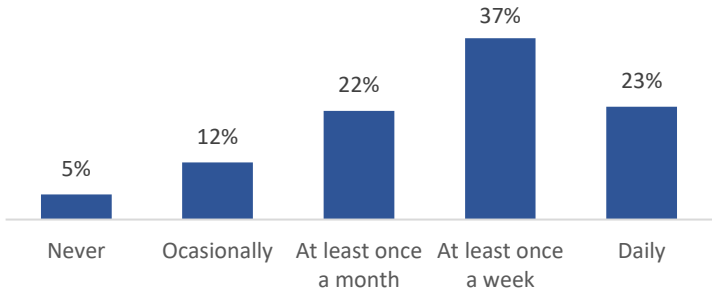


Figure 4.7: Frequency of DFS usage. (Source: author own elaboration)

¹⁴ The number of used DFS does not necessarily correspond to the number of digital platforms used, as different services may be available through the same provider. For example, an individual having one single digital account capable of processing digital payments, purchasing cryptocurrency, and investing, among other options, or even having several digital bank accounts to dispose of the same service.

4.2.4 Financial Behaviour

For the purposes of this study, the financial decision-making of millennials is analysed under two categories: short-term and long-term behaviours. The means of the composite scores of STFB and LTFB were 2.90 (SD=1.168) and 2.36 (SD=1.274), respectively. In particular, over half of the sample exhibited positive behaviours in three of the four short-term behaviours investigated: spending less than income (81.05%), having an emergency fund (78.13%), and not experiencing an overdraft (77.26%), while 53.64% kept a budget. Regarding the long-term behaviours, 75% of those with the lowest scores exhibited up to three of the four behaviours: had a plan for long-term financial goals (81.34%), owned investments outside their retirement account (61.52%), had figured out the amount needed for retirement (53.94%) and only 39.65% owned at least one retirement account (see Figure 4.8).

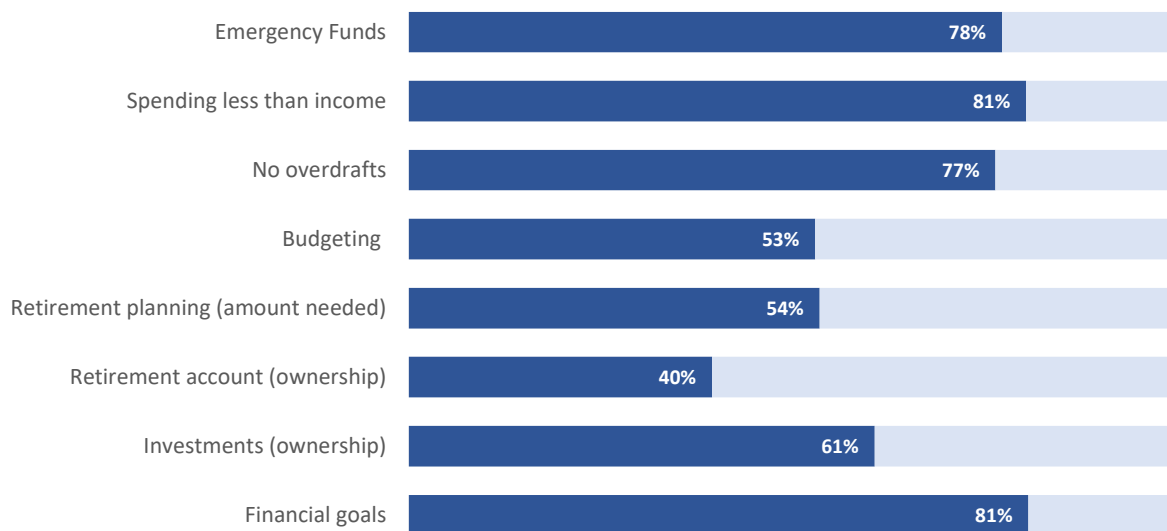


Figure 4.8: Distribution of exhibited financial behaviours. (Source: author own elaboration)

In order to understand if the averages of STFB and LTFB scores are significantly different, and to compare each of these with an overall financial behaviour dimension (FB), the Wilcoxon signed rank sum test¹⁵ was conducted to compare the means of two variables within the same group of data (see Table 4.4). The variable FB was computed as the average of STFB and LTFB, therefore equally ranging from 0 to 4. On average, the STFB score (M=2.90, SD=1.168) was higher than the LTFB score (M=2.36, SD=1.274), $t(342) = 8.358, p < .001$; and higher than the overall FB score (M=2.63, SD=1.068), $t(342) = 8.358, p < .001$. In contrast, the LTFB score was, on average, lower than the overall FB score, $t(342) = -8.358, p < .001$.

¹⁵ The Wilcoxon sign test is a statistical comparison of the average of two dependent samples, being the non-parametric alternative to the Paired Samples t-test. This test was chosen given the non-normal distribution of the dependent variables and the ordered nature of the STFB, LTFB, and FB variables.

Table 4.4: Wilcoxon Signed Ranks Test

Pair	Variables	Z	Asymp. Sig. (2-tailed)
1	STFB – LTFB	-7.704 ^a	<.001
2	STFB – FB	-7.704 ^a	<.001
3	LTFB - FB	-7.704 ^b	<.001

Note: The null hypothesis states that there is no difference between the means of the two compared groups.

- a. Based on positive ranks.
- b. Based on negative ranks.

Therefore, it was observed from the collected sample that the average score for STFB was significantly higher than the LTFB and the overall FB scores. The LTFB average score, however, was found to be lower than the overall FB score. This difference is also suggested when the highest scores are compared within both dimensions: while 36.73% of the respondents exhibited all the short-term behaviours, the same score of 4 (out of 4) for the long-term behaviours was reported by 22.45% of the sample.

As discussed in the Literature Review, a growing number of studies suggest that financial literacy plays a key role in influencing financial decision-making, and the causality goes from knowledge to behaviour (Lusardi & Mitchell, 2014). Therefore, the possible explanatory factors of financial behaviours were further detailed in the following section.

4.2.5 Ordered Logistic Regression Results

Given the ordered nature of the dependent variables STFB and LTFB, two Ordered Logistic Regressions were performed to investigate whether financial knowledge and the use of digital financial services are predictors of the level of financial behaviour of millennials in Portugal.

The -2 Log likelihoods shown in Table 4.5 indicates that the STFB model containing the full set of predictors represents a significant improvement in fit relative to the null model, $LR \chi^2(11) = 221.744$, $p < .001$. Furthermore, the model containing the full set of predictors exhibits a 23.7% improvement in fit relative to an intercept-only model¹⁶. Likewise, the LTFB model fitting is significantly better than the null model: $LR \chi^2(10) = 188.666$, $p < .001$, but with a 17.7% improvement in fit when compared to the model without predictors.

¹⁶ McFadden's Pseudo R-square represents the proportionate reduction in error of the full model containing the predictors and the null-model, and values between .2 and .4 may be viewed as being consistent with a strong improvement in model fit (Tabachnick & Fidell, 2019).

Table 4.5: Model fitting information

Dependent Variable	Model	-2 Log Likelihood	Chi-Square	df	Sig.	Pseudo R-square ^a
STFB	Intercept Only	911.747				
	Final	690.004	221.744	11	<.001	.237
LTFB	Intercept Only	1039.310				
	Final	850.644	188.666	11	<.001	.177

a. McFadden's Pseudo R-square is reported.

The results of the ordered logistic regressions, reported in Table 4.6 and further detailed in Annex B.3 and Annex B.4 revealed that financial knowledge and the use of digital financial services are related to higher odds of being in a higher level of both short-term and long-term financial behaviour indices.

Table 4.6: Ordered logistic regression results of STFB and LTFB

Variables	Short-term behaviours		Long-term behaviours	
	Odds ratio	Chi square	Odds ratio	Chi square
Perceived Financial Knowledge	2.024***	24.162	2.495***	41.364
Measured Financial Knowledge	1.357*	5.287	1.291*	4.103
uDFS (Ref: No DFS is used)				
One DFS is used	.445	1.592	.295*	4.098
One or more DFS are used	.472*	6.326	.265***	18.906
Awareness of Financial Attitudes	2.923***	26.957	1.095	.240
Age	.978	.753	.977	.834
Gender	1.216	.659	1.159	.422
Married	1.917*	6.285	1.969**	7.790
UniDegree	2.858***	12.077	.818	.511
Income (Ref: Less than 1001 €)				
Between 1001 € and 2500 €	1.206	.254	1.503	1.359
More than 2500 €	1.337	.512	2.656*	6.587

Note: n=343. *p<.05, **p<.01, ***p<.001

First, it is relevant to point out that the dependent variables are ordered in ascending fashion, i.e. with categories moving from lower (0) to higher values (4). On this basis, the estimated regression slopes can be interpreted as the predicted change in the log odds (or logits) of a case falling above a given category *j* on the dependent variable, holding the remaining predictors constant. Positive coefficients are associated with an increased likelihood of a case falling in a higher (as opposed to

lower) category, and negative coefficients are associated with a decreased likelihood of falling in a higher (as opposed to lower) category.

Measured financial knowledge was identified as a positive and significant predictor of the probability of a case falling into a higher, as opposed to lower, category on both short-term ($b=.305$, $s.e.=.1328$, $p=.021$) and long-term ($b=.255$, $s.e.=.1261$, $p=.043$) financial behaviours. Likewise, perceived financial knowledge was also a positive and significant predictor on both STFB ($b=.705$, $s.e.=.1434$, $p<.001$) and LTFB ($b=.914$, $s.e.=.1422$, $p<.001$) models. In particular, a one-unit increase in the MFK score increased the odds of a case being in a higher level of STFB by 35.7% and increased the odds of being in a higher level of LTFB by 29.1%, kept the remaining predictors constant. A one-unit increase in the PFK score increased the odds of a case being in a higher level of short-term behaviours by 102.4% and long-term behaviours by 149.5%, holding the remaining predictors constant.

A higher awareness of financial attitudes was also found to increase the odds of being in a higher level of short-term behaviours ($b=1.073$, $s.e.=.2066$, $p<.001$), but there was no significant effect on long-term behaviours ($b=.091$, $s.e.=.1859$, $p=0.624$).

Whereas age and gender were not found to be significantly associated with financial behaviours within this study sample, being married was a positive and significant predictor of the probability of an observation falling into a higher as opposed to lower category on both short-term ($b=.651$, $s.e.=.2595$, $p=.012$) and long-term ($b=.677$, $s.e.=.2427$, $p=.005$) financial behaviours. Having a university degree was a positive and significant predictor ($b=1.050$, $s.e.=.3022$, $p<.001$) in the STFB model, indicating persons with a higher level of education were more likely to fall into a higher as opposed to a lower category in terms of short-term financial behaviours. Lastly, having a monthly household income above 2,500 €, relative to an income inferior to 1,001 € ($b=-.977$, $s.e.=.3805$, $p=.010$) was found to be a positive and significant predictor of the probability of a case falling into a higher as opposed to lower category and long-term financial behaviours, holding the remaining predictors constant. This indicates that individuals with higher household incomes exhibit more positive long-term financial behaviours.

The analysis of the categorical variables uDFS and Income is similar to the other predictors, although not equal to. Using one DFS, relative to not using any DFS, was found to be a positive and significant predictor of the probability of an observation falling into a higher as opposed to lower category on both short-term ($b=.752$, $s.e.=.2988$, $p=.012$) and long-term ($b=.108$, $s.e.=.5880$, $p=.043$) financial behaviours. While using more than one DFS, in comparison to not using any, was only a significant predictor ($b=1.221$, $s.e.=.6032$, $p<.001$) on the LTFB model. However, the overall effect of the categorical variables with more than two categories is retrieved from the Tests of Model Effects, and as reported in Table 4.7, the use of digital financial services was a significant predictor of better short-term financial behaviours: $t(2) = 6831$, $p=.033$, and long-term financial behaviours: $t(2) = 19.461$, $p<.001$.

Likewise, the overall effect of income on STFB: $t(2) = .504, p=.777$ and LTFB: $t(2) = 8.558, p=.014$ was not identified as a statistically significant predictor of better financial behaviours of millennials within the sample.

Table 4.7: Tests of Model Effects.

Variables	Short-term behaviours			Long-term behaviours		
	Chi square	df	Sig	Chi square	df	Sig
PKF	24.162	1	<.001	41.364	1	<.001
MFK	5.287	1	.021	4.103	1	.043
uDFS	6.831	2	.033	19.461	2	<.001
AwFA	26.957	1	<.001	.240	1	.624
Age	.753	1	.385	.834	1	.361
Gender	.659	1	.417	.422	1	.516
Married	6.285	1	.012	7.790	1	.005
UniDegree	12.077	1	<.001	.511	1	.475
Income	.504	2	.777	8.558	2	.014

4.3 Summary of results

Following the presented throughout this chapter, this section summarises the results obtained and its main findings.

Based on the Chi square tests and the significant p-values ($p<.05$) of the logistic regressions reported in Table 4.6, the validation of each proposed hypotheses on this study is reported below (see Table 4.8). Both self-perceived and objectively measured financial knowledge were found to be positive and significant predictors of positive short-term and long-term financial behaviours of millennials, therefore hypotheses 1 and 2 were accepted.

Table 4.8: Validation of research hypotheses.

Hypothesis	Significance	Decision
<i>H1</i> FK is associated with positive STFB	PFK: <.001, MFK: .021	Accepted
<i>H2</i> FK is associated with positive LTFB	PFK: <.001, MFK: .043	Accepted
<i>H3</i> uDFS is associated with positive STFB	.033	Accepted
<i>H4</i> uDFS is associated with positive LTFB	<.001	Accepted

Taking the Chi square test reported in Table 4.7, the overall effect of the use of digital financial services was equally found to be a positive and significant predictor of higher levels of short-term and long-term financial behaviours: $t(2) = 6.831$, $p=.033$ and $t(2) = 19.461$, $p<.001$, respectively. Thus, considering the overall effect of DFS, rather than each category individually, hypotheses 3 and 4 were accepted.

The results obtained suggest that higher levels of financial knowledge are important predictors of better financial behaviours, but so is subjective knowledge. Both are positively related to better short-term and long-term financial behaviours among the millennials in the sample. These findings are in line with the discussed during the Literature Review, as previous studies have come to associate both measured and perceived financial knowledge with positive financial behaviours (Allgood & Walstad, 2016; Henager & Cude, 2016; Kim et al., 2019a; Hauff et al., 2020).

In addition to that, it was observed a mismatch between individual's measured knowledge and their self-assessment of their own knowledge, which was identified as an overconfidence effect, as suggested by different authors (Lusardi & Mitchell, 2014; Xia et al., 2014; Porto & Xiao, 2016). Within the studied sample, it was observed that nearly 20% of the respondents believe to possess a level of financial knowledge higher than what was effectively observed.

Furthermore, the awareness of positive financial attitudes was also identified as a positive and significant predictor of better short-term behaviours. Whilst authors have not attempted to associate awareness of better attitudes towards money specifically with short- and long-term behaviours, previous studies suggested this construct is positively associated with better financial management behaviour among millennials (Dewi et al., 2020), and that negative attitude towards money is significantly associated with poor financial decision-making among young people (Heuberger et al., 2018).

Finally, it is relevant to highlight that, within the studied sample, millennials' long-term financial behaviours were lower than the short-term ones. While 37% of the respondents exhibited all the short-term behaviours, the same score (4 out of 4) for the long-term behaviours was reported by less than 23% of the respondents. This is particularly concerning given that this cohort will face less optimal conditions in retirement than previous generations, in a way that individuals must save to ensure their own financial security on retirement (Bottazzi & Lusardi, 2021).

5 CONCLUSIONS

The final chapter of this dissertation includes a summary of the research, its main findings, the limitations of the study, contributions and possible recommendations for future research.

5.1 Main conclusions

This dissertation investigated the impact of financial knowledge and the use of digital financial services on financial behaviours of millennials in Portugal. It complements previous research by analysing this relationship within two dimensions (short-term and long-term financial behaviours), and by adding a new relevant aspect: the use of digital financial services.

For a better development of the proposed objectives, a thorough Literature Review was conducted, and a quantitative methodological approach was chosen to carry out the data analysis. Primary data were collected through an online questionnaire designed by the author, targeting those aged between 25 and 40 years old. The survey gathered 348 valid responses, of which 5 outliers were excluded, resulting in a sample comprised of 343 observations.

For this analysis, having emergency funds, spending less than income, not experiencing an overdraft, and budgeting for saving and spending were considered positive short-term behaviours. The long-term financial behaviours used were knowing the amount needed for retirement, owning at least one retirement account, owning investments outside one's retirement account, and having a plan for long-term financial goals. The mean score of STFB was found to be significantly higher than the mean LTFB score and the mean score of overall FB. Therefore, millennials in the sample exhibit more positive short-term financial behaviours than those related to planning for the future. A growing number of studies suggest how unprepared millennials are for retirement, especially when compared to previous generations. This is particularly concerning in the current scenario, where financial products and the financial environment have become increasingly complex.

Financial knowledge, in turn, has been consistently linked to positive financial behaviours (Allgood & Walstad, 2016; Ergün, 2018; Henager & Cude, 2016a; Kim et al., 2019a; Landerretche & Martínez, 2013; Lusardi, 2008). Aiming to detect a possible overconfidence effect individuals may have regarding their own financial knowledge (Lusardi & Mitchell, 2014), and taking overconfidence as the positive difference between perceived and measured financial knowledge, it was possible to observe from the sample that while more than half of the respondents believes to possess a level of financial knowledge above or well above average, an overconfidence effect was identified in nearly 20% of the respondents.

Regarding the use of digital financial services, digital payments were the most used service by millennials in the sample, mainly due to established banks that offer digital channels. It was also observed that more than 75% of the respondents use two or more DFS, and the COVID-19 outbreak may have been a huge contributor as it has pushed companies towards technology, forcing them to adapt to a new reality.

Aiming to identify the explanatory factors of positive financial behaviours among millennials, two ordered logistic regressions were performed, and the presented results revealed that both financial knowledge and the use of digital financial services are related to higher odds of an individual being in a higher level of both short-term and long-term financial behaviour indices.

As the main findings of this research, it was observed that financial knowledge, both measured and self-perceived, and the use of digital financial services were positive and significant predictors of short-term and long-term financial behaviours of millennials within the sample.

5.2 Study limitations

The first identified limitation in this dissertation was the lack of a well-defined and standardised approach when measuring each of the studied dimensions within the broader area of financial literacy. Despite being an extensively explored area of study, especially when it comes to financial behaviours, financial well-being and financial inclusion, the inexistence of an instrument that measures financial literacy makes the comparison between results from different studies challenging, as questions across different surveys vary widely. Having said that, the limited research available regarding digital financial services and their implication on one's financial decision-making, as much as the lack of a structured methodology to measure it, represents an equally challenging aspect of this study.

Another potential concern is regarding the available methods of data collection. Implementing a questionnaire to collect primary data, although very enriching, relies heavily on individuals' willingness to respond, and the sample size will hardly correspond to the desired number of responses. Additionally, by advertising the survey on social networks, data collection is not entirely random and responses may be biased, so the sample is unlikely to be representative of the population. Similarly, the collected data may also have a different distribution from the one found in the population, such as gender, age groups and other sociodemographic indicators.

5.3 Contributions

Based on the conclusions outlined above, policy interventions focusing on improving financial knowledge would be highly relevant in leading to better financial behaviours among millennials. The inclusion of financial education in the school education system is crucial for the next generations, but for millennials it would be of great importance to receive this support in financial education through the workplace, mainly targeting the relevance of positive long-term financial behaviours. Likewise, it would also be important to raise awareness about the opportunities and threats of digital financial services.

Another contribution of this dissertation is based on the noticed gap between millennials' awareness of available digital financial services and the actual use of such tools. This finding is relevant for companies, that could further understand why this gap exists and how to change it, converting awareness into use.

5.4 Future research

The importance of financial knowledge on those attitudes that are understood as positive financial behaviours has been extensively addressed in the literature. This dissertation discusses this topic and incorporates the role that the use of digital financial services may have on millennial's financial behaviour.

Given millennials are part of a tech-savvy generation that constitutes a large share of the world workforce today, future studies could expand this research to include the relatively new concept of Digital Financial Literacy. Research on this matter is still scarce, and the measure of DFL is hardly found in the literature.

Furthermore, for future studies on this topic, it would be relevant to gather data on other generation cohorts, such as Generation Z. The generational study is particularly important when digital literacy is considered, as the access to digital technology varies widely between these groups and the ease of use of such technologies can directly impact financial behaviour, financial well-being, and financial inclusion.

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ANNEXES

Annex A: Questionnaire

Variable	Description	Score computed	
<i>Section 1 - Perceived Financial Knowledge (Q01)</i>			
PFK	“On a scale from 1 to 7, where 1 means very low and 5 means very high, how would you assess your overall financial knowledge?”	1-5	1-5
<i>Section 2 - Measured Financial Knowledge (Q02-Q06)</i>			
MFK1	“Suppose you had \$100 in a savings account and the interest rate was 2% per year. After 5 years, how much do you think you would have in the account if you left the money to grow?”	More than \$102 Exactly \$102 Less than \$102 Do Not Know	1 0 0 0
MFK2	“Imagine that the interest rate on your savings account was 1% per year and inflation was 2% per year. After 1 year, how much would you be able to buy with the money in this account?”	More than today Exactly the same Less than today Do Not Know	0 0 1 0
MFK3	“If interest rates rise, what will typically happen to bond prices?”	They will rise They will fall They will stay the same There is no relationship Do Not Know	0 1 0 0 0
MFK4	“A 15-year mortgage typically requires higher monthly payments than a 30-year mortgage, but the total interest paid over the life of the loan will be less.”	True False Do Not Know	1 0 0
MFK5	“Buying a single company’s stock usually provides a safer return than a stock mutual fund.”	True False Do Not Know	0 1 0
<i>Section 3.1 - Short-term financial behaviours (Q07-Q10)</i>			
STFB1	“Have you set aside emergency or rainy-day funds that would cover your expenses for 3 months, in case of sickness, job loss, economic downturn, or other emergencies?”	Yes No	1 0
STFB2	“Over the past year, would you say your spending was less than, more than, or about equal to your income? (Please do not include the purchase of a new house or car, or other big investments you may have made)”	Yes No	1 0
STFB3	“Do you overdraw your checking account occasionally?”	Yes No	1 0
STFB4	“Does your household have a budget? A household budget is used to decide what share of your household income will be used for spending, saving or paying bills.”	Yes No	1 0

Section 3.2 - Long-term financial behaviours (Q11-Q14)

LTFB1	“Have you ever tried to figure out how much you need to save for retirement?”	Yes	1
		No	0
LTFB2	“Do you have any retirement accounts through an employer or not, such as a pension plan or a PPR?”	Yes	1
		No	0
LTFB3	“Not including retirement accounts, do you have any investments in stocks, bonds, mutual funds, or other securities?”	Yes	1
		No	0
LTFB4	“Do you seek to set long-term financial goals?”	Yes	1
		No	0

Section 4 - Awareness of Financial Attitudes (Q15-Q21)

AwFA1	“I find it more satisfying to spend money than to save it in the long run.”	Strongly agree	1
		Agree	2
		Neither agree nor disagree	3
		Disagree	4
		Strongly disagree	5
AwFA2	“Money exists to be spent.”	Strongly agree	1
		Agree	2
		Neither agree nor disagree	3
		Disagree	4
		Strongly disagree	5
AwFA3	“I always keep an eye on my finances.”	Strongly agree	5
		Agree	4
		Neither agree nor disagree	3
		Disagree	2
		Strongly disagree	1
AwFA4	“I set long-term financial goals and strive to achieve them.”	Strongly agree	5
		Agree	4
		Neither agree nor disagree	3
		Disagree	2
		Strongly disagree	1
AwFA5	“Before I buy something, I find out if I can afford it.”	Strongly agree	5
		Agree	4
		Neither agree nor disagree	3
		Disagree	2
		Strongly disagree	1
AwFA6	“I pay my bills on time.”	Strongly agree	5
		Agree	4
		Neither agree nor disagree	3
		Disagree	2
		Strongly disagree	1
AwFA7	“I tend to live for today and let tomorrow take care of itself.”	Strongly agree	1
		Agree	2
		Neither agree nor disagree	3
		Disagree	4
		Strongly disagree	5

Section 5 - Digital Financial Services (Q22-Q25)

uDFS1	“Which of the platforms listed below, do you know or have you heard of?”	ActivoBank Coinbase Degiro eToro MbWay Moey	N26 OpenBank Revolut Trading 212 XTB Wise
uDFS2	“Which items from the list below do you believe can be carried out through digital accounts and/or online platforms?”		Investments Financial advice Insurance Payments Savings Purchase of digital currencies Loans None
uDFS3	“In the last 12 months, have you used an online platform or digital account to do any of the following?”	To make investments and/or savings To obtain financial advice To take out insurance (health, life or car insurance) To make payments To acquire digital currencies To obtain mortgage or other credit (car, personal, etc)	
uDFS4	“Among the services listed above, how often do you use the one that is most important to you?”		Daily At least once a week At least once a month Once every two or three months Occasionally I do not use any of them

Section 6 – Sociodemographics (Q26-Q30)

Age	“What is your age?”		-
Gender	“What is your gender?”		Female Male
Education	“Which is higher your educational level?”		Up to high school Bachelor’s degree Master’s degree Doctorate degree
Marital status	“Which option describes your marital status?”		Married Single Separated/divorced Widowed
Income	“On average, which of these describe the net monthly income of your household?”		Up to 501 € Between 501 € and 1,000 € Between 1,001 € and 2,500 € Between 2,501 € and 3,500 € Between 3,501 € and 5,000 € More than 5,000 €

Annex B: Descriptive Statistics

Annex B. 1: Descriptive statistics.

		STFB	LTFB	MFK	PFK	AwFA	uDFS_sc ^b	MFK_over	PFK_over
N	Valid	343	343	343	343	343	343	343	343
	Missing	0	0	0	0	0	0	0	0
Mean		2.901	2.364	3.650	3.700	3.877	2.367	.536	.516
Median		3	3	4	4	4	2	1	1
Std. Deviation		1.168	1.274	1.054	.940	.720	1.116	.724	.708
Minimum		0	0	1 ^a	1	1.43	0	-1	-1
Maximum		4	4	5	5	5	6	1	1
Percentiles	25	2	1	3	3	3.57	2	0	0
	50	3	3	4	4	4.00	2	1	1
	75	4	3	4	4	4.29	3	1	1

Note: n=343.

a. Observations where MFK = 0 were excluded as they were severe outliers.

b. Considering uDFS as a scale variable ranging from 0 to 6.

Annex B. 2: Distribution of AwFA responses.

	Mean (SD)	Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree
		%	%	%	%	%
I tend to live for today and let tomorrow take care of itself	4.06 (1.051)	42.86	32.07	15.74	6.41	2.92
I pay my bills on time	4.49 (0.802)	0.29	3.79	6.41	25.36	64.14
Before I buy something, I find out if I can afford it	4.28 (0.978)	1.46	6.71	8.75	28.57	54.52
I set long-term financial goals and strive to achieve them	3.60 (1.137)	5.54	11.95	23.32	35.28	23.91
I always keep an eye on my finances	3.84 (1.092)	3.21	10.50	18.08	35.57	32.65
Money exists to be spent	3.22 (1.118)	13.41	28.28	32.65	18.37	7.29
I find it more satisfying to spend money than to save it in the long run	3.65 (1.226)	28.57	34.11	19.24	9.62	8.45

Note: n=343.

Annex B. 3: STFB ordered logistic regression results.

Parameter Estimates

Parameter	B	Std. Error	95% Wald Confidence Interval		Hypothesis Test			Exp(B)	95% Wald Confidence Interval for Exp(B)		
			Lower	Upper	Wald	df	Sig.		Lower	Upper	
Threshold	[STFB=0]	4.760	1.2918	2.228	7.292	13.578	1	<.001	116.764	9.283	1468.662
	[STFB=1]	6.313	1.3233	3.719	8.907	22.758	1	<.001	551.757	41.240	7382.076
	[STFB=2]	7.792	1.3551	5.136	10.448	33.068	1	<.001	2421.727	170.095	34479.276
	[STFB=3]	10.172	1.3925	7.443	12.901	53.364	1	<.001	26160.482	1707.569	400786.665
PFK	.705	.1434	.424	.986	24.162	1	<.001	2.024	1.528	2.681	
MFK	.305	.1328	.045	.566	5.287	1	.021	1.357	1.046	1.761	
[uDFS=2]	.809	.6410	.247	2.065	1.592	1	.207	.472	.139	2.887	
[uDFS=1]	.752	.2988	.203	1.317	6.326	1	.012	.445	.230	2.734	
[uDFS=0]	0 ^a	.	.	.	.	.	.	1	.	.
AwFA	1.073	.2066	.668	1.477	26.957	1	<.001	2.923	1.950	4.382	
Age	-.023	.0261	-.074	.029	.753	1	.385	.978	.929	1.029	
Gender	.196	.2414	-.277	.669	.659	1	.417	1.216	.758	1.952	
Married	.651	.2595	.142	1.159	6.285	1	.012	1.917	1.153	3.188	
UniDegree	1.050	.3022	.458	1.643	12.077	1	<.001	2.858	1.581	5.169	
[Income=3]	.286	.4092	-.516	1.088	.490	1	.484	1.332	.597	2.970	
[Income=2]	.183	.3754	-.553	.918	.236	1	.627	1.200	.575	2.505	
[Income=1]	0 ^a	.	.	.	.	.	.	1	.	.
(Scale)	1 ^b										

Note: n=343.

Dependent Variable: STFB

Model: (Threshold), PFK, MFK, uDFS, AwFA, Age, Gender, Married, UniDegree, Income

- a. Set to zero because this parameter is redundant.
- b. Fixed at the displayed value.

Annex B. 4: LTFB ordered logistic regression results.

Parameter Estimates

Parameter	B	Std. Error	95% Wald Confidence Interval		Hypothesis Test			Exp(B)	95% Wald Confidence Interval for Exp(B)		
			Lower	Upper	Wald	df	Sig.		Lower	Upper	
Threshold	[STFB=0]	2.265	1.2214	-.128	4.659	3.440	1	.064	9.635	.879	105.554
	[STFB=1]	4.314	1.2357	1.892	6.736	12.190	1	<.001	74.764	6.636	842.390
	[STFB=2]	5.600	1.2524	3.145	8.055	19.993	1	<.001	270.423	23.226	3148.556
	[STFB=3]	7.398	1.2759	4.897	9.899	33.616	1	<.001	1632.394	133.891	19902.141
PFK	.914	.1422	.636	1.193	41.364	1	<.001	2.495	1.888	3.297	
MFK	.255	.1261	.008	.503	4.103	1	.043	1.291	1.008	1.653	
[uDFS=2]	1.221	.6032	.039	2.403	18.906	1	<.001	.265	.145	.482	
[uDFS=1]	.108	.5880	.060	.145	.034	1	.043	.295	.284	1.843	
[uDFS=0]	0 ^a	0 ^a	.	.	.	.	.	1	.	.
AwFA	.091	.1859	-.273	.456	.240	1	.624	1.095	.761	1.577	
Age	-.023	.0255	-.073	.027	.834	1	.361	.977	.929	1.027	
Gender	.148	.2276	-.298	.594	.422	1	.516	1.159	.742	1.811	
Married	.677	.2427	.202	1.153	7.790	1	.005	1.969	1.224	3.168	
UniDegree	-.201	.2811	-.752	.350	.511	1	.475	.818	.471	1.419	
[Income=3]	.977	.3805	.231	1.722	6.587	1	.010	2.656	1.260	5.598	
[Income=2]	.408	.3497	-.278	1.093	1.359	1	.244	1.503	.757	2.984	
[Income=1]	0 ^a	.	.	.	.	.	.	1	.	.
(Scale)	1 ^b										

Note: n=343.

Dependent Variable: LTFB

Model: (Threshold), PFK, MFK, uDFS, AwFA, Age, Gender, Married, UniDegree, Income

- a. Set to zero because this parameter is redundant.
- b. Fixed at the displayed value.

Annex C: Analysis Syntax

The syntax used for data analysis is specified below.

*Descriptive statistics: Sociodemographic.

```
FREQUENCIES VARIABLES=gender edu mar inc age_group
/NTILES=4
/STATISTICS=STDDEV VARIANCE MINIMUM MAXIMUM MEAN MEDIAN MODE SKEWNESS SESKEW KURTOSIS SEKURT
/ARCHART FREQ
/ORDER=ANALYSIS.
OUTPUT MODIFY
/SELECT TABLES
/IF COMMANDS=["Frequencies(LAST)"] SUBTYPES="Frequencies"
/TABLECELLS SELECT=[VALIDPERCENT CUMULATIVEPERCENT] APPLYTO=COLUMN HIDE=YES
/TABLECELLS SELECT=[TOTAL] SELECTCONDITION=PARENT(VALID MISSING) APPLYTO=ROW HIDE=YES
/TABLECELLS SELECT=[VALID] APPLYTO=ROWHEADER UNGROUP=YES
/TABLECELLS SELECT=[PERCENT] SELECTDIMENSION=COLUMNS FORMAT="PCT" APPLYTO=COLUMN
/TABLECELLS SELECT=[COUNT] APPLYTO=COLUMNHEADER REPLACE="N"
/TABLECELLS SELECT=[PERCENT] APPLYTO=COLUMNHEADER REPLACE="%".
```

*Descriptive statistics: Variables.

```
FREQUENCIES VARIABLES=STFB LTFB MFK PFK AwFA uDFS_sc PFK_over MFK_over
/NTILES=4
/PERCENTILES=60.0 70.0 80.0
/STATISTICS=STDDEV MINIMUM MAXIMUM MEAN MEDIAN
/ARCHART FREQ
/ORDER=ANALYSIS.
```

*Reliability Analysis: STFB.

```
RELIABILITY
/VARIABLES=FB_EmergFunds FB_Spending
FB_NoOverdraft FB_Budgeting
/SCALE('ALL VARIABLES') ALL
/MODEL=ALPHA
/STATISTICS=DESCRIPTIVE SCALE CORR
/SUMMARY=TOTAL MEANS.
```

*Reliability Analysis: FK.

```
RELIABILITY
/VARIABLES=FK_Interest FK_Inflation FK_Bonds
FK_Mortgage FK_Risk
/SCALE('ALL VARIABLES') ALL
/MODEL=ALPHA
/STATISTICS=DESCRIPTIVE SCALE CORR
/SUMMARY=TOTAL MEANS.
```

*Reliability Analysis: LTFB.

```
RELIABILITY
/VARIABLES=FB_RetPlan FB_RetAcc FB_Invest
FB_FinGoals
/SCALE('ALL VARIABLES') ALL
/MODEL=ALPHA
/STATISTICS=DESCRIPTIVE SCALE CORR
/SUMMARY=TOTAL MEANS.
```

*Reliability Analysis: AwFA.

```
RELIABILITY
/VARIABLES=AwFA1_R AwFA2_R AwFA3 AwFA4 AwFA5
AwFA6 AwFA7_R
/SCALE('ALL VARIABLES') ALL
/MODEL=ALPHA
/STATISTICS=DESCRIPTIVE SCALE CORR
/SUMMARY=TOTAL.
```

* Wilcoxon sign test.

```
NPAR TESTS
/WILCOXON=STFB STFB LTFB WITH LTFB FB FB (PAIRED)
/MISSING ANALYSIS.
```

*Multicollinearity VIF test.

```
REGRESSION  
/MISSING LISTWISE  
/STATISTICS COEFF OUTS R ANOVA COLLIN TOL  
/CRITERIA=PIN(.05) POUT(.10)  
/NOORIGIN  
/DEPENDENT STFB  
/METHOD=ENTER PFK MFK uDFS_0 uDFS_1 AwFA Age Male Married UniDegree Inc_less1001 Inc_1001_2500.
```

*Ordered Logistic Regression: STFB (Test of Parallel Lines).

```
PLUM STFB BY Income uDFS WITH PFK MFK AwFA Age  
Male Married UniDegree  
/CRITERIA=CIN(95) DELTA(0) LCONVERGE(0)  
MXITER(100) MXSTEP(5) PCONVERGE(1.0E-6)  
SINGULAR(1.0E-8)  
/LINK=LOGIT  
/PRINT=FIT PARAMETER SUMMARY TPARALLEL.
```

*Ordered Logistic Regression: LTFB (Test of Parallel Lines).

```
PLUM LTFB BY Income uDFS WITH PFK MFK AwFA Age  
Male Married UniDegree  
/CRITERIA=CIN(95) DELTA(0) LCONVERGE(0)  
MXITER(100) MXSTEP(5) PCONVERGE(1.0E-6)  
SINGULAR(1.0E-8)  
/LINK=LOGIT  
/PRINT=FIT PARAMETER SUMMARY TPARALLEL.
```

* Generalized Linear Models (Ordered Logistic Regression: STFB).

```
GENLIN STFB (ORDER=ASCENDING) BY Income uDFS  
(ORDER=DESCENDING) WITH PFK MFK AwFA Age Gender  
Married  
UniDegree  
/MODEL PFK MFK uDFS AwFA Age Gender Married  
UniDegree Income  
DISTRIBUTION=MULTINOMIAL LINK=CUMLOGIT  
/CRITERIA METHOD=FISHER(1) SCALE=1 COVB=MODEL  
MAXITERATIONS=100 MAXSTEPHALVING=5  
PCONVERGE=1E-006(ABSOLUTE) SINGULAR=1E-012  
ANALYSISTYPE=3(WALD) CILEVEL=95 CITYPE=WALD  
LIKELIHOOD=FULL  
/MISSING CLASSMISSING=EXCLUDE  
/PRINT CPS DESCRIPTIVES MODELINFO FIT SUMMARY  
SOLUTION (EXPONENTIATED).
```

* Generalized Linear Models (Ordered Logistic Regression: LTFB).

```
GENLIN LTFB (ORDER=ASCENDING) BY Income uDFS  
(ORDER=DESCENDING) WITH PFK MFK AwFA Age Gender  
Married  
UniDegree  
/MODEL PFK MFK uDFS AwFA Age Gender Married  
UniDegree Income  
DISTRIBUTION=MULTINOMIAL LINK=CUMLOGIT  
/CRITERIA METHOD=FISHER(1) SCALE=1 COVB=MODEL  
MAXITERATIONS=100 MAXSTEPHALVING=5  
PCONVERGE=1E-006(ABSOLUTE) SINGULAR=1E-012  
ANALYSISTYPE=3(WALD) CILEVEL=95 CITYPE=WALD  
LIKELIHOOD=FULL  
/MISSING CLASSMISSING=EXCLUDE  
/PRINT CPS DESCRIPTIVES MODELINFO FIT SUMMARY  
SOLUTION (EXPONENTIATED).
```

* Custom Tables – FB (syntax used for various dimensions).

```
CTABLES  
/VLABELS VARIABLES=FB_EmergFunds FB_Spending FB_NoOverdraft FB_Budgeting FB_RetPlan FB_RetAcc FB_Invest  
FB_FinGoals DISPLAY=LABEL  
/TABLE FB_EmergFunds [COUNT F40.0, ROWPCT.COUNT PCT40.1] + FB_Spending [COUNT F40.0, ROWPCT.COUNT  
PCT40.1] +  
FB_NoOverdraft [COUNT F40.0, ROWPCT.COUNT PCT40.1] + FB_Budgeting [COUNT F40.0, ROWPCT.COUNT PCT40.1] +  
FB_RetPlan  
[COUNT F40.0, ROWPCT.COUNT PCT40.1] + FB_RetAcc [COUNT F40.0, ROWPCT.COUNT PCT40.1] + FB_Invest  
[COUNT F40.0, ROWPCT.COUNT PCT40.1] + FB_FinGoals [COUNT F40.0, ROWPCT.COUNT PCT40.1]  
/CLABELS ROWLABELS=OPPOSITE  
/CATEGORIES VARIABLES=FB_EmergFunds FB_Spending FB_NoOverdraft FB_Budgeting FB_RetPlan FB_RetAcc FB_Invest  
FB_FinGoals ORDER=A KEY=VALUE EMPTY=EXCLUDE  
/CRITERIA CILEVEL=95.
```