A study of the impact of financial literacy in determining the outcome of individuals' financial well-being.

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Dissertation submitted in partial fulfilment of requirements for the MSc in Management with Specialization in Strategy and Entrepreneurship, at the Universidade Católica Portuguesa, May 2024.

Abstract

Financial well-being is still a relatively new term in academia. The present dissertation intends to explore the impact of financial literacy in the outcome of individuals financial well-being. Through a concise review of literature regarding financial well-being, financial health, financial literacy, and financial capabilities, the main drivers of financial well-being were formulated. The dissertation goal is to explore the relationship between financial well-being and financial literature, as well as to deliver an algorithm model that allows Doutor Finanças to cluster customers into different financial well-being profiles. To test the and build such hypothesis, a quantitative survey was designed to collect the relevant data regarding the determinants of financial well-being. As such, the survey collected data regarding the respondent's financial situation, their financial behaviors, their financial literacy and knowledge, and their sociodemographic details. Based on 236 valid responses, a K-Means clustering model was applied to enable the creation of different groups of respondents with similar characteristics within each cluster group. Considering each cluster as a different financial well-being profile, it was then tested the impact of the financial literacy results in determining the financial well-being outcome of each respondent. The results of the study confirmed that the financial literacy of respondents significantly impacts the financial well-being outcomes.

Keywords: Financial well-being; financial health; financial literacy; financial knowledge; financial capability

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Abstrato

O bem-estar financeiro é um termo ainda relativamente recente no meio académico. A presente dissertação pretende explorar o impacto da literacia financeira no resultado do bem-estar financeiro dos indivíduos. Através de uma revisão concisa da literatura sobre bem-estar financeiro, saúde financeira, literacia financeira e capacidades financeiras, foram formulados os principais factores de bem-estar financeiro. O objetivo da dissertação é explorar a relação entre o bem-estar financeiro e a literatura financeira, bem como desenvolver um modelo de algoritmo que permita ao Doutor Finanças agrupar os clientes em diferentes perfis de bem-estar financeiro. Para testar e construir esta hipótese, foi elaborado um inquérito quantitativo para recolher os dados relevantes sobre os determinantes do bem-estar financeiro. Assim, o inquérito recolheu dados sobre a situação financeira dos inquiridos, os seus comportamentos financeiros, a sua literacia e conhecimentos financeiros e os seus dados sociodemográficos. Com base em 236 respostas válidas, foi aplicado um modelo de agrupamento K-Means para permitir a criação de diferentes grupos de inquiridos com características semelhantes dentro de cada grupo de agrupamento. Considerando cada grupo como um perfil de bem-estar financeiro diferente, foi então testado o impacto dos resultados da literacia financeira na determinação do resultado do bem-estar financeiro de cada inquirido. Os resultados do estudo confirmaram que a literacia financeira dos inquiridos tem um impacto significativo nos resultados de bem-estar financeiro.

Palavras-chave: bem-estar financeiro; saúde financeira; literacy financeira; capacidade financeira

Título: Estudo sobre o impacto da literacia financeira na determinação dos resultados de bem-estar financeiro dos indivíduos.

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Acknowledgements

First and foremost, I want to extend my heartfelt gratitude to my dissertation supervisor, Professora Rute Xavier, for her unwavering patience throughout this journey. I deeply appreciate the time and effort she dedicated to assisting me in developing and refining my work.

I am also immensely grateful to my parents for their constant encouragement and steadfast support throughout my academic endeavors. Their motivation has been a crucial source of strength for me.

In addition, I owe a great deal of thanks to my girlfriend, whose relentless support and ever-present listening ear made this process significantly more manageable.

Finally, I would like to express my sincere appreciation to my friends, family, and colleagues for their assistance with the research process. Whether through interviews or by distributing and completing the questionnaire, their support was instrumental. Without their contributions, the data collection necessary for this study would have been far more challenging and time-consuming.

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1. Introduction

As numerous ways of investing surged in recent years – much aided by the development of the FinTech sector – investing has become accessible to almost everyone with internet access. From developed economic blocs to large developing economies and emerging markets, access to banking and financial services has expanded largely recently. The digitalization of financial services allied with the relatively unconstrained movement of capital is leading to a higher level of personal engagement of individuals with their money (Feyen, Frost, Gambacorta, Natarajan, & Saal, 2021).

While financialization grows and includes ever more people (Demirguc-Kunt, Klapper, & Singer, 2017), individuals' financial indicators such as financial well-being, financial wellness, or financial health are getting increased attention by researchers. The advancements made in democratizing investment instruments require levels of financial knowledge and capabilities that might have been overlooked in the past. Furthermore, the link between a healthy life, especially with regards to mental health, and a comfortable financial life are being exposed by growing literature surrounding the topic (Ryu & Fan, 2023). The link between a healthy life and a financially healthy living is proving to be of the utmost importance at a time where governments start considering a partial shift of the responsibility of retirement from Social Security systems to private savings ownership.

Nowadays, individuals can swiftly pick and choose the type of investment they want to pursue almost without intermediaries. Nevertheless, such development doesn't come without a cost to society, as the lack of financial literacy and knowledge may lead people to engage in investing with a similar approach taken by gamblers in a casino (Watanapongvanich, Binnagan, Putthinun, Khan, & Kadoya, 2020). Such events can generate financial bubbles and affect not only the investments made by those individuals but also jeopardize the stability of global financial markets (Fisch, 2022). Late good examples of such gamble-like situations are the GameStop stock rally in early 2021, or the crypto bubble which popped by the end of the same year - both events led to major losses from both institutional investors, as well as retail investors (Fisch, 2022). The lack of financial literacy, as well as the absence of investment solutions providers that could assist these new investors, might have led many to lose their hard-earned savings. In fact, there are proven links between the lack of financial knowledge

and higher likelihood of engaging in financial scams, attracted by exuberant returns (Kasim, Awalludin, Ismail, Ahmad Shukri, & Zainal, 2023).

The driving purpose of Doutor Finanças is to improve financial literacy and help families to better manage their finances' health by providing educational resources and assisting customers with the most suitable financial decisions for their households. Acting mainly as a B2C, the majority of Doutor Finanças revenues are generated by the brokerage of mortgages, personal credit consolidation and insurance plans, which are mostly financial products inherently focused on individuals/households. As Doutor Finanças continues their growth path, they are looking into diversifying their offering towards the investment solutions segment. Such endeavor requires the development of internal tools that allow Doutor Finanças to profile and segment each customer from a financial/investor point of view, in furtherance of presenting the best-suited solutions for each customer.

Since Doutor Finanças operates as a Market Broker, to succeed as an investment solutions provider it is essential to understand their customers' goals and needs, but also their risk tolerance, investment literacy, liquidity needs and such. By profiling each customer, Dr Finanças can forward its clients to the financial products that better fit their needs, improving their service to customers, as well as to other stakeholders involved (credit institutions, banks, etc.).

This dissertation is structured as follows:

1. This section, "Introduction", provides an overview of the research topic and explains the importance and scope of the study.
2. Followed by the "Problem Statement and Research Question" section
3. The "Literature Review" section reviews existing research on financial well-being, examining various frameworks and concepts that have been proposed, financial literacy and the different conceptualization, and finally, the connection between financial well-being and financial literacy.
4. The "Quantitative Study" section outlines the methodology used to analyze the data collected through the online survey and reports the key findings from this analysis, the financial well-being profile obtained, and the relationship with financial literacy. It also provides recommendations for the future.

5. The "Conclusion" section summarizes the main findings of the study and provides final insights on financial well-being and financial literacy asserted throughout the dissertation.

2. Problem Statement and Research Questions

As investing democratization proliferates and financial products and services multiply (Preece, et al., 2023), there is a growing market to be tapped for investment solution providers. To tap into that market, it is crucial for Dr Finanças to accurately profile their customers and further assist them in better managing their finances. The creation of a Financial Well-being Profiling tool will help Dr Finanças to provide better investment solutions to its customers, as well as nourish their financial literacy. Such endeavor will require the construction of clusters which will equate to different financial well-being profiles. The clustering will be based on each respondent's financial situation, financial behaviors, and financial literacy & knowledge.

Considering the all the above, the following research question will be tackled throughout this dissertation:

- What is the contribution of financial literacy to individuals/households' financial well-being outcomes?

3. Literature Review

3.1 Financial Well-Being

The concept of financial well-being has long been a topic of interest among economists, researchers, financial counselors, and financial planners. However, the research on the topic is still in its early stages and spread across different disciplines, which has led to uncertainty when it comes to establishing what the term financial well-being means (Brüggen, Hogreve, Holmlund, Kabadayi, & Löfgren, 2017).

In early research, the concept of financial well-being was defined depending on the researcher's methodology, as financial well-being was theorized either focusing on objective measures, or subjective measures. The isolated research of objective and subjective factors in the literature represented a major limitation since financial well-being is proved to be a multidimensional concept with both objective and subjective variables (Wilmarth, 2021). Furthermore, financial well-being depends not only upon objective and subjective measures of the financial situation, but also on how a person perceives objective attributes of the financial situation after comparing those attributes against certain standards of comparison.

In 1990, Nancy Porter PhD dissertation established one of the first comprehensive studies testing a conceptual model and measurement of financial well-being, combining subjective and objective measures, such as personal characteristics; quantitative indicators of the financial domain and financial behaviors; and perceived attributes, such as the perception of life conditions and one's financial situation (Porter, 1990). The results obtained by Porter asserted that a sense of financial well-being depends not only upon objective and subjective measures of the financial situation, but more importantly, they are also correlated to how a person perceives objective attributes of the financial situation after comparing those attributes against certain standards of comparison.

Later, in the early 90's**,** Porter and Garman together proposed one of the first frameworks to conceptualize and measure financial well-being, combining objective and subjective factors. (Porter & Garman, 1993). Since then, uprising empirical literature has further proved their assertiveness, suggesting that the determinants for financial well-being are an elaborate blend

of factors which include financial resources, financial behaviors, psychological traits and (possibly) financial literacy (Kempson, Finney, & Pope, 2017).

Prawitz and Cohart research indicates that financial management competency, internal locus of control and savings were positively associated with the outcomes of financial well-being, Above all, the results also indicate that resource allocation and perceived usefulness of financial actions are more paramount to financial wellness than the actual resources owned (Prawitz & Cohart, 2016). Furthermore, other research findings suggest that markedly different savings habits are a critical component of financial well-being, demonstrating that saving habits and amounts – financial behaviors – have a more powerful relationship with financial well-being than financial shocks or income volatility (Anvari-Clark & Ansong, 2022).

In another scientific article, Iramani and Lutfi further assert that financial experience significantly mediates the influence of financial behavior, financial knowledge, and locus of control on financial wellbeing (Iramani & Lutfi, 2021). On a different note, Metzler et. al confirm the definite, but limited, roles played by age and income, while also reinforcing the roles of financial behaviors and financial resilience in determining financial well-being (Metzler, Zhou, & Grace, 2019). Another landmark study found a direct link between financial efficacy and financial well-being, where financial efficacy is interpreted "as a person's satisfaction with/confidence in his/her level of financial knowledge and his/her ability to meet financial objectives" (Vosloo, Fouché, & Barnard, 2014). The authors also found a direct linkage between remuneration satisfaction with financial well-being, although this bond could be foreseeable, as well as an inverse relation between financial stress and financial well-being.

The relationship between financial literacy and financial inclusion is also highlighted by other authors, which uncovered the importance of financial knowledge and skills in achieving financial well-being (Grohmann, Klühs, & Menkhoff, 2018), as financial inclusion is inherently correlated with financial well-being. Nonetheless, current literature does not confirm categorically if financial literacy is a relevant factor impacting financial well-being outcomes (Collins & Urban, 2020).

A major limitation found across the literature is the lack of a clear generalized definition of financial well-being. Bridging this gap, recent research provided more clarity over the concept, by defining it as "the perception of being able to sustain current and anticipated desired living standards and financial freedom." (Brüggen, Hogreve, Holmlund, Kabadayi, & Löfgren, 2017). Recently, several researchers have also grounded their work on the Consumer Financial Protection Bureau definition of financial well-being as "a state of being wherein a person can fully meet current and ongoing financial obligations, can feel secure in their financial future, and is able to make choices that allow enjoyment of life" (Gutman, Garon, Hogarth, & Schneider, 2015). The CFPB report points out that an individual or household achieves financial well-being when it fulfills a series of conditions as stated (Gutman, Garon, Hogarth, & Schneider, 2015)**:**

1. has control over day-to-day, month-to-month finances,
2. has the capacity to absorb a financial shock;
3. is on track to reach its financial goals; and
4. has the financial freedom to make the choices that allow you to enjoy life.

More recently, a similar conceptualization was proposed asserting financial well-being as "the set of conditions that enable people to fulfill present and recurrent financial obligations, make consumption decisions without getting stressed financially, prepare for facing economic contingencies, and pursue future financial goals" (García Mata & Zerón Félix, 2022)

3.2. Financial Health

Financial health appeared as a new concept due to the necessity of evaluating the financial conditions of households that isn't just related to income levels, taking as a basis the knowledge produced around financial well-being.

The **Center for Financial Services Innovation** introduced the concept of financial health, in essence a framework to evaluate how well individuals' financial systems "help build resilience from shocks and create opportunities to pursue one's dreams" (Parker, Castillo, Garon, Levy, & Rob, 2016). Financial health is measured by assessing an individual's financial knowledge, behaviors, attitudes, and access to financial resources, variables which are also used by researchers to infer the level of financial well-being. The concept is

inherently connected to the financial well-being of an individual or household, as it is not possible to be financially healthy and have poor financial wellness and vice-versa. In a posterior report, the CSFI developed a financial health index by focusing on four key areas that significantly influence a influence a consumer's financial health in the developing world: absolute income level, income and expense volatility, social network, and financial role (Ladha, Asrow, Parker, Rhyne, & Kelly, 2017).
The four main components of financial health utilized were split as the following (Parker, Castillo, Garon, Levy, & Rob, 2016):

1. Spend: Spend less than you earn & Pay bills on time and in full
2. Save: Have sufficient living expenses in liquid savings & Have sufficient long-term savings or assets
3. Plan: Have appropriate insurance & Plan ahead for expenses
4. Borrow: Have a sustainable debt load & Have a prime credit score

Despite some points such as the credit score and the insurance plan aren't particularly relevant for the research in Europe, the rest of the factors are extremely relevant as a basis to the framework to be produced in this dissertation. One of the most relevant findings is that financial behavior and planning play a more significant role in determining a family's capacity to achieve financial "health" than other measures of income poverty such as housing or food insecurity.

Similarly, an **Insight2impact** research provides a conceptual model of the drivers of financial health and examines methodology issues involved in measuring financial health, aimed towards policy-makers. The research report defines financial health as achieving success in managing one's financial life, while it also suggests that financial health is a state of being, not a set of behaviors (Rhyne, 2020) – in line with the research regarding financial well-being. Furthermore, it concluded that financial health is strongly correlated with higher income, while inversely correlated with income volatility – a factor known to be correlated with financial stress. The report builds an index score of financial health based on a set of inputs such as socio-economic factors, personality traits and financial literacy, which directly impacts financial capabilities and behaviors that allied with exogenous shocks result in different financial health outcomes. One of the main constraints pointed out by the report is the need for extensive and detailed surveys, a relevant consideration for the scope of this dissertation.

3.3. Financial Literacy

One of the first definitions for financial literacy dates to the early 1990s, asserting it as ‘the ability to make informed judgments and to take effective decisions regarding the use and management of money’ (Noctor, Stoney, & Stradling, 1992). In a deeper approach to the concept, Mandell defines financial literacy as the capacity to evaluate new financial instruments and make informed decisions regarding their choices and extent of use (Mandell, 2007).

More recently, Remund suggested an improved definition of financial literacy as describing it as "measure of the degree to which a person understands key financial concepts and has the necessary ability and confidence to manage own finances through short term decisions and long term planning, taking into consideration the economic events and changing conditions” (Remund, 2010). Thus, the literature implies that financial literacy is comprised by financial knowledge acquired, but also as significant, by the ability to leverage that knowledge for informed decision-making. A more extensive definition comprehends "ability to manage the situation of cash and payments, knowledge about opening a savings account and obtaining a credit, basic understanding of health and life insurance, ability to compare offers and plan for future financial needs" (Emmons, 2005).

On the other hand, several authors shift their focus to the specific knowledge one has with regards to financial terms and notions, instead of the more general approaches previously taken by researchers. Hence, financial literacy is dependent on the comprehension of different financial notions such as compounding interest, nominal and real values or the basics related to risk diversification (Lusardi & Mitchell, 2008).

Volpe & Chen published an extensive study on the financial literacy of college students in the United States of America. The study, from the late 1990’s, concluded that a clear the of financial literacy and financial knowledge was a problem affecting a large portion of the population (Chen & Volpe, 1998). Not long ago, Gianni Nicollini research came to a similar conclusion while analyzing the scores of financial literacies in Europe. The author studied financial literacy at different levels, focusing on the use of money and investment products, unveiling significantly low scores regarding financial knowledge. An obvious conclusion

from this study is that a low score of financial knowledge could be interpreted as a low level of financial literacy, as people cannot apply knowledge they do not have. This empirical analysis in Europe highlights a deficiency in financial literacy, as financial skills entail the capability to utilize financial knowledge for making informed financial decisions (Nicollini, 2019). As relevant as defining financial literacy, is the ability to measure it. Despite several authors theorizing the concept and conducting primary research, there are conflating concepts utilized throughout different research articles which affects the quality of the results obtained.

Aiming to bridge this gap, a research report from RAND Corporation succeeded in aggregating different definitions and reaching a final one as follows: "knowledge of basic economic and financial concepts, as well as the ability to use that knowledge and other financial skills to manage financial resources effectively for a lifetime of financial well-being." (Hung, Parker, & Yoong, 2009). Likewise, Hizgilov and Silber produced intensive research of different approaches for financial literacy measurement in Israel. The authors' research based on different measurement techniques reinforced previous findings, as financial literacy is significantly lagging (Hizgilov, Silber, & Jacques, 2020). The conclusion and methodologies of both experimentations are extremely useful for further research aiming to utilize financial literacy measuring as the one I will further present, as they aggregate previous authors' surveys in different waves to evaluate their success in measuring financial literacy, and compare the different results.

Independent of the methods and measurement techniques, overall, there are some common findings across the different literature. Firstly, research suggests that higher scores of financial literacies are correlated with the degree of education (Yakoboski, Lusardi, & Hasler, 2023). Secondly, financial literacy appears to be correlated with gender (Lusardi & Tufano, 2015) as well as with the conjugal status of individuals – for example, married men display higher levels of financial literacy than single men (Iramani & Lutfi, 2021)**.** On the other hand, financial literacy is also related with age, with younger and older individuals scoring the lowest (Lusardi & Mitchell, 2014). Additionally, researchers also found a strong correlation between financial literacy and financial behavior (Allgood & Walstad, 2016) – as within financial literacy it is also considered the ability to use that knowledge for informed decision-making, it is not surprising that responsible/positive financial behavior is positively correlated with higher levels of financial literacy. Individuals with higher scores in financial

literacy are more likely to engage in financial planning and budgeting (Lusardi & Mitchell, 2007).

3.3. Financial Well-Being linkage with Financial Literacy

The association between financial well-being and financial literacy is yet to be completely proved, although significant research points in that direction. Despite some research associating higher levels of financial literacy with positive outcomes of financial well-being or financial health, the inclusion of financial behaviors in some definitions and measurements of financial literacy makes it hard to isolate the impact of financial knowledge alone.

Recently, there has been growing research connecting high financial literacy and knowledge scores to higher levels of satisfaction with one's financial condition, or directly with financial health. In their study, (Taft, Hosein, Mehrizi, & Roshan, 2013) investigated the interplay between financial concern, financial literacy, and financial well-being. The analysis demonstrated significant correlation between financial worry, educational level, and financial literacy with individuals' overall financial well-being. This highlights the concept that financial literacy is essential for a thriving economic life, supporting informed decision-making, efficient asset management, and fostering increased savings and investments. On a different study conducted with university students in Malaysia, (Falahati & Sabri, 2015) produced a study pinpointing and examining the factors that shape the financial well-being, mostly focused on gender impacts.The study found that financial well-being is impacted by various factors, including financial literacy, individual consumer experiences, and advice from socialization agents. It was also observed that both personal consumer experiences and the guidance from socialization agents are linked to financial literacy.

Focusing on a set of different demographics than Falahati and Sabri, (Adam, Frimpong, & Boadu, 2017) investigated the influence of financial literacy among other factors, on the financial well-being of pensioners. The authors found on top of other factors; financial literacy has a strong influence on the outcome of pensioners' financial well-being. A different approach was taken by (Hasibuan, Lubis, & Altsani, 2018) demonstrating how financial literacy and financial behavior, two interrelated factors, influence the financial well-being of entrepreneurs. Their study found that high levels of financial literacy, along with positive financial behavior, are linked to enhanced financial well-being.

In an extensive nation-wide study conducted in the US, encompassing several generations, it was also concluded that individuals' financial well-being was strongly influenced by their level of financial literacy and knowledge (Yakoboski, Lusardi, & Hasler, 2021). The research also showed that, particularly among young adults, lower levels of financial literacy are linked to lower levels of financial well-being, reinforcing the connection between these two concepts.

In a similar approach, Sabri et al. delved into the relationship between financial literacy and the financial well-being of adults. Their analysis unveiled noteworthy findings, indicating that the financial well-being of adults is profoundly influenced by factors such as financial behavior, knowledge, and locus of control (Sabri, et al., 2023). It was observed that financial knowledge and educational background are crucial in influencing the financial behavior of adults, significantly affecting their overall financial well-being.

Both financial literacy and financial well-being hold significant importance in an individual's financial journey. The term "financial literacy" refers to the knowledge, skills, and awareness necessary for informed financial decisions and achieving a thriving financial life. On the other hand, "financial well-being" describes a “state where individuals can meet their financial obligations, secure their financial future, and enjoy life” (Das & Kumar Mahapatra, 2023). It can be inferred that an increase in financial literacy leads to an improvement in financial well-being, and vice versa. Therefore, to enhance individuals' financial well-being, stakeholders should prioritize efforts to enhance their financial literacy, as progress in financial literacy apparently serves as a critical step toward developing better levels of financial well-being.

4. Quantitative Research

4.1 Methodology Design

This dissertation is focused on two main objectives, as it is part of a conjoint project with the Portuguese start-up Doutor Finanças, as well as a research master's thesis. The following research and model developed will provide Doutor Finanças with a statistical clustering prototype that allows them to differentiate financial health profiles within a dataset, enabling better insights on each of their current and prospect customers. Secondly, it aims to bridge the gap surrounding current research, as the positive relationship between financial literacy and financial well-being is still unclear.

The project is centered around prototyping a survey that can be completed online and automatically allocates each respondent to a specific financial health profile (cluster). The literature review covered the different aspects affecting and determining financial health, its' direct relation with one's financial well-being, and the possible importance of financial literacy to achieve higher levels of financial health. Furthermore, the thesis intends to decipher the importance of financial literacy to determine outcomes of financial health. While current literature isn't conclusive regarding this fact, the model developed intends to further explore and demonstrate the relevance of financial literacy and financial knowledge on the respondents allocated profile.

The approach followed comprised the collection of primary data through a survey, which gathered information related to the focus areas proved to determine and affect individuals' financial well-being. The survey was split in 4 different sections, which followed the split presented below:

- Section 1: ***Current financial situation*** (consisting of 6 questions)
- Section 2: ***Financial behaviors*** (consisting of 6 questions)
- Section 3: ***Financial literacy and knowledge*** (consisting of 7 questions)
- Section 4: ***Socio-Demographic information*** (consisting of 6 question)

The first section intended to gather data on the day-to-day finances management of each respondent, their ability to face unexpected events (financial resilience) and their capability of

raising funds. It evaluates the individual's financial foothold and their preparedness to face an economic downturn, regardless of the income bracket they are allocated in, as income is not necessarily correlated with healthier financial outcomes.

Table 1. Survey: Section 1 (Current Financial Situation)

Aspect measured	**Question**	**Possible answers**
Financial Capability	Q1: How often do you need to use a credit card, overdraft or borrow money to buy food, pay household expenses, purchase clothes or meet financial commitments? (not including payments which require a credit card such as car rentals, software subscriptions, etc.)	Never Rarely Sometimes Often Most of the time
Financial Capability	Q2: Classify the following sentence: I am able to meet my current bills and credit commitments comfortably.	Strongly disagree Somewhat disagree Neither agree nor disagree Somewhat agree Strongly agree
Financial Resilience	Q3: Would you need to borrow money or use a credit card to meet an unexpected expense of 1-month's salary?	I can cover 1-month's salary expense without any troubles. I could cover the expense however I would need to make use of emergency funds or savings. I would need to withdraw long-term savings or liquidate investments in order to cover the expense. I would need to use credit to be able to cover such expenses or ask relatives for help.
Financial Resilience	Q4: If your current source of income fell by half, how long would you be able to maintain	More than 6 months Between 3 to 6 months Between 1 to 3 months (3)

	your current financial commitments without accessing credit or asking for financial assistance to a friend/relative?	Less than 1 month (4)
Financial Resilience	Q5: Which one of the following statements best describes your current savings' provisions?	I have built different provisions which include emergency funds, savings and at least 1 investment account. I have at least one savings or invesment account and one emergency fund to navigate worse days. I have one savings or emergency fund account. I don't have any savings.
Financial Stress	Q6: Classify from a scale of 1 to 5, where 1 is financially distressed and 5 is completely satisfied.	Likert Scale (1 to 5)

The second section intended to gather data on individual's financial behaviors – their attitudes towards savings, their spending habits, their ability to plan and budget ahead of unexpected circumstances, as well as their locus of control. The goal is to understand their overall behavior towards money, with the focus points being spending, savings and budgeting behavior, as individuals' financial behaviors are proven to be one of the main determinants to the outcomes of financial well-being observed (Prawitz & Cohart, 2016).

Table 2. Survey: Section 2 (Financial Behaviors)

Aspect measured	**Question**	**Possible answers**
Savings behavior	Q7: On a monthly basis, what percentage of your disposable income do you save on average?	More than 20% Between 10 to 20% Between 5 to 10% Less than 5% I do not save

Savings behavior	Q8: With regards to your savings habits and planning, choose the affirmation that best characterizes your behavior?	I have a detailed budget and savings plan that I stick to every month. I have a savings plan and save regularly, but I can't stick to it every month. I save money often, but I don't have a specific plan or budget. I save money whenever I have extra income, but I don't actively plan for it. I don't have a savings plan and tend to spend most of my income.
Savings behavior	Q9: Would you need to borrow money or use a credit card to meet an unexpected expense of 1-month's salary?	I can cover 1-month's salary expense without any troubles. I could cover the expense however I would need to make use of emergency funds or savings. I would need to withdraw long-term savings or liquidate investments in order to cover the expense. I would need to use credit to be able to cover such expenses or ask relatives for help.
Attitudes towards money	Q10: If you receive an unexpected bonus of 2000€, what would you do with the money?	Save or invest the total value. Save or invest most but use part buy something nice. Use most of the funds to cover expenses. Spend all the funds.
Attitudes towards money	Q11: How often do you personally buy things you don't need even if it leaves you with insufficient money to accumulate savings or unable to face unexpected expenses?	Never . Once or twice a year. Somewhat often (between 3 to 6 months per year). Most of the time (more than 6 months per year).

Planning & Budgeting	Q12: Do you budget/organize your financial life and make provisions for the future (e.g., do you keep track of your expenses and income streams)	Yes. No.
Expectations	Q13: What are your expectations for your future financial situation versus your current one?	My financial situation is going to improve greatly in the years to come. My financial situation will improve moderately in the future. My financial situation will remain similar to the one I have today. My financial situation will get worse as the years go by.

The third section gathered data on the individuals' financial knowledge and consequent financial literacy, working basically as a small questionnaire test. In the beginning of this section, it is also gathered information regarding the confidence of the respondents in their own knowledge, as over-confidence is associated with poor financial choices (Vörös, et al., 2021). This section focused on basic notions such as interest rates, investment instruments, and other non-complex economic concepts, to estimate the respondents financial understanding and mastery of financial concepts. The questions were based on previous research and summarized in a shorter questionnaire, due to the necessity of avoiding a too extensive survey which would result in a smaller sample being collected.

Table 3. Survey: Section 3 (Financial Literacy and Knowledge test)

Aspect measured	**Question**	**Possible answers**
Financial Literacy & Knowledge	Q13: How do you perceive your financial knowledge?	Likert Scale Evaluate on a scale from 1 – 7, where 1 is Not Knowledgeable and 7 is Very Knowledgeable
Financial Literacy & Knowledge (Compounding)	Q14: Suppose you had 1000 Euros in a savings account and the interest rate was 3% per year.	More than 1090 Euros. (1) Exactly 1090 Euros. (2) Less than 1090 Euros. (3)

	After 3 years, how much do you think you would have in the account if you left the money to grow?	I don't know. (4)
Financial Literacy & Knowledge (Inflation)	Q15: Assume that inflation is now 5%, while your savings account provides 3% return. After 1 year, how much will the money you saved buy you?	Exactly the same as today. (1) More than today. (2) Less than today. (3) I don't know. (4)
Financial Literacy & Knowledge (Investment instruments)	Q16: What is the difference between a stock and a bond?	A stock represents ownership in a company, while a bond represents a debt owed by a company. (1) A stock represents a debt owed by a company, while a bond represents ownership in a company. (2) A stock and a bond are the same thing. (3) None of the above. (4) I don't know. (5)
Financial Literacy & Knowledge (Stocks)	Q17: What is the difference between a common stock and a preferred stock?	Preferred stockholders may have priority over dividends when compared to common stockholders. (1) Preferred stockholders have more voting rights than common stockholders. (2) In the event of a company's bankruptcy, the ordinary shares have a collection preference over the preference shares. (3) None of the above. (4) I don't know. (5)
Financial Literacy & Knowledge (Corporate Loans)	Q18: What is the relationship between the spread and the risk of default on a loan?	The higher the spread, the lower the risk of default. (1) The lower the spread, the higer the risk of default. (2)

		The higher the spread, the higher the risk of default. (3) The risk of default has no relationship with the spread. (4) I don't know. (5)
Financial Literacy & Knowledge (Bonds pricing)	Q19: What is the relationship between fixed-interest bonds prices and interest rates?	Bond prices and interest rates move in opposite directions. Bond prices and interest rates move in the same direction. (2) Bond prices are not affected by interest rates. (3) None of the above. (4) I don't know. (5)

Finally, the fourth section serves as a control for the data collected, focusing on the individuals' social and demographic traits. The section covers the respondents' gender, age, education, income, employment status and country of residence, relevant features to study financial well-being (Riitsalu & van Raaij, 2022). However, these factors such as income and education are significantly important to derive the outcomes of financial health, however, they can also be correlated with the asserted results of financial literacy and knowledge of the respondent.

Table 4. Survey: Section 4 (Socio demographics)

Aspect measured	**Question**	**Possible answers**
Socio-Demographics	Q20: Which gender do you identify with?	Male (1) Female (2) Others (3
Socio-Demographics	Q21: What is your age segment?	18 – 25 years olds (1) 26 – 35 years old (2) 36 – 50 years old (3) 51 – 65 years old (4) Over 65 years old (5)
Socio-Demographics	Q22: What is your highest degree of education obtained?	Did not complete highschool (1) High school degree (2)

		Apprenticeship or Professional School (3) Bachelor's degree (4) Master's degree or MBA (5) Phd (6)
Socio-Demographics	Q23: What is your gross income per year (including other income sources such as rents, dividends, government support, etc.)?	Less than 10.000€ (1) Between 10.000€ – 15.000€ (2) Between 15.000€ – 20.000€ (3) Between 20.000€ – 30.000€ (4) Between 30.000€ – 45.000€ (5) Between 45.000€ – 60.000€ (6) Above 60.000€ (7)
Socio-Demographics	Q24: What is the difference between a common stock and a preferred stock?	Preferred stockholders may have priority over dividends when compared to common stockholders. (1) Preferred stockholders have more voting rights than common stockholders. (2) In the event of a company's bankruptcy, the ordinary shares have a collection preference over the preference shares. (3) None of the above. (4) I don't know. (5)
Socio-Demographics	Q25: What is the relationship between the spread and the risk of default on a loan?	The higher the spread, the lower the risk of default. (1) The lower the spread, the higer the risk of default. (2) The higher the spread, the higher the risk of default. (3) The risk of default has no relationship with the spread. (4) I don't know. (5)

The purpose of the data collected is to build different groups of financial health, which statistically translates to the construction of clusters within the population of data collected. Taking that into consideration, the best method to develop a model which generates the needed outputs is clustering technique. Due to the academic scope and budget limitations to treat and analyze the data, the most efficient and scientifically appropriate way to treat the sample and provide the highest quality of clusters possible the application of K-Means clustering models (Ikotun, Ezugwu, Abualigah, Abuhaija, & Heming, 2023).

Considering the categorical nature of the variables assembled, the variables needed to be transformed to perform the K-Means clustering technique. As the variables collected on section 1 and 2 are all categorical and follow a scaling order (apart from question 11), the variables can be transformed into numerical ones. Transforming them into numerical variables will allow us to bypass the limitations of not having Euclidean distances to build the clusters, a necessary feature to use the K-Means technique which requires the use of numerical variables (Ikotun, Ezugwu, Abualigah, Abuhaija, & Heming, 2023).

Additionally, since financial literacy's impact in determining the outcomes of financial well-being is the hypothesis tested in this dissertation, section 3 results are aggregated into a score. The score is a composite of the number of correct answers provided, ranging 1 to 7, considering that 1 would represent zero correct answers. The composite is then entered as a numerical variable representing the respondent's Financial Literacy. Since the results of financial literacy and knowledge are concluded directly from the survey answers for each respondent, it is possible to test the different variables influence in the results of financial literacy and knowledge observed. The significance of the variable Financial Literacy in the outcome of each cluster of financial well-being obtained is then tested via Kruskal-Wallis' test. As financial literacy is correlated with factors that were also collected during the survey, such as education level or certain financial behaviors, it is also relevant to the dissertation to look at those relationships and understand how the dots are connected to each other.

The survey consisted of 26 questions, of which 25 of them are collected as categorical variables due to the type of information needed to congregate. Of those 26 questions, one is a control question to make sure respondents were truly taking the time to answer the survey correctly. The survey was spread through social media platforms, and generated 249 responses, although only 237 respondents completed it from start to finish. Of these 237

respondents, 236 resulted in valid responses, hence usable for the statistical tests taken afterwards.

The data analysis for this dissertation was conducted utilizing Python, an open-source programming language, which allowed me to treat and transform the data as well as perform the necessary statistical tests and build the clusters.

4.2. Data Description & Manipulation

The data was treated by transforming the needed categorical variables into numerical ones, to enable the measurement of Euclidean Distances in the K-Means analysis. Due to the ordinal properties of the variables, the transformation maintains the ordinal nature of the data but allows me to work with numerical values in calculations and analysis (Larose & Larose, 2015). For the survey's section 3, variables 14 to 19 were aggregated into a score and transformed into a composite score of financial literacy – renamed as SQ. As this variable is the result of the sum of correct answers to questions 14, 15, 16, 17, 18 and 19, there is no transformation to numerical needed. To maximize the effectiveness of the K-Means clustering, a feature selection technique was used by calculating the Spearman Correlation Matrix (see Appendix A). As the data we are treating is not normally distributed and the relationship between variables is not strictly linear, the Spearman Correlation Matrix is more appropriate than the Pearson Correlation Matrix (Winter, Gosling, & Potter,, 2016). The Spearman Correlation Matrix did not show any variables with a higher correlation than the threshold considered (0.7), except for variables Q14 to Q19 which were highly correlated with variable SQ. However, these variables were already planned to be excluded as it would not make sense to include them and SQ.

Following the calculation of the Spearman rank correlation coefficients, it was necessary to normalize the data with the intention to balance the possible effects created by the numerical transformation of the initial variables. The data normalization ensures that variables with different scales do not disproportionately affect the clustering process, namely, to minimize the sensitivity to scale effect (Amorim, Cavalcanti, & Cruz, 2022).

Due to the different data characteristics of the variables, the most efficient way to leverage the strengths of the K-means clustering is merging two separate K-Means analysis into a final one using a hierarchical algorithm (Peterson, Ghosh, & Maitra, 2018). The first K-Means was focused on the subset related to the variables encountered on section 1 and 2 of the survey, and the composite score variable SQ derived from section 3. To obtain optimal number of clusters, I calculated the WCSS (Within-Cluster Sum of Square) and plotted them using the Elbow Method (Patel, Sivaiah, & Patel, 2022). Following the Elbow Method, the inferred optimal number of clusters to calculate the first K-Means is 4 (see Appendix B).

The second K-Means was calculated for the Demographic features, following the same approach as the one above. Due to the added complexity, the variables Q20 and Q24, related with gender and employment status respectively, were removed due to the absence of scalability properties. The Elbow method result provided two possible optimal results for the number of clusters, either 3 or 4 (see Appendix C). As different combinations of the optimal number of clusters were tested and re-tested in the later stages, it was concluded that 4 clusters would provide the most optimal results to utilize in the final merged clusters.

To overcome dimensionality due to the large number of variables utilized in the model, the t-SNE (t-Distributed Stochastic Neighbor Embedding) technique was applied (Maaten & Hinton, 2008). This technique allowed me to visualize and identify the potential clusters, as well as confirm the different data points are grouped in distinctive ways. From this stage, it was clear that there were different groups of data points within each subset, and subsequently, the K-Means clustering would provide relevant results (see Appendix D & Appendix E). The clusters were then merged using the hierarchical algorithm.

4.3. Key findings and results

After merging the two subsets of K-Means, the final K-Means clusters centroids were calculated. Each cluster resulting from the merger of the two previous subsets has significantly different characteristics, as the centroids calculations show in Table 5.

Starting with the features related with respondents' current financial situation (survey Section 1), Cluster A observations display a higher propensity of needing to borrow money to make

ends meet (variable Q1), while in the opposite spectrum, cluster D observations tend to never use credit to make their ends meet (variable Q1). Similarly, cluster A observations tend to have difficulties in comfortably meeting their current bills and financial commitments (variable Q2), while cluster D observations can comfortably comply with their financial commitments. If faced with unexpected expenses representing one month of salary, Cluster A observations will most likely need to use credit or ask help from relatives/friends to be able to cover the expense (variable Q3), while Cluster D are likely to be able to cover the expense without much hassle. When it comes to financial resilience (Q4), Cluster A observations are more likely to be able to maintain their current financial commitments in less than one month if their income falls by half, while Cluster D are more likely to be able to maintain their current commitments for more than 6 months. Cluster A observations are the most likely to have the least financial provisions – not having savings – while Cluster D is likely to have built several provisions ranging from emergency funds to investment accounts (variable Q5). Finally, when considering the perception of one's current financial situation (variable Q6), Cluster A observations are most likely to feel financially distressed, while Cluster D observations are presumably satisfied with their financial situation.

Considering the financial behaviors of the respondents (survey Section 2), the Clusters also display significantly different centroids. Cluster A observations are expected to save the least or not save at all, while Cluster D most probably save the most within the sample population (variable Q7). With regards to savings habits and planning (variable Q8), Cluster A observations likely do not have savings plans, while Cluster D have detailed budget and savings plans that they stick to. Regarding their behavior when faced with an expected bonus (variable Q9), Cluster A respondents are most likely to spend all the funds, whereas the Cluster D observations will probably save or invest the total amount received. Cluster A allocations are also more likely to be less financially responsible, purchasing unnecessary items and being left with insufficient funds to save recurrently (variable Q10), while Cluster D allocations most likely never decide on purchasing something if that leaves them in a fragile financial position – even if just for the current month.

With regards to financial literacy, variable SQ, Cluster A observations are most likely to score the lowest and have the least financial knowledge, while Cluster D observations are the most literate, displaying the highest scores. Interestingly, financial knowledge perception (variable Q13) also appears to be in line with the results of the financial literacy results.

The results from the K-Means clusters assembled are in line with the past literature and research produced, further strengthening the credibility of the model to be used by Doutor Finanças as a prototype for future testing.

Table 5. Centroids results from the merged K-Means (normalized)

Variables	**Cluster A**	**Cluster B**	**Cluster C**	**Cluster D**
Q1	0.743750	0.779412	0.864286	0.923333
Q2	0.481250	0.715686	0.892857	0.970000
Q3	0.283333	0.614379	0.847619	0.928889
Q4	0.316667	0.483660	0.857143	0.920000
Q5	0.291667	0.411765	0.619048	0.808889
Q6	0.400000	0.475490	0.653571	0.743333
Q7	0.287500	0.563725	0.703571	0.813333
Q8	0.275000	0.539216	0.542857	0.763333
Q9	0.650000	0.705882	0.766667	0.875556
Q10	0.700000	0.732026	0.819048	0.840000
Q11	0.05	1.00	0.00	1.00
Q12	0.608333	0.601307	0.538095	0.697778
Q13	0.379167	0.460784	0.538095	0.662222
SQ	0.350000	0.424837	0.561905	0.677778
Q21	0.393750	0.333333	0.450000	0.373333
Q22	0.590000	0.588235	0.662857	0.693333
Q23	0.304167	0.454248	0.550000	0.688889

After calculating the K-Means clusters' centroids, further statistical tests were performed to assert the features' importance. Since Q11(budget or not budgeting) is a yes or no question, it is comprehensible that by transforming it into a numerical variable it provides less accurate results as it is not an ordinal categorical variable. Bypassing that limitation, we can see that Q4, Q3, Q2 are the top 3 most important variables for the model, as they are related to respondents' financial capability, conditions and resilience, all factors proven to be essential to financial well-being.

Closely following these 3 variables are the variables Q5, Q7 and Q8. As it is related to different savings provisions, it was also predictable that Q5 would be one of the most relevant variables, as it is still part of the "Current Financial Situation" section of the survey. Q7 and

Q8 are related with financial behavior and internal locus of control, which are factors also mentioned several times across past research regarding their importance to the financial well-being of individuals.

The least important variables to the model are the highest degree of education obtained (variable Q22), the expectation regarding the future financial condition (variable Q12) and the respondents' age (variable Q21).

Table 6. Feature importance ranked - ANOVA results

Variables	**F-statistic value ANOVA**
Q11	0.967564
Q4	0.498395
Q3	0.486188
Q2	0.381876
Q5	0.357411
Q7	0.335216
Q8	0.329186
Q6	0.326084
Q23	0.232558
SQ	0.205893
Q13	0.164365
Q9	0.125766
Q1	0.073929
Q10	0.061401
Q22	0.058421
Q12	0.046648
Q21	0.022122

Finally, everything is set to perform test the dissertation hypothesis:

H0: Financial literacy (variable SQ) does not contribute to individuals' financial well-being clusters' outcome.
H1: Financial literacy (variable SQ) contributes to individuals' financial well-being clusters' outcome.

As the data gathered through the survey isn't normally distributed, the ANOVA test cannot be performed to assert the impact of financial literacy in the cluster's outcome and test the dissertation's hypothesis. To overcome this barrier, I decided to use the Kruskal-Wallis' test, which is a non-parametric test utilized to assert if there are significant differences between groups when the dependent variable is not normally distributed.

Table 7. Kruskal-Wallis' test

Kruskal-Wallis' results
Test Statistic: 48.259521178182965
P-value: 1.8751865167937015e-10

As the result above shows, the p-value of the Kruskal-Wallis' test is smaller than 0.05, which leads me to conclude that the null hypothesis can be rejected. Hence, it can be asserted that financial literacy has an impact on the outcomes of financial well-being, as observed in the above clusters' centroids value.

4.4. Model Limitations

The theme of financial well-being and financial literacy is especially tricky, as to produce appropriate models it is required to gather a huge amount of information, as well as collect data that is representative of the studied population. Most studies discussing these topics have collected much larger samples, especially the ones pertaining to financial well-being. The lack of a diverse sample, which is the case for this dissertation, hampers the findings and results in relatively similar Clusters – especially when considering Cluster B and C.

Furthermore, it should be noted that despite efforts to spread the survey to as many people as possible, most of the people that answered it are people who either work in similar areas, studied at the same places as I did, relatives, friends of my parents and other people with a certain degree of acquaintance. This results in a biased sample, which is particularly noticeable when we look at the demographics data – roughly 87% of the survey respondents have at least a bachelor's degree, and 44% have at least a master's degree. In no way this can be considered a representation of the broad universe, especially if we consider that Doutor Finanças mainly operates in Portugal and the survey will be targeted to the Portuguese population.

Additionally, the length of Section 3 of the survey, related with Financial Literacy and Financial Knowledge, isn't as extensive as it should be or as other researchers made it, although it should be stated that the advised length of a master's thesis survey was already surpassed due to the necessity of collecting other data as well – and make it as extensive and in-depth as possible. On this topic, another relevant thing to point out is that it would be interesting to gather concrete data regarding the respondents' assets or net worth, as it would possibly enable even more accurate results, however, due to the sensitivity of the question I've chosen to keep it out of the survey. Still regarding variables left out, due to the length of the survey, I've chosen to eliminate demographic questions such as marital status or ethnicity, as despite interesting to include, previous literature did not conclude that they were determinant factors – despite having some influence on the financial well-being outcomes.

Finally, it should be noted that further statistical tests should be considered, if the model is to be perfected. The K-Means clustering technique assumes that homogeneity of cluster variances is held, however, when performing post-Hoc tests on the model built I have found that this premise does not hold.

Table 8. Post Hoc Tests to evaluate the homogeneity of clusters variances

Levene's test results
Test Statistic: 6.13359368643723
P-value: 0.00039382496472053585

The Levene's test performed results in p-value smaller than 0.05, which means that the null hypothesis of "homogeneity of variances across clusters" is rejected. This can impact the interpretation of the clusters, despite not necessarily invalidating the K-Means analysis produced. However, it means that further investigation into the clusters variances is needed to be sure that the interpretations made are accurate and definite.

5. Conclusion

The topics regarding financial well-being, financial health and financial literacy are still quite recent. The interest in financial well-being isn't embryonic in academia, however, the methodologies and frameworks to measure it and the consensus surrounding its definition are still relatively new. Being a topic still in its recent stage of development, it is not as easy to draw conclusions as an important part of the research and literary production is still in progress. On the other hand, it also provides opportunities to explore different frameworks and models, and test the assumptions and findings made recently by other researchers.

The research presented throughout this dissertation aimed to combine the highest quality of knowledge produced and build a prototype that can be further tested and implemented by Doutor Finanças to categorize customers and prospects into different profiles of financial well-being. The clustering analysis performed, resulted in significant and differentiable clusters – for Doutor Finanças, with each cluster representing a different financial well-being profile – as well as provided relevant results which are in line with the peer-reviewed literature produced by experts in both financial well-being and financial literacy. The primary research included most if not all significant factors known to influence individuals' financial well- being. The survey collected data for approximately all the variables that were proven to influence the outcomes of financial health and well-being in previous academia production, as well as producing a simplified version of a financial literacy test.

In conclusion, the results assert that it is feasible to group individuals into different financial well-being profiles based on the answers gathered in a relatively short survey. The use of such clustering algorithms would allow Doutor Finanças to allocate their potential and current customers into different financial well-being profiles, which was one of the main objectives of this research. Furthermore, such financial well-being profiles are founded on the work of previous researchers, as the definition used is derived from past literature. Last, but not least, the results also lead us to conclude that financial literacy contributes to determining each individual financial well-being outcome.

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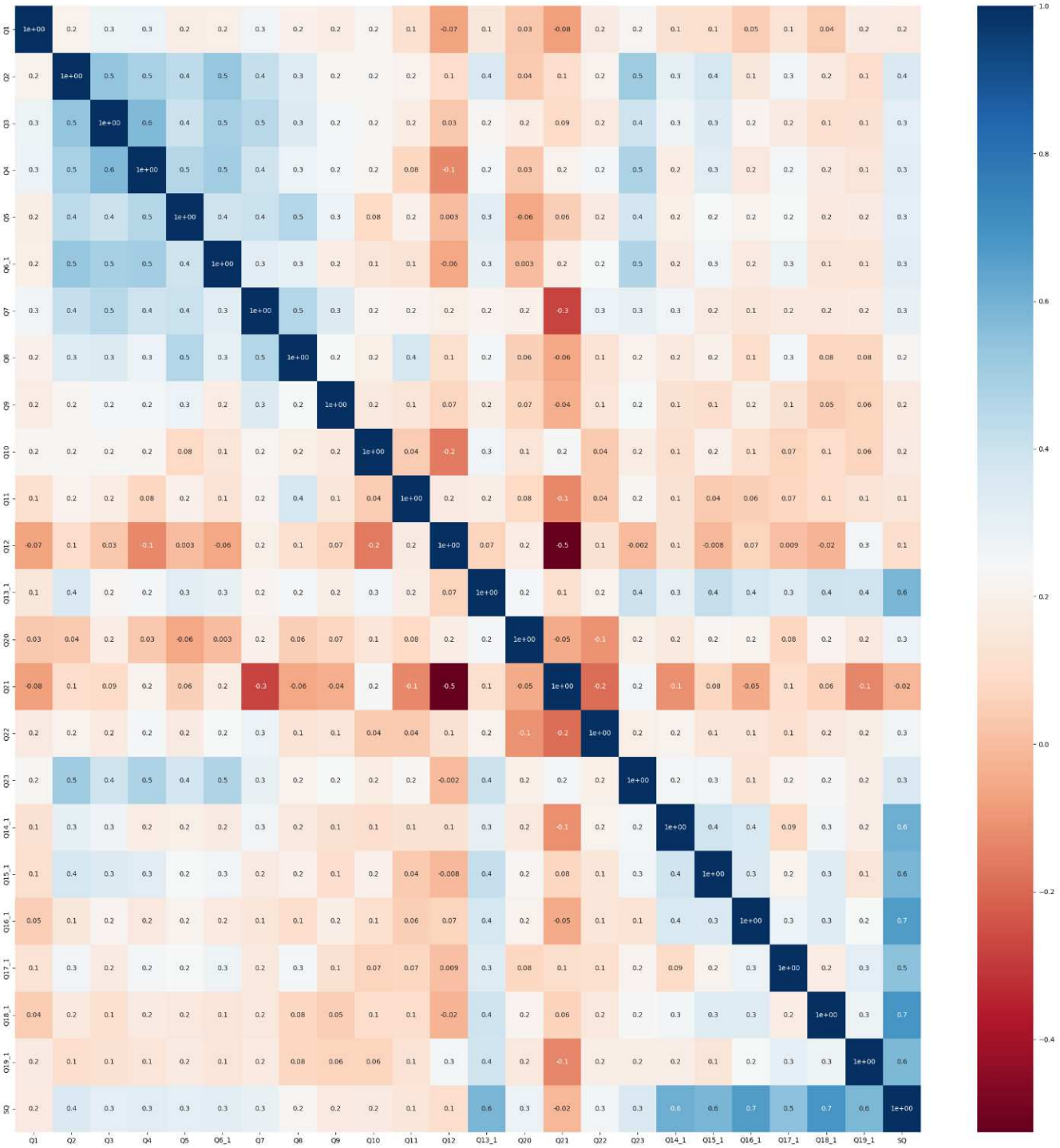
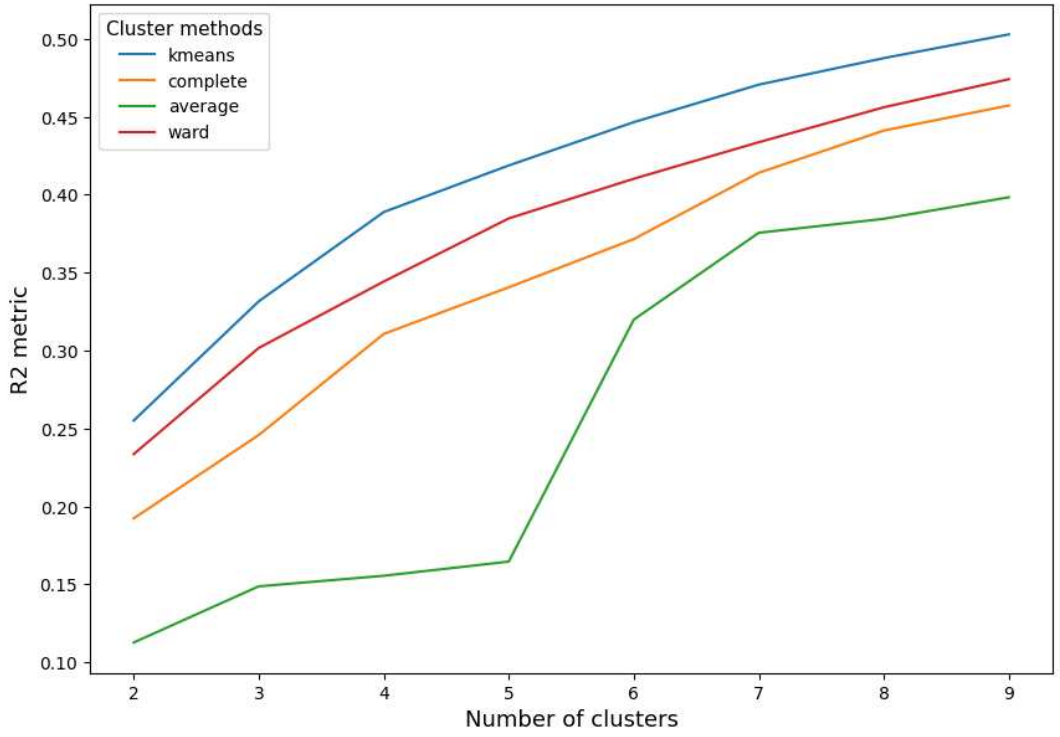
7. Appendix

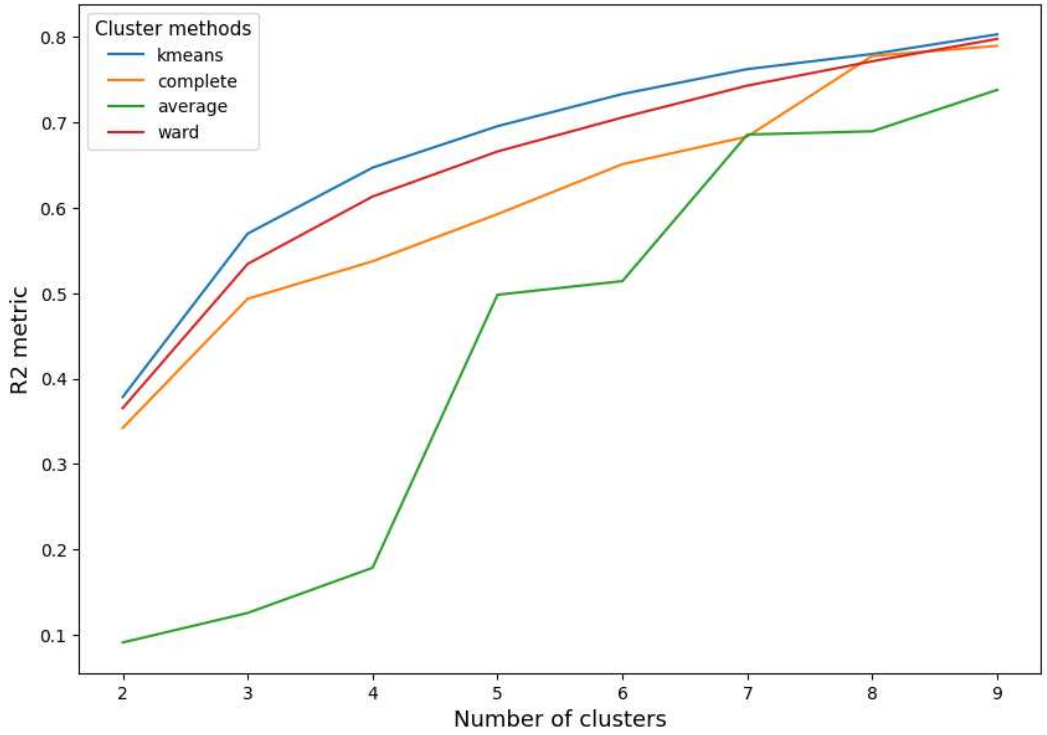
Appendix A – Spearman correlation coefficients matrix



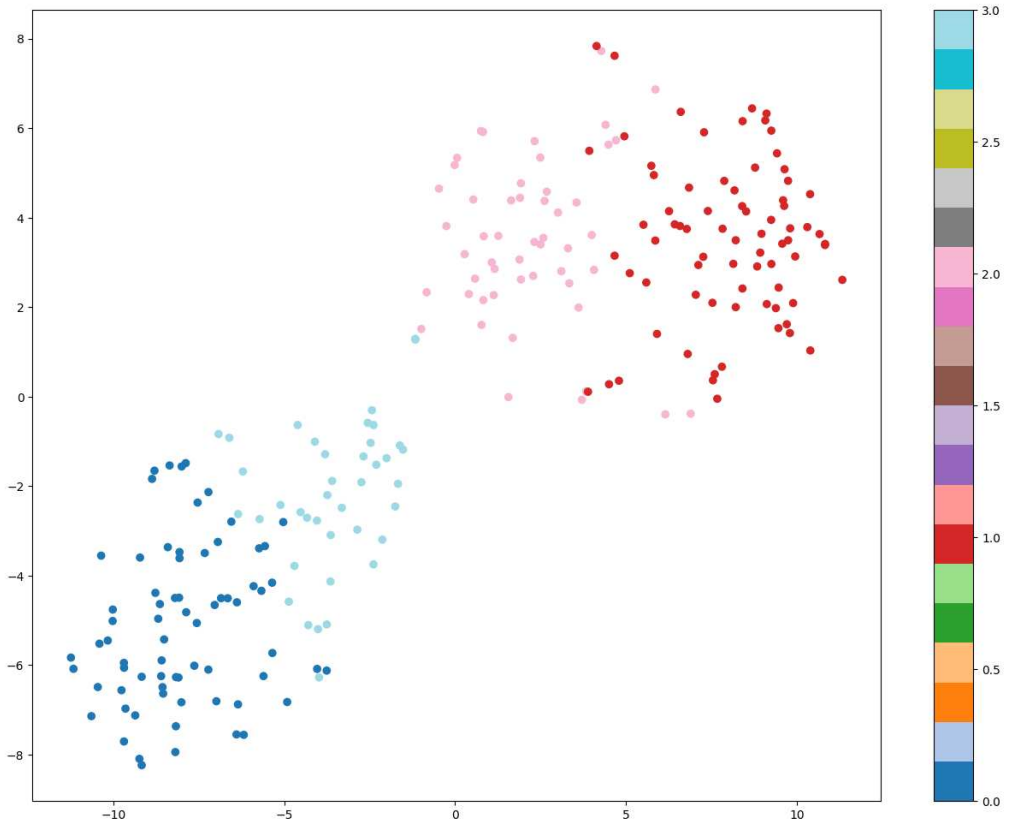
Appendix B – Elbow Method to infer the optimal number of clusters for the survey features K-Means (excluding Demographic features)



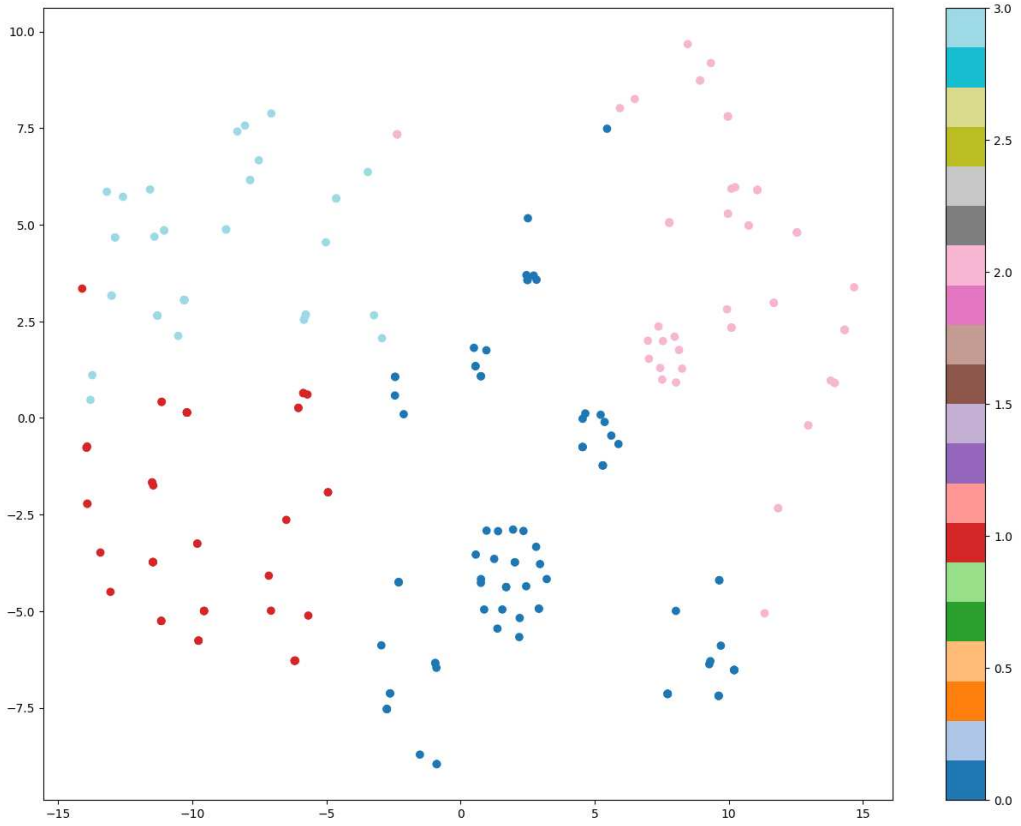
Appendix C - Elbow Method to infer the optimal number of clusters for the Demographic features K-Means.



Appendix D – t-SNE: Survey features (excluding Demographic features)



Appendix E – t-SNE visualization: Demographic features



Appendix F – t-SNE visualization: Final K-Means Clusters