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Individual's Financial Literacy, Pros and Cons of the Digitalization in the Financial Industry within European Union

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Summary

L'educazione finanziaria degli individui e i pro e i contro della digitalizzazione nell'ambito delle scelte finanziarie. Nowadays, the access to Financial Markets is no more in the hands of traditional financial institutions. The emergence of FinTech companies leads to decentralization of the Financial Industry thanks to new digital financial products and services with lower costs for customers than long-established financial institution. Another positive effect of FinTech companies is the increase level of competition that forces traditional companies to innovate their business models and value chain processes.

However, it is "not all that glitters is gold". A decrease in the level of financial market concentration as well as a decentralization of financial industry result also in an increased number of risks (cyber and not) in which retail investors could incur, especially inexperienced, financial and digital illiterate individuals.

The questions for which this work (composed of 5 chapters) tries to give some data-driven answers are related to the above introduction. In particular, the focus is on the Wealth Management services, which sub segments are Digital Investment and (traditional) Financial Advisory segments, in the European Union.

The first two are dedicated to the literature review about the most important literature evidences linked to Digital and Financial literacy of individuals of EU

countries. Moreover, there is a focus on the role of FinTech companies and the tremendous trust placed by people on the majority of these companies. Additionally, there are some evidences that the algorithm employed inherit some of human biases. The third chapter has as outcome a new theoretical model that qualitatively explain the role of several factors (digital and financial literacy; trust placed by individuals on financial institutions, risk tolerance of individuals; the role of investment experience; the role oh human and digital financial advisors; individual's cognitive biases and personal traits) on the final investment decision of a retail investor.

The fourth chapter is about the data analysis and it describes the evidences about the asset managed by Wealth Management services, in relation with the level of digital and financial illiterate people.

The fifth chapter outlines the findings related to the data analysis:

- technology is an enabler and it cannot fully replace human judgment;
- the higher the level of financial literacy, the higher the interest towards Digital Investment services;
- human biases play a role in the final investment decision and the return on investment linked to a choice ("Dunning–Kruger effect");
- the more the number of people with at least basic digital skills, the more is the demand for Digital Investment services; the more is the demand, the greater is the Penetration Rate;
- a country with high share of digital literate people will be more likely to decrease the amount of digital illiterate people in the future.

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Glossary and Acronyms

Wealth Management

Wealth Management is a service provided by financial institutions, such as banks or investment firms, to help individuals manage their money and investments. The goal of wealth management is to help people grow and protect their wealth over time, by creating personalized investment plans that consider their financial goals, risk tolerance, and overall financial situation. This goal ultimately emphasizes wealth creation through wealth preservation. The Wealth Management market consists of two different segments: Financial Advisory and Digital Investment. Digital Investment contains automated investment services (Robo-Advisors) and online trading services (Neobrokers) that go beyond the means of traditional financial advisory services [1].

Financial Advisory

Financial advisory is a segment of the financial market as well as a (traditional) service provided by the financial industry. This service is based on a process of providing guidance and recommendations to clients regarding their financial decisions employing financial advisors. Financial advisors use their expertise and knowledge to help clients make informed decisions about their investments,

retirement planning, taxes, insurance, and other financial matters [1].

Digital Investment

Digital Investment is a segment of the financial market as well as an innovative service provided by the financial industry. It consists of two sub-segments: Robo-Advisors and Neobrokers. Platforms without automated or recommendation-based advisory roles are not included in the Digital Investment market segment. Digital Investment refers to the use of digital platforms and technology to facilitate the buying and selling of financial assets such as stocks and bonds. This includes online brokerages, robo-advisors, and mobile trading apps. The market for digital investment also includes the use of artificial intelligence and machine learning algorithms to assist with investment and portfolio management [1].

Robo-Advisors

Robo-Advisors are private asset management providers who offer automated online portfolios in which private investors can choose investment volumes depending on their scope and appetite for risk [1]. For more details see sec. 2.3.3.

Neobrokers

Neobrokers are a type of online brokerage platform that provides users with easy and convenient access to financial markets, often with low fees and user-friendly interfaces. They have gained popularity in recent years as more people turn to digital platforms for investing. [1]. For more details see sec. 2.3.3.

DESI

The Digital Economy and Society Index (DESI) is a composite index that summarises relevant indicators on Europe's digital performance and tracks the evolution of EU Member States, across five main dimensions: Connectivity, Human Capital, Use of Internet, Integration of Digital Technology, Digital Public Services [2].

DESI Individual Indicator At least Basic Digital Skills

Individuals with 'basic' or 'above basic' digital skills in each of the following five dimensions: information, communication, problem solving, software for content creation and safety [2].

DESI Individual Indicator Above basic digital skills

Individuals with 'above basic' digital skills in each of the following five dimensions: information, communication, problem solving, software for content creation and safety [2].

DESI Individual Indicator Not Even basic digital skills

Individuals without 'basic' or 'above basic' digital skills (digital illiterate individuals) in each of the following five dimensions: information, communication, problem solving, software for content creation and safety [2]. It is the ones' complement of DESI Individual Indicator At least Basic Digital Skills.

AUM

Asset Under Management

UN

United Nations

EU

European Union

OECD

Organization of Economic Co-operation Development

Penetration Rate

Share of active paying digital investments customers (or accounts) from the total population of the selected market for each year. It is the sum of Neobrokers and Robo-Advisors penetration rates

CFA Institute

Chartered Financial Analyst Institute

Chapter 1

Literature about Financial Literacy of Individuals

Everyone has to make a choice. The majority of choices has an impact on individual's wealth. Based on this consideration, each individual should have theoretical and practical tools at his/her disposal allowing each one to opt for the best (perceived) choice according to individual's needs and surrounding environment. Each individual should be able to understand and minimize the risk involved when borrowing or (in a broad sense) investing money to pursue the goal of maximizing its social-economic wealth.

From the point of view of an individual, financial literacy is a powerful tool that could lead people to shape and plan their future, making better choices about when and how to use or to invest their money in a manner that meets their needs. Moreover, it is a complement of consumer protection as well because it helps individuals protecting from excessive risk-taking, fraud, over-indebtedness, or

cyber-risks[3].

Based on those considerations, the aim of this chapter is to collect and present the relevant literature that could explain how an investor behaves according to several endogenous and exogenous factors which could influence his/her investment choice.

1.1 Financial Literacy: Introduction and Definition

The decision made by an individual about undertaking an investment is influenced by several factors. A key factor linked to an investment decision is Financial Literacy: «a combination of financial awareness, knowledge, skills, attitudes and behaviours necessary to make sound financial decisions and ultimately achieve individual financial well-being».

Following the Organization of Economic Co-operation Development (OECD) methodology, individual's financial literacy can be measured through its indicator, which is the sum of the scores obtained by [4]:

- *Financial Knowledge*. It has a score ranging from 0 to 7; it represents the understanding of the basic relationships useful for making financial choices: inflation, interest rates, difference between simple and compound interest rates and risk diversification.
- *Financial Behaviour*. It has a score ranging from 0 to 9; it represents the management of financial resources in the short and long term: setting financial objectives, planning of resources to be used for consumption, bill payments and savings in recent months.

- *Financial Attitude*. It has a score ranging from 1 to 5; it represents the orientation of individuals towards saving, especially precautionary saving, in a long-term perspective.

1.1.1 The role of personal traits

Consistent with the definition given in the section 1.1, individual's personal traits play a role towards investment decisions as well. It has been demonstrated that households with similar social-economic conditions present different rate of accumulation of wealth. This difference cannot be explained only by observed differences in risk preferences because attitudes and soft-skills play a role in a decision to undertake an investment as well. There are some evidences about a positive association between poor personal finances and impulsivity and reduced appreciation of the long-term consequences of current choices.

Another example of the influence of the role of personal traits is financial anxiety: it may reduce the propensity to make financial plans, suggesting that financial anxiety may be intertwined with the feeling of avoidance ¹ and disengagement ² [5]. About this feeling, an important role can be played by human advisors, which can be viewed by retail investor as a sort of "beacon of hope". Indeed, some retail investors prefer to rely on their advisors despite inferior portfolio outcomes (for example potentially reachable changing credit institute or advisor, and so on) since they receive other, less tangible, benefits from their advisor relationship (e.g. advisors increase overall investor comfort with their investment decisions). Despite

¹The will to avoid thinking about the state of one's own personal finance

²The lack of commitment to managing personal finances.

that, it should be taken into consideration that many other factors may impact advisor/client relationship, for example many behavioural biases due to emotion or cognitive limits may be relevant on both the advisor side and the investor side [6]. However, this topic is examined deeply in paragraph 2.3.1.

1.1.2 Financial Resilience tied to Financial Literacy

A further topic worthy of mention is that financial literacy can be another tool to increase household's financial resilience. Financial literacy is inversely related with financial objective variables of individuals as a whole (such as inability to make savings, to face current expenditure, and so on) as well as to individual's subjective financial variables linked to individual's personal traits (such as habit not to make financial plans, and so on). Therefore, it is possible to deduct that a high level of financial literacy (knowing at least the rudimentary topics of finance) can allow each individual to be financially aware, possibly reducing his/her own biases related to irrational choices about consumption, investments and loans: financial skills overconfidence, which leads individuals to underestimate the probability of a negative event to happen as well as to overestimate individual's own capability to react to those events; probability heuristics, which affects probability estimations of an event associating to it similar events experienced by that individual; hyperbolic discount, which influences individual assessment of events because that individual gives more weight to actual events than future ones.

All in all, financial literacy could affect individual's financial behaviour looking also to long terms financial plans and better financial decisions. Avoiding wrong financial decisions could result in a positive effect at the level of population, since government states can have the right level of financial resilience to face (financial) crises. Past

financial crises highlighted individual's costs of having pursued wrong financial choices. As a consequences, when these costs are really exorbitant, impacting on broad (vulnerable) citizens clusters, financial state aids can have serious impact on taxpayers and on state government financial stability [7].

1.2 Financial literacy, Investment Experience and Investment Decision: an empirical model

According to the model shown in Fig. 1.1, financial literacy, investment experience and investment decisions of an individual are mediated by his/her risk tolerance. This model is based on two assumptions: "Financial literacy is positively related with investment decisions due to risk tolerance" and "Investment experience is positively related with investment decisions mediated by risk tolerance". Therefore, an investor with no investment experience as well as no knowledge could face several challenges to do the proper investment and he/she could experience severe losses as a result of not managing properly investment risks. On the other hand, an experienced investor (also with a high level of financial literacy) has a greater ability (than an inexperienced investor) to hold risky investments exploiting a trial-and-error approach: having a diversified portfolio of favourable and unfavourable experiences, that investor can handle properly risky simulation so that he/she undertakes risky investments to earn high returns, being ready to manage them properly [8]. Anderson et al (2015) came to a similar conclusion (learning-by-doing effect): "a favourable self-assessment of one's abilities induces engagement in one's financial decisions, which, in turn, increases both actual and perceived knowledge"[5].

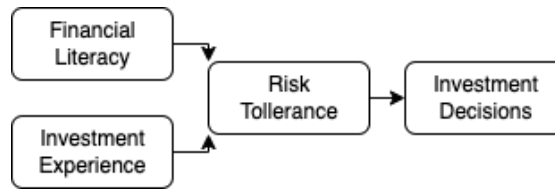


Figure 1.1: Empirical model [8]

1.3 Financial Literacy and Gender Differences

It has to be recognized that financial literacy is not an exogenous factor but that it responds to stimuli and incentives, starting early in individual life. Different papers support this claim and discovered that the level of financial literacy is not equally (or normal) distributed in a given population: there are several reasons for differences in financial literacy levels between men and women. Moreover, gender differences in financial literacy exists among both old and young respondents as well. In addition to that, there is no single explanation that can satisfactorily address these differences as well as several studies on gender gaps in financial literacy show that there are not yet definitive explanations for that phenomenon.

Those gender differences in financial literacy can be observed in a number of circumstances. There are gender differences not only with respect to long-term saving and investment behavior, but also with respect to short-term objectives and behavior. For example, women are found to be more financially fragile (that is, they are less confident about their capacity to handle an unexpected expense). Other example of this difference can be also found in the access to and the usage of financial service: female borrowers systematically get worse credit conditions, even after controlling for risk characteristics and bank fixed effects; financial advisors systematically sell more expensive financial products to women; female bank clients

are more frequently offered expensive bank-owned mutual funds, and are less likely to get rebates on the front loads [9]. This can be linked to some stereotypes that affects women; financial software can inherit from software developer and this will be further explained in section 2.3.1.

Chapter 2

Literature about Fintech and Digital Platforms

A new breed of consumers have arrived. Empowered by mobile, today's consumers can get exactly what they want, instantly and effortlessly. As a result, they are more curious, demanding, and impatient than ever before. For marketers, this means these consumers are also tougher to reach and tougher to please and retain. Therefore, both financial and technological companies should enhance their ability to leverage data to anticipate customer needs; this ability defines their business future in terms of growth overtime, preserving their competitive advantage and minimizing the risk of losing customers (also increase the cost of switching from own financial services and products to competitors' ones) [10]. Indeed, with the improvement of technology, customers are switching from in-person to digital transactions through a complementary effect delivered by the enhanced access to digital banking services, and an enhanced experience of new digital access products,

services, and functionality [11].

The above introduction is to emphasize that there is a change in paradigm in the financial industry driven by the rising of tech companies as well as new customers' behaviour and needs. Therefore, the aim of this chapter is to describe the effect of the not-ended digital transition in the financial sector, the role of tech companies in building trust and the influence on retail investors' financial behaviour with respect to their socio-economics status and their level of digital and financial literacy.

2.1 Financial Technology

Finding and/or stating precisely the definition of FinTech is really challenging because of its broad areas of application and its evolution overtime. FinTech is not only the computerisation on existing 'analog' banking work flows to make them digital (for example, credit or debit cards, ATMs, and so on). FinTech is not only Fast Trading, which is an extreme (online) trading allowing users to do a number of buying and selling operations 24/7 in few seconds. Moreover, FinTech protects consumers from online frauds (deterrent with respect to online shopping). Further, FinTech helps financial advisors in doing wealth management as well as individuals to manage their wealth also through robo-advisors tailored on each customer's needs.

Getting to the point, fintech allows to digitalize bank fundamental business operations as well as financial services and products (saving, lending, investing, paying) providing them directly to customers and/or making the financial system more efficient with new, intangible, low-cost production processes exploiting state-of-art IT technologies and services. Therefore, fintech firms are distinguished because of their

capability to think in a new shape legacy, non optimized processes, compensating asymmetrical information between financial firms and customers, acting as a guarantor of transactions, acquiring new customers (usually considered non-bankable) and managing risks in a structured ways than traditional ones [12].

2.2 From analogical to digital researching process for investments

The analogical way at disposal to an individual to open an investment account was to reach a physical location and to set down with a financial adviser talking about future objectives and financial options. Nowadays, that is not the way people are researching and buying financial products and services (more broadly shopping). The way people are discovering information and narrowing down their options has fundamentally changed towards a digital way of doing it because people expect their shopping experiences to be frictionless, personal, helpful and often in a remote way¹.

According to Google data analysis regarding researches done by users, there is a noteworthy increase in researches (therefore an increased interest) related to financial topics, advises, wealth management, and so on. Indeed, in 2017 there were growths in mobile searches equal to 115% for "retirement calculator" and equal to 75% for "financial advisor" over the past 2 years before 2017. Moreover, mobile searches with the qualifier "should I ..." have grown over 65% in the past two years

¹More generally, nowadays people look to their phones for almost everything (from booking a restaurant to browsing for a new jacket, to learning about their digital banking options); they are looking for ideas and advice, researching every decision they make — no matter how small it is

before 2017, including searches such as “what should I invest in” and “should I invest in ...”. In addition to that, some people still want to seal the deal offline: one out of four investors prefer to open an account in-person, over the phone, or in a branch, but those offline investors are still heavily influenced by digital processes (more than half gathered information online first) [13].

2.3 Trust and Technology

In the financial industry, trust is a fundamental factor for both (private as well as public) financial institutions and (retail as well as institutional) investors. Nowadays, a key tool to pursue the objective of increasing perceived trust is technology: it allows advisers and managers to offer more transparency to investors (information can be accessible everywhere at anytime); simplifies access to markets and products; can better align products or services offerings with clients’ needs through personalization.

The role of technology to develop and enhance trust in the financial services industry continues to grow. Indeed, retail and institutional investors consider technology as a tool through which trust not only can be instilled but also can be multiplied. This consideration finds a match in the results shown in Fig. 2.1 of different surveys made overtime: 50% of retail investors and 87% of institutional investors said that the use of technology in financial services increases trust in their financial adviser/asset manager, a trend that has steadily risen over recent years [14].

HOW HAS THE INCREASED USE OF TECHNOLOGY IN FINANCIAL SERVICES CHANGED YOUR RELATIONSHIP WITH YOUR FINANCIAL ADVISER/ASSET MANAGERS?

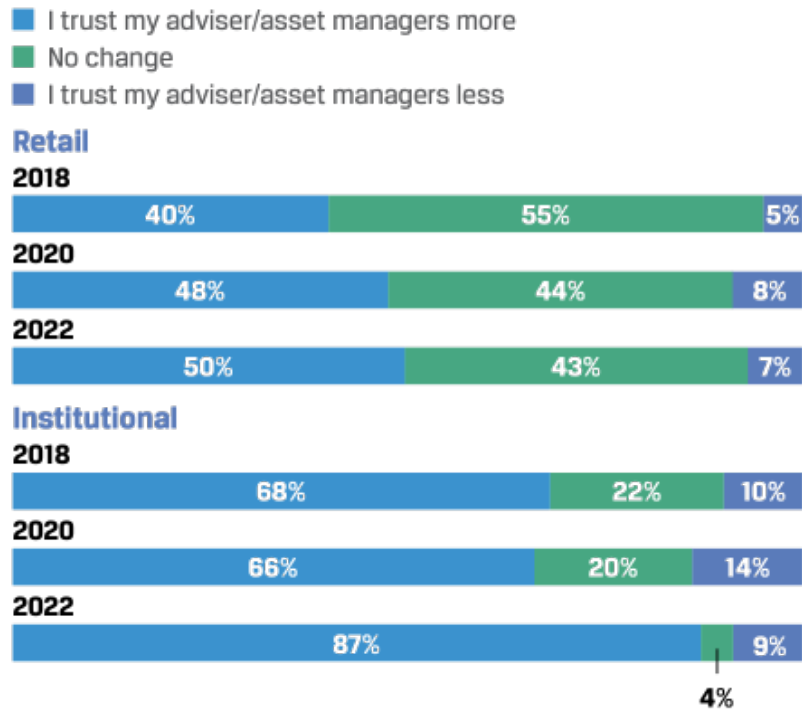


Figure 2.1: Relationships with financial advisors overtime [14]

2.3.1 The Role of Tech Companies in Improving Trust

Although technology and human expertise are both important components to build trust, technology plays an important role in improving as well as generating trust. Indeed, 90% of institutional investors believe retail trading tools, financial apps and services increase trust in financial markets.

Given the high trust in the technology industry generally and the benefits to investors of financial technology, it is not surprising that 56% of retail investors would rather invest in a new investment product and/or financial service created

by a large technology firm (for example, Amazon, Google, Alibaba, Apple², and so on) versus one created by a financial institution [14]. This shift from trusting old-fashioned banks with great-looking buildings towards digital neo banks, tech companies and brands that provide the best user experience, the best value, the best (perceived) transparency and ultimately, can help them reach their financial goals started in 2008. In that year began the worldwide financial crisis, started with the bankruptcy of Lehman Brothers. That crisis was terrible for the financial industry reputation of trust; this is especially true for the younger generations (millenials, gen-z, and so on). By the way, this observation is slightly different from the perspective of institutional investors, because among them — who are themselves part of the investment industry — only 37% favor a technology firm product [15].

Apple card and Savings

In April 17th, 2023, Apple Inc. launched its last and new financial product "Savings", which is a saving account co-launched with Goldman Sachs. The account cannot be opened by everyone because an "Apple Card" is required (and obviously to get an Apple Card you must have Apple Wallet, which in turn need an iPhone and/or an Apple Swatch [16]). With this new financial product, Apple Inc. wants to offer to its (potential and already) customers³ a saving account which offers a high-yield APY of 4.15 percent (a rate that is more than 10 times USA national average), no

²Later in this section, Apple Inc. financial products and their impacts on customers (and investors at the same time) are described, since in March 2023 it launched a saving account jointly with Goldman Sachs Group, Inc.

³Most of Apple's customers are also Apple's fans, so the 'brand' Apple has a strong fidelization as well as a high level of trust [17].

fees, no minimum deposits, and no minimum balance requirements⁴, where inflows of cash are automatically deposited into the account. This financial product is embedded in Apple's financial service "Apple Wallet". Indeed, users can easily set up and manage their financial account directly from Apple Card in Wallet [18]. In addition to that, thanks again to Wallet, customers can also make either an online or a physical payment having the opportunity to split purchases into four payments, spread over up-to six weeks with no interest and no fees [19].

Looking back to Apple Inc. business decision, it is possible to observe that this company is no more only a tech company selling hardware devices carrying Apple's software; it still makes most of its money selling devices, but as it gets deeper into the digital services business. Starting from a few years back, among these supplied digital services, this company is also embracing the financial industry and its customers, shifting from a pure tech company towards a fintech company. This shift towards new ways of business is mostly due to two strong factors of which Apple is really conscious. The first one is that Apple has considerably more global reach and consumer trust than most banks (both traditional and not). The second one is the power of its brand (and the trust linked to it), which is most powerful than every other bank [20]. Indeed, Apple Inc. raised nearly \$1 billion in deposit by its customers in only the firsts 4 days after the launch in the market of Savings [21].

Therefore, Apple Inc. is starting to act and think such a bank, exploiting the fact of supplying financial services with a devices which is touched by its users more than 2,600 times a day (that is not the same connection that a consumer can get

⁴These are true at the time of the last access to those information: May 15, 2023.

walking into a bank branch). The dark side of all of this is the closed ecosystem of Apple (once in the ecosystem, users might find it hard to leave) as well as the absence of severe regulation like the ones imposed to pure financial companies in favour of customers.

Another interesting fact about the difference in the way of behave between Apple (and in general tech companies) and traditional bank is the different way of looking to money. Apple Inc. actually funds the loans largely from its own balance sheet, which had a hefty \$165bn in cash and marketable securities as of the first quarter of 2023, with total debt of \$111bn. This ratio sits in contrast with most banks, which do their daily business with 90% or more borrowed money form their customers (or, in a broadly way, creditors). Indeed, much of that debt consists of deposits and short-term loans that can be withdrawn quickly (his is exactly what we witnessed during the Silicon Valley Bank meltdown). About this consideration, Anat Admati⁵, who has long called for higher levels of equity funding of banks, affirms: “Bank CEOs sometimes forget that depositors are creditors because depositors don’t behave like normal creditors, instead trusting deposit insurance, and maybe regulators, to make sure they will be paid. Non-banks wouldn’t dream of, and wouldn’t even be able to, fund their business with so much debt and so little equity.” [20].

Another noteworthy fact, regarding the perception of transparency of Apple’s customers and the level of trust believed by them in Apple, is about Apple Card credit line experienced by two EU customers and spouses as well. The two spouses have similar wealth conditions, indeed they have been married for a long time, fill joint tax returns and live in a community-property state. The unique difference is

⁵Economist and currently the George G.C. Parker Professor of Finance and Economics at Stanford Graduate School of Business [22].

that the wife has a higher credit score than the husband. Nonetheless, according to Apple's black box algorithm, the husband deserves 20 times the credit limit she does. Indeed, the wife was denied a credit line increase for the Apple Card, despite having a higher credit score than him. After this news (or better said, a tweet), dozens of people shared through social media similar experiences, including Apple co-founder Steve Wozniak, who indicated his credit limit is 10 times that of his wife. After these facts, New York's State Department of Financial Services, started an an investigation the Apple Card algorithm over claims of discrimination based on gender biases. The bottom line is that with the spread of automation, more and more decisions (from credit approval to medical care to hiring choices) are algorithm-centric; sometimes is only an algorithm that makes a choice. The algorithms that make these judgments are programmed by people and thus often inherit human biases, unintentionally or otherwise, resulting in less favorable outcomes for women and people of color. But the public, and even companies themselves, often have little visibility into how algorithms operate [23].

2.3.2 Mobile App

The use of mobile apps by people has led to an increased demand for other and new digital services and the rise complementary effects between smartphone and tablet use of them. Due to a number of financial mobile apps, there is more competition within the financial industry with respect to some years ago They also report that mobile phone and tablet users are less likely to pay credit card fees [11]. Retail trading apps are fundamentally changing how users interact with financial markets (in wider terms, with all the markets), because they increase access to all sort of - good and bad - information, investing tools and financial

services. As can be seen in Fig. 2.2, this evidence is especially true in millennials population because this generation is the most digitalized and has the highest level of trust towards retail apps. Another important fact is that this generation strongly believes in the phenomena of digital nudge⁶. Overall, thanks to apps and platforms at disposal of a click/tap, retail investors express an increase in trading frequency (once again, this is expressed especially by millennials). In terms of disclosure and information provided, 80% of retail investors aged 25–34 affirms that they trust the completeness and accuracy of information on trading apps, and 87% of those investors asserts that these apps increase their understanding of investing. in the whole population aged 25 - 54, it is possible to observe that at least more than half of them trust financial apps, has a trading account and trades in financial markets with an higher frequency than pas years [14]. This behavioural change of people

| | Total | 25-34 | 35-44 | 45-54 | 55-64 | 65+ |
|---|-------|-------|-------|-------|-------|-----|
| Has retail trading account | 54% | 68% | 66% | 52% | 38% | 37% |
| Trust in digital nudges | 74% | 92% | 86% | 72% | 51% | 33% |
| Retail tools/apps enhance understanding of investing | 71% | 87% | 82% | 66% | 49% | 36% |
| Trust the completeness and accuracy of information from retail apps | 61% | 80% | 73% | 55% | 33% | 25% |
| Retail tools/apps increase frequency of trading | 57% | 75% | 73% | 56% | 28% | 10% |

Figure 2.2: Retail investor characteristics by age [14]

regarding financial markets is not only due to a technological reason. Looking back to the past years, the act of trading something in the financial markets was

⁶A subtle form of using design, information and interaction elements to guide user behavior in digital environments, without restricting the individual’s freedom of choice [24]

characterized by technological constraints (difficulties in obtaining near-real time information about prices; trading only via either phone or physical bank branch; delay to fulfill an order that impacts the final price of what an investor chose to buy) and financial barriers (expensive trading fees and significant amount of money to invest) [25]. Starting from 1990, it was taking place the digitalization of of the financial industry. As a consequence of digitalization, those technological and financial constraints have been overcome year by year. Thanks to online trading, financial institutions and brokers at first, retail traders last, experienced as the years go by ease in obtaining useful, near real time information and a decrease in trading and commissions fees [26].

Robinhood Markets Inc.

Regarding what stated before, an interesting case to mention concerns Robinhood Markets Inc. Consistently with its stated mission («democratize finance for all [...] make investing friendly, approachable, and understandable[27]»), it is a financial technology company that operates an online discount brokerage with commission-free trading. Its brokerage services are provided through both web- and mobile-based financial services platform that retail investors can use to buy and sell stocks, exchange-traded funds (ETFs), options, American depositary receipts (ADRs) and allow investing in certain crypto-currencies [28].

As claimed in Robinhood Market Inc. mission, the democratization of financial markets does come down to only lowering investment costs. Indeed, the company supplies a simple, friendly. approachable and understandable which can be downloaded easily with a smartphone. The user experience is strongly based on the digital nudge theory⁶ that makes the app very simple to use. The simple user

interface provides cognitive ease to retail investors, leading them to rely more on their intuition and less on critical thinking.

The simplicity of Robinhood's app guides investor attention for two reasons. First, the app prominently displays lists of stocks in an environment relatively free of complex information (e.g., besides basic market information, Robinhood only provides five charting indicators, while TD Ameritrade provides 489). This streamlined and simplified interface one of the invisible (to users) nudges that guides the choices of Robinhood users. Second, the Robinhood app makes it very easy to place trades and the reduction of frictions increases trading (another invisible digital nudge towards financial investments) [26].

A further interesting fact that creates synergy with the simplified information displayed in the platforms is the so-called «Herd Behaviour», which is a form of convergent social behaviour that can be broadly defined as the alignment of the thoughts or behaviours of individuals in a group (herd) through local interaction and without centralized coordination [29]. The effect of this behaviour on Robinhood users has been analyzed by Barber et al. (2021) taking into consideration the "Top Mover list": a list of only 20 stocks that changes every day (and throughout each day), where a user can watch inside it the stocks with the largest absolute percentage price changes from the previous day close as well as stocks above \$300 million in market capitalization. They have found that Robinhood users are more likely than other investors to be influenced by attention-driven stocks buying, that is, they are more likely to herd than other investors: 35% of net buying by Robinhood users is concentrated in 10 stocks compared to 24% of net buying by the general population of retail investors. Therefore, an increased attention-driven buying of stocks leads to more concentrated trading by Robinhood users than other retail

investors and contributes to buy-side herding events⁷ that are usually followed by negative returns. For example, the top 0.5% of stocks bought by Robinhood users each day experiences negative average returns of approximately 5% over the next month. More extreme herding events are followed by negative average returns of almost 20%. Another interesting observation about the top mover list is that Robinhood users are more likely to buy stocks with market capitalization between \$300 and \$350 million that are in the top twenty stocks when sorting on absolute return than stocks with similar absolute returns but market capitalization below \$300 million. And so, displaying information is another digital nudge which affects investors' trading behaviour.

A further characteristic of Robinhood platform is about making the act of investing as a (fun) game through features available within the web and app platforms. As a consequence, new and inexperienced investors could be attracted by those features. However, some believe that Robinhood over-emphasizes the fun of trading at the cost of good investment practices⁸. A feature which reflects that characteristic is the introduction of a lottery ticket: after the enrolment, new users get a free share of stock but only after they scratched off images that looks like a lottery ticket. All in all, Robinhood features, strategy and platforms resulted in a strong customer acquisition (13 milion of enrolled users until 2020). More general, this kind of platform had a positive influence on market participation. Nonetheless, the influence of Robinhood platform on retail investors' trading behavior is an open question

⁷Herding event: a day when the number of Robinhood users owning a particular stock increases dramatically [26].

⁸In 2020, Massachusetts state regulators filed a complaint against Robinhood citing its "aggressive tactics to attract inexperienced investors" and "use of strategies such as gamification to encourage and entice continuous and repetitive use of its trading application." [26]

(especially in the long run), because half of Robinhood users are first-time investors, who could potentially benefit from participating in financial markets. Robinhood attracts investors by reducing frictions and promoting simplicity. While a lack of frictions encourages market participation, it also makes speculative trading easy, which can lead to low investment returns. Even though the financial industry uses complexity to obscure risks and costs (promoting instead potential profits), simplicity is not problem free. Simply focusing the attention of many investors on a small number of stocks it is possible to promote herding behavior that affects market returns and redounds to the investors' detriment. Thus, while it is important that investors have access to transparent, pertinent information, disclosure alone is not sufficient to assure good retail investor outcomes; how information is displayed influences decisions in ways that can both help and hurt investors [26].

2.3.3 Financial Consultancy: Software Advice and The Role of Human Being

Starting from the 90s, the use of Internet (in the broader sense of the term) and its exploitation in the financial sector began with showcase web sites (that is, making available online the same offline information, documentation, etc.) up to entering into the social web⁹ phase (which does not only means advertising on social media platform, but creation of social media contents, exploitation of influencers, partnerships with digital news companies, and so on). All of these things implies also the supplying of product and services tailored to more and more smaller,

⁹The social web is defined by the relationships and interactions people have through the Internet, but also includes the actual websites, software, hardware and systems that are designed, created and launched to support that interaction [30].

targeted clusters of customers as well as products and services make only for online distribution. Therefore, the (not finished yet) digital revolution of the financial industry does not only impact the "bureaucratic" tasks and "analogical" processes behind the day-to-day operations of a financial institution (storage of information, remote services, ATMs, etc.), but also the financial consulting value chain (Fig. 2.3) and the role of human interactions in this process. Indeed, this revolution does not necessarily imply the complete replacement of human consultants, but rather they work with a multi-channel mindset (internet is another tool for their job). In short terms, the digitalization of the financial sector does not only mean the substitution of a human consultant with a digital consultant, but rather it means also the necessity to supply new, value-added services to investors with the requalification of the human being in terms of soft-skill and tools employed.

Going into more details, the digitalization introduced in the financial industry lead to the automation of the consulting process depending on the needs of a generic user of the software:

- *Robo Advisor*. It is a software solution addressed to retail investors and can be tailored depending on the target cluster of customers. In this perspective, internet is a pillar to access this kind of service. However, there are two types of Robo Advisor:
 - *Fully Automated*. It is characterized by the absence of a human, third-party advisor; a customer is assisted from the consultancy of contract obligations, to the advice process of financial products in line with customer's profile, until the payment process and, potentially, in wealth management.

- *Hybrid Automated*. It is characterized by the coexistence of a software and human being interaction; a customer is advised/supported along the financial consulting value chain by both of them in an alternative or combined way.
- *Robo4Advisor*. In this case a financial software is employed as a supporting tool for human financial consultant in the required phases of the consulting process starting from the collection of customer's information, to the elaboration of these for the purpose of adequacy assessment, asset allocation and portfolio selection, to, eventually, formulation of the financial proposal and negotiation, optionally, portfolio rebalancing and customer relationship management over time [31].

Robo Advisor, Robo4Advisor and Traditional Consultancy: differences and complementarity

In this section it is presented several pros and cons of the Robo Advisor service and it is compared with the traditional consulting service (that is, financial consulting service with a physical consultant) on different topics.

As stated above, the Robo Advior is software applied in B2C models. This implies that the supplied services are focused on retail investor's needs, that is financial consulting of products and/or wealth management. The financial products supplied to customers are shares of Exchange Traded Funds¹⁰ and Mutual Funds¹¹ which usually does not include products related to the company supplying the digital

¹⁰For more information check: Exchange-Traded Fund (ETF) Explanation With Pros and Cons

¹¹For more information check: Mutual Funds: Different Types and How They Are Priced

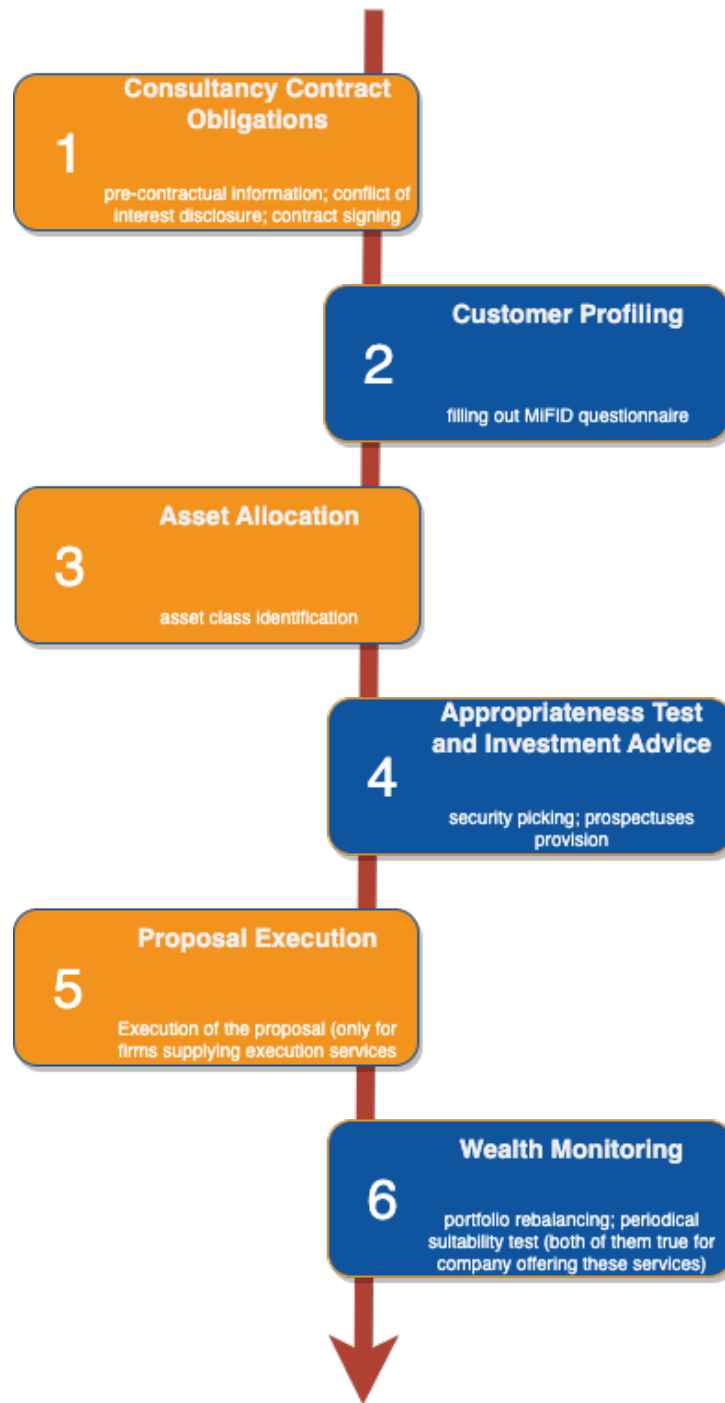


Figure 2.3: Financial Consulting Value Chain [31]

service/software.

In terms of costs linked to the consulting service offered to customers, the price of fees charged depends on the type of service provided, type of products, business model of the company, etc. Overall, the fees applied to the assets under advice range from 0.3% 0.7% yearly and, in addition, there customers could also face performance fees, underwriting fees, and so on. By the way, comparing the traditional consulting process with a Robo Advice service, the latter is competitive in terms of fees charged because they are lower than the ones of a traditional consulting service [31]. It is interesting to observe the result shown in Fig. 2.4 of a 2018 survey on types of investment choices of Italian households: 37% of surveyed investors believe that consulting services are free services and 25% do not want to pay for this service; 45% of surveyed investors do not know whether consultants are compensated and 25% do not want to pay for this service [32]. Since it is reasonable to extend the qualitative results¹² to the worldwide population, it is possible to affirm that Robo Advice is potentially a competitive services in a domestic scenario (which is characterized by a low propensity of small investors to pay for consulting services) with respect to the traditional financial consultancy.

Another crucial factor that guides the choice of a retail investor to opt for a traditional or Robo Advice consultancy is the amount of wealth at disposal of an investor and the minimum thresholds of money needed to invest. Robo Advice services are really accessible by any kind of investor. Indeed, the minimum amount of money set as threshold to invest is below 20,000 € and sometimes there are not thresholds at all. On the other hand, this kind of financial service is not the best

¹²Pay/not to pay consultants, and so on.

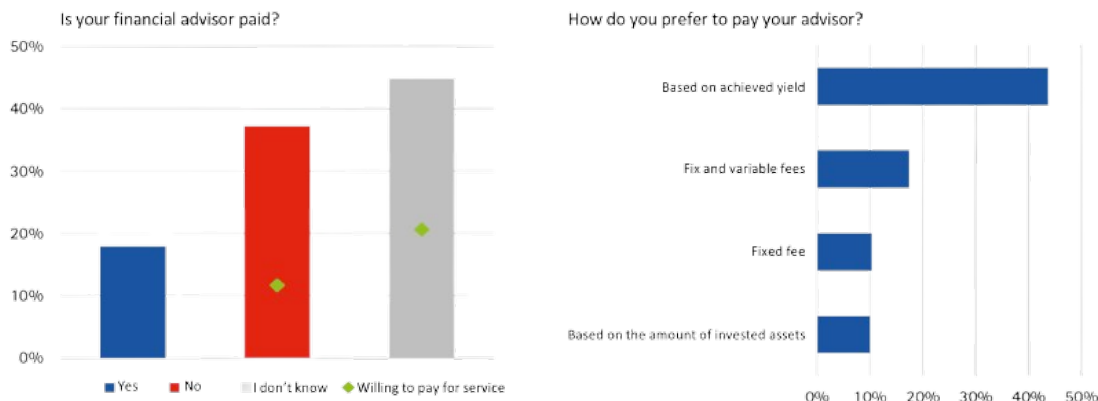


Figure 2.4: Willingness to pay for financial consulting services [32]

choice in cases where the minimum wealth amount at disposal is at least 50,000 k€. The other distinction and advantage of Robo Advice with respect to "traditional advice" is accessibility of the service: retail investors (with slightest digital knowledge and internet access) can use the digital service without any time and physical restrictions. Often, the user experience of the digital service is smoother, charming and easy to use. Therefore, the success factors seem to be linked to the functionality and usability (strictu sensu) of a digital platform¹³ as well as the financial operator which provides the digital service rather than intrinsic characteristics of the supplied service. However, the automatized financial consulting service is little known for the majority of Italian retail investors (87%), whereas 85% of them are not very interested in using it mainly due to potential online scam. Further, 15% of surveyed investor are interested in it; they are mainly men with high levels of education and financial literacy and/or young people with a high level of digital culture (statistically, young people have more competencies than people

¹³It is possible to find out more about the role of Robo Advisor usability in De Bernardis et al. [31].

over 50) [31]. However, it should be taken into account that these results are the outcome of a survey carried out by CONSOB on Italian investors conducted in 2016 [33]. so the propensity to seek for robo advice services changed during the past years towards more propensity to use this financial service. Indeed, according to the results contained in Fender et al. (2022) [14], where they track the relative importance of technology overtime, they claim that: «Although technology and human expertise are both important components of trust [...] for the first time since our research began, more investors believe that in three years, access to technology platforms and tools will be more important to them than the assistance of a human being (Fig. A.1, ed). This is the case in 12 of 15 markets globally» [14]. Even though the Italy is not included in the markets analyzed (but some of the European markets are within), it is reasonable to affirm that also in Italy (more broadly, in the European Union) people have more faith in robo advisors (more generally, in fintech platforms) than previous years. Probably, this mindset change is also due to a generational shift because more than 70% of millennials prefer technology platforms and tools over having a human being to help navigate their investment strategy, compared with just 30% of those 65 or older [14] (a result that is in line with the 15% of questioned Italian retail investors).

Despite that, it must be mentioned that the the use of technology and the phenomena of increasing trust in technology have not changed the need for human advice. Indeed, as it is shown in Fig. A.2, around 75% of people questioned strongly trust a human adviser with respect to a Robo Advisor (and this percentage did not change since 2020). This can be explained because technology is only a tool that cannot fully replace human judgment and experience. Instead, technology can be seen as a

complement (and internet the enabler) of a financial service that financial institutions have to exploit to provides customers with a comprehensive financial service [14]. Therefore, in line with the results of Debernardis et al. [31], web channels (Internet Banking, Mobile App, and so on) are tools that enable and boost the interaction and proximity of a human financial consultant with customers, guiding them towards the best financial products. From these considerations, it becomes evident the key role of human advisor in the financial consulting process, which has to be professional and technically qualified (better if he/she work for/with a trusted financial company) as well as endowed with good relational soft-skills. The latters are the crucial elements that an investor takes into account in choosing an advisor (both among human advisors or human being against robo advisors). Further, relational soft-skills positively influence investor's opinion about the (perceived) quality of the financial services he/she received. The most important are: be the center of attention of his/her human advisor and perceiving the availability of financial consultant (these factors increase trust of investors on financial products recommended) [31]. These results are consistent with several CONSOB reports and Fender et al. [14] which claims also that the 58% of questioned retail investors value an adviser with economic intuition and market experience over a financial consultant who is data-driven with a highly quantitative skill set. These are the added characteristics of human advice that, when paired with technology, can improve investor outcomes [14].

Influence on Investment Decision of Advice Source

To conclude the chapter, this section is about the influence of financial advise on investment decisions made by a given investor and the probability to follow them.

Generally speaking, the likelihood that a retail investor follows some financial advice does not depend on the source of the recommendation (human versus robo advisor versus non-professional people¹⁴) but rather on the alignment between the self-directed choice made before receiving the advice and the recommendation subsequently received. Specifically, the propensity to follow the recommendation of an advisor (either human or robo) increases if the advice confirms individual's own beliefs about her/his investment that potentially will be undertaken. This behaviour might be explained by referring, among others, to individuals' attitude towards the so-called 'confirmation bias' [6].

As already mentioned (implicitly and explicitly) in this work, trust (in a broader sense) is a key factor that influences investment decisions and it can be declined in different contexts. First of all, a potential retail investor has to have trust in financial institutions, must have a bank account and, to open it, he/she has to rely on the chosen bank. There is no guarantee about the latter fact, indeed it is sufficient to say that in 2022 the 4% of adult European citizens, a non negligible part, does not have any kind of bank account - i.e., unbanked - and some of them does not trust financial institutions [34]. These are necessary but not sufficient conditions that can lead an investor to undertake any kind of financial products or service. Trust in financial system and in financial intermediaries plays a crucial role in many stages of an individual's investment decision making. It prompts stock market participation as well as the demand for human financial advice. Trust is also a heuristic allowing investors to make choices that are based on subjective expectations and on 'proxies for trustworthiness' (that is, an unconscious

¹⁴This term has to be intended as recommendations coming from relatives, a partner, friends, social media contents generated by human beings, and so on

psychological workaround that an individual puts into action to come to conclusions quickly and effortlessly) rather than on true and detailed information. In other words, this behavioural phenomena can be described as the confidence of a person based on personal relationships, familiarity, persuasive advertising, connections to friends and colleagues, communication and schmoozing which leads investors to rely human financial advisors which may appease their anxiety and help them to undertake the (potentially) proper investment [6]. However, financial advisors (both human being and robots) could not be always the first choice as in the case of Italian citizens. According to a report conducted by CONSOB in 2017 on Italian households¹⁵, seeking advice from a financial consultant is not always the first choice. Indeed, the largest portion of Italian retail investors seek financial advice from relatives and friends whereas only 20% of retail investors relies on professional financial consultants; instead, 28% of Italian investors makes financial choices on their own [31]. It is interesting that these results can be integrated with the outcomes coming from the experiment conducted by Alemanni et al. (2020): trust is positively correlated with financial literacy, which in turn some studies found to be positively associated to financial advice seeking from any kind of financial advisor, ed.) whereas exists a negative mismatch between perceived and actual capability (which leads to the so called overconfidence) that discourages financial advice seeking. Furthermore, the higher the level of digital literacy¹⁶ owned by

¹⁵Even though this survey is conducted within Italian context, the qualitative results can be considered true for the worldwide population

¹⁶According to UNESCO, Digital literacy involves the confident and critical use of a full range of digital technologies for information, communication and basic problem-solving in all aspects of life. It is underpinned by basic skills in ICT: the use of computers to retrieve, assess, store, produce, present and exchange information, and to communicate and participate in collaborative networks via the Internet [35]

a person, the greater the probability that person will follow the financial advice from both human and robo advisor. This can be explained by the fact that digital literacy might result to be a key driver in the propensity to rely on robo advice and on digital financial services in general. For instance, individuals' cultural attitude towards innovation is a key factor in shaping investors' attitudes towards automated advice. In addition, it is not demonstrated that exists a correlation and/or causation between digital literacy financial knowledge, as shown by empirical evidence relating both adults and youth population, reported by OECD in 2017, 2018 and 2020.

Other elements (previously mentioned) that contributes to build trust in investors and lowers the risk of under and/or over confidence are: educational, financial and digital capabilities; the ability of an individual to recognize his/her biases (which is the difficult thing to train and to put into practice). These elements have an impact on investor's source of the given financial recommendations/information as well as on the investment choices; about that, Alemanni et al. (2020) describe two distinct behavioural phenomena. The first one is that the probability to follow recommendations from the advisor (either human or robo) increases if the recommendation confirms individual's own beliefs about her/his investment strategy and portfolio of choices, independently from individuals' level of financial and/or digital literacy. They suggests also that this behaviour might be explained by referring to individuals' natural tendency to selectively listen to people (or, in general, relying on sources of information) that confirm their prior ideas or outcome made before seeking for advice from an advisor (the so called confirmation bias). Instead, the second behavioural phenomena could slightly depends on individual's level of digital and financial literacy. Indeed, they observed that when the self

directed choices and outcomes do not coincide with the outcomes recommended from the advisor (human or robo), the source of the advice does play a role in the final outcome. In this case participants, who are supposed to have not been able to correctly assess their risk profile and have poor digital and financial knowledge, are more likely to follow the recommendation received from a human advisor and less likely to follow the advice received from a Robo Advisor [6]. However, it is useful to mention that this behavioural study does not take into account the digital nudge effect which could increase the probability to follow the recommendations provided by the Robo Advisor.

Up to this point, it is described the different investor attitude approaching a human versus a robo advisor, but it is worth to mention that the gender of the human advisor could enters differently in the decision process of female and male investors to follow the financial advice received. Considering male versus female human advisor, it seems that a weak influence could exist depending on the investor gender according again to Alemanni et al. (2020). They mention that women are more likely to follow the financial advice provided by a female advisor, compared to the advice given by a male advisor; instead, men are less likely to follow the advice provided by a female advisor compared to female participants. However, the significance of the latter result is weaker when compared to the probability to follow the advice provided by a human (either man or woman) or a robo financial advisor [6].

Chapter 3

New Theoretical Model

After having depicted the relevant literature regarding socio-economic factors, digital and financial literacy of individuals and the role of FinTech companies in the financial industry, the aim of this chapter is to make a synthesis of the covered topics, exposing a new model that could explain qualitatively the role of each element that affects the final decision of an investor. The mentioned model is the one represented in Fig. 3.1 and it is based on empirical evidences related to the above literature. The basic purpose of this model is to provide a simple map that can explain which factors affects (the most) the final investment decision of an individual. The arrows in the map have to be interpreted as a link (in the broader sense), not as a hierarchy and as one-way arrows.

If there will be discovered new evidences, the model can be developed further more in the future (indeed, this is not the scope of this work); for example, adding other connections, defining new influences, establishing a correlation value among the elements, and so on. Potentially, it can be developed further up to the point in which it can act as an algorithm-like where either a business unit or a research entity

collects some inputs of a cluster of potential customers or individuals (investment experience, financial literacy, digital literacy, risk tolerance, amount of capital to invest, trust and personal traits, and so on), adds the type of consulting service offered and eventually it obtains a sort of portfolio of financial products which suits more with the given customer/individual.

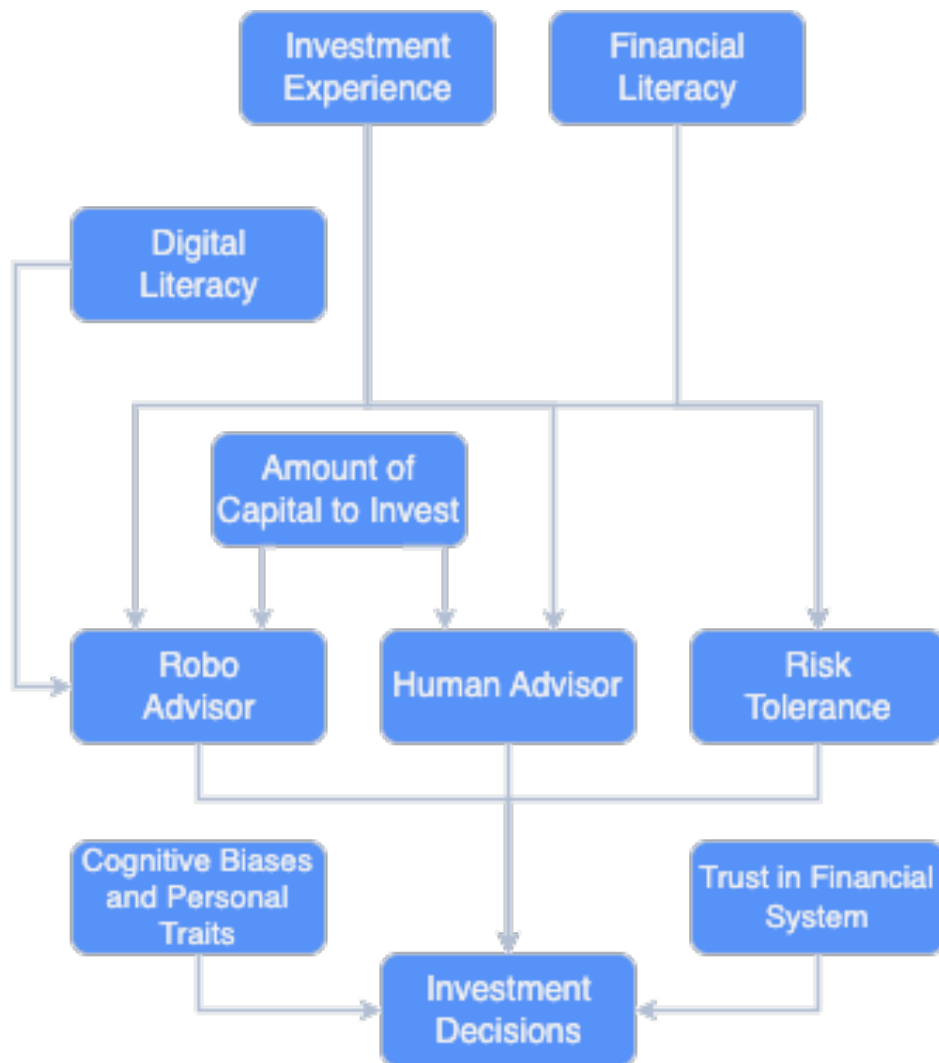


Figure 3.1: New Empirical Model

Financial Literacy Let's consider the definition of Financial Literacy given in section 1.1: «a combination of financial awareness, knowledge, skills, attitudes and behaviours necessary to make sound financial decisions and ultimately achieve individual financial well-being». Therefore, the reason behind this decision is that Financial Literacy, better said Financial Knowledge, is a necessary but not sufficient condition so that an investment decision is undertaken by a retail investor. For example, even if an individual has a financial advisor, to understand what the financial advisor suggests, he/she has to know at least what is an investment. Moreover, financial knowledge is the foundation to make a financial plan and to understand short/middle/long period investments as well.

Investment Experience The more a retail investor chooses to undertake investments, the more that investor will be confident with his/her risk tolerance.

Trust in Financial System To undertake an investment, a retail investor has to trust his/her bank, advisor (professional or not), and so on. As a matter of fact, 12% of the citizens of Romania do not have a bank account because of lack of trust in financial institution [36].

Risk Tolerance The level of risk tolerance affects the type of investment undertaken.

Human Advisor The type of financial advisor (professional or not) and the level of trust placed with that advisor influence retail investor's investment decision.

Robo Advisor The digital nudge and the algorithm used by financial platforms influence the choice of retail investors.

Digital Literacy The higher the level of Digital Literacy, the higher is the probability of an individual to use a digital platform to undertake an investment.

Cognitive Biases and Personal Traits Human biases affects (positively and negatively) human decisions, even those related to financial topics.

Amount of Capital to Invest The amount of money at disposal to invest influences the type of investment of an individual.

Chapter 4

Data Analysis

The aim of this chapter is to show some relevant data, insights and trends related to the EU-27 market. The data presented are focused on the 'consumer side', i.e. the effect of some elements presented in Fig. 3.1 on the final investment decision (understood as yearly Average Asset Under Management (AUM) of retail investors which subscribe a Wealth Management service). Since the data are collected considering a consistent sample size (which in turn allows to represent the population under analysis), these data shown in this chapter are aggregated at a country level, and they were collected, merged and processed through Microsoft Excel; the data were extracted from several database:

- *Wealth Management services.* They were taken from the platform "Statista.com" [1]; they represent the Wealth Management service in the European Union market. They are based on gross revenues, Assets Under Management, wealth management customers and advisor data of relevant services and products offered within the Wealth Management market; moreover, they are based on data from the following institutions: International Monetary Fund, World

Bank, United Nations and Eurostat. The time range considered in this work is between 2011-2027;

- *DESI*. It is an indicator calculated as the weighted average of the five main DESI dimensions. To represent the level of digital literacy of EU countries, the DESI Human Capital dimension was taken into account. In particular, were collected data about people with at least basic digital skills (DESI Individual Indicator At least Basic Digital Skills) and people with digital skills above the basic digital skills (DESI Individual Indicator Above basic digital skills). The time coverage goes from 2017 to 2022 [2];
- *The Global Findex Database 2021*. It is the source of data on global access to financial services (from payments to savings and borrowing) provided by The World Bank. This database is based on 4 years: 2011, 2014, 2017 and 2021[36].
- *Monitoring financial literacy levels*. The outcome of interest is the Financial Knowledge results¹ (defined as Number of correct responses to the five proposed financial knowledge questions). The survey was conducted in 2023 and the target population were 18+ years EU [37];
- *Overall Financial literacy of Italian adults*. The data collected represent the aggregated indicator of the level of Financial Literacy of adults in Italy. They are based by the results coming from the surveys conducted by Bank of Italy in 2017, 2020 and 2023², according to OECD methodology defined in Sec. 1.1.

¹Note that these results does not follow the methodology defined by the Organization of Economic Co-operation Development and mentioned in section 1.1

²In the 2023 survey, there was a change to the metric used to measure attitudes, compared

Note that each single indicator and its description are explained in the paragraph Glossary and Acronyms.

4.1 Level of Digital Literacy of European Citizens

To track the level of Digital Literacy in the EU, the European Commission established the DESI indicator. For the purpose of this work, among the DESI's dimension, the focus is on the Human Capital dimension. This dimension is composed of several sub-dimension indicators. The focus of attention is on DESI Individual Indicator Not Even basic digital skills which depicts the percentage of "digital illiterate" individuals per each country (Fig. A.6). This indicator is derived from two other indicators: DESI Individual Indicator At least Basic Digital Skills and DESI Individual Indicator Above basic digital skills; the value are represented in Fig. A.7.

From the DESI database, it is possible to observe that in 2017 the percentage of EU citizens with at least basic digital skills (represented by DESI Individual Indicator At least Basic Digital Skills) and above basic skills (represented by DESI Individual Indicator Above basic digital skills) are respectively 25.44% and 8.13%. In five years, these values increased to 10.02% (5 years increase: 5.97%) and 26.96% (5 years increase: 23.27%). Obviously, the values throughout the 5 years are different

with previous editions. The range of values for the attitudes component was set at 0 - 4 (with a value of 0 for those who did not answer any question correctly). In the previous surveys, the range went from 1 to 5 (with a value of 1 for those who did not answer any question correctly). For the purpose of historical comparison, the scores for the attitudes component of the past years editions were adjusted downwards by one point. As a result, the range of values for the aggregated financial literacy scores is 0 - 20 for all three survey editions.

among EU countries. What is interesting is not the value per se, but the fact that the two values of the 5 years increases presented before are the same for each EU country [2].

Having said that, let's switch on the percentage of digital illiterate EU citizens. From the values exhibited in Fig. A.6 it is possible to observe that in 2018 nearly 75% of EU citizens do not have neither. This value decreased up to 73% in 2022 (which means a 2.037% decrease - nearly 6.5 mln of EU citizens³ - with respect to 2018), with a yearly decrease rate of approximately -0.411%.

Throughout the time horizon considered, the countries with a value lower than EU average are in order: Romania, Bulgaria, Poland, Italy, Lithuania, Germany, Hungary, Slovenia, Cyprus, Latvia and Greece⁴. Among them, the countries that show the most digital illiterate countries are⁵: Romania (86.48% on average), Bulgaria (84.85%), Poland (79.15%) and Italy (77.85%).

Another interesting fact is that the countries that in 2018 had the lowest level of people without basic digital skills (in order: Finland, Netherlands and Ireland) are the ones that achieved the highest decrease in 5 years (Finland: 3.561 %; Netherlands: 3.544 %; Ireland: 2.975%). Furthermore, the most digital illiterate countries are the ones that achieved the worst decrease (Romania: 0.902%; Bulgaria: 1.030%; Poland: 1.516%; Italy: 1.636%). Therefore, there is positive correlation between the percentage of digital illiterate people and the rate of decrease of the percentage of these individuals: the lower the DESI Individual Indicator Not Even basic digital skills of a country, the higher will be its variation throughout the years.

³The actual and expected values of the number of people in each country can be consulted in the Fig. A.8.

⁴This order is the same in each year.

⁵Average values.

In other words, a country with high share of digital literate people will be more likely to decrease the amount of digital illiterate people in the future ⁶.

4.2 Level of Financial Literacy in 2023 of European Citizens

From the Fig. 4.1 it is possible to observe that in the EU, there are roughly 105.96 mln of citizens that achieves a low financial knowledge score (24% of EU population); this number is not negligible. However, the majority of EU citizens (76%) have medium or high level of financial knowledge.

Going into details, the countries having people with excellent knowledge about financial themes (also greater than EU average score) are: Netherlands (43.4%); Finland (40.0%); Denmark (39.9%); Estonia (39.2%); Slovenia (36.0%); Sweden (34.4%); Luxembourg (33.3%); Germany (32.1%); Ireland (31.1%); Belgium (30.2%).

On the opposite side, the countries with poor financial knowledge are: Cyprus (30.2%); Romania (29.9%); Greece (28.6%); Portugal (28.1%); Spain (27.3%); Italy (26.3%); Belgium (26.1%); Bulgaria (26.0%).

4.2.1 A focus on the level of Financial Literacy in Italy

The results coming from Bank of Italy questionnaires done in 2017, 2020 and 2023 are shown in Fig. 4.2. In 2023 the country achieves an Overall Financial Literacy indicator equal to 10.6. Compared with the score achieved in 2020, it is possible to

⁶This assumption does not take into consideration all the countries policies and their effectiveness.

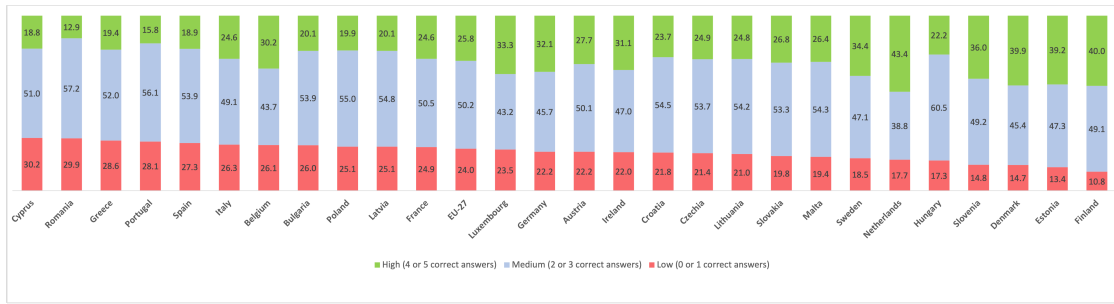


Figure 4.1: Financial Knowledge results (in percentage) of EU countries 2023 [37]

observe that this score has slightly increased (from 10.2 in 2020 to 10.6 in 2023). This improvement can be attributed to the financial behaviour component (from 4.2 in 2020 to 4.6 in 2023) and the financial attitude component (from 2.0 in 2020 to 2.3 in 2023). Conversely, the knowledge component has decreased slightly (from 3.9 in 2020 to 3.7 in 2023; by the ways, these results are created than the 4.4 achieved in 2017).

The study conducted by Bank of Italy in 2023 found out also other three intriguing evidences. The first one is that the level of financial literacy score varies depending on certain characteristics of individuals. Financial literacy appears to increase with educational attainment: individuals with a lower secondary school education or lower have an average score of 9.5 points, whereas upper secondary school or university graduates score 11.0 and 11.8 points, respectively. The second one is that the score is lower among young adults aged 18 to 34 (9.8) and the population over 64 years old (10.3). Eventually, there is a gender gap: average women score is equal 10.4, 0.4 points less than men [38].

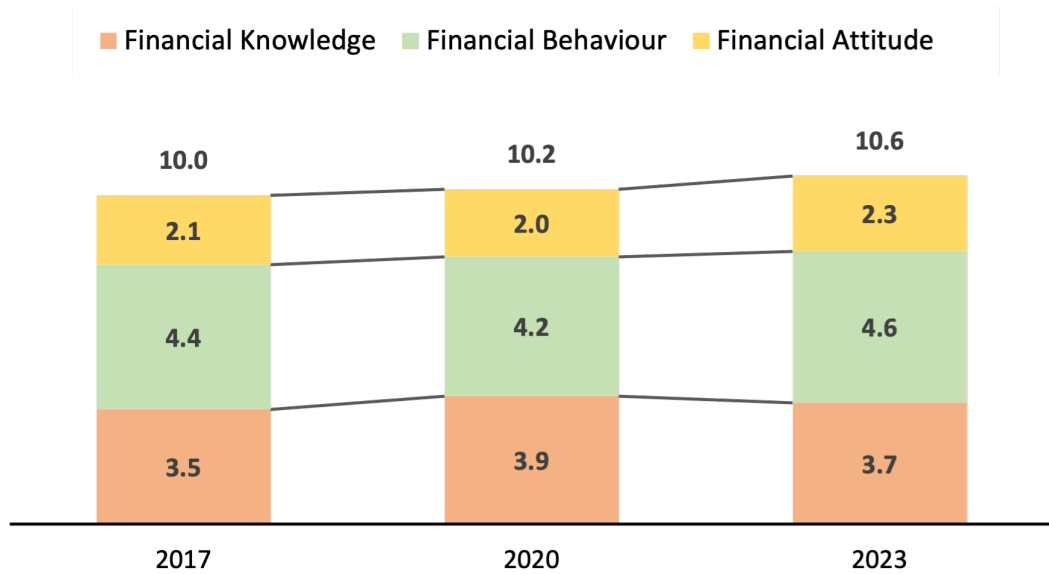


Figure 4.2: Overall Financial Literacy Score (on a scale of 0 to 20) of Italy in 2017, 2020 and 2023 [38]

4.3 Wealth Management in the European Union

The purpose of this section is to describe the past, current and estimated future of the AUM of retail investors in the European Union that use at least one Wealth Management service. In the first instance, it is described the situation at the level of European Union as a whole. Afterwards, it is analyzed the existing differences among EU-27 countries and EU as a whole.

In the Fig. 4.3 are represented three trends of the total AUM (in billion of €) of EU-27:

- *Wealth Management service.* This trend depicts the total AUM of retail investors which use at least one Wealth Management service. Indeed, each yearly value is the sum of the asset under Financial Advisory and/or Digital

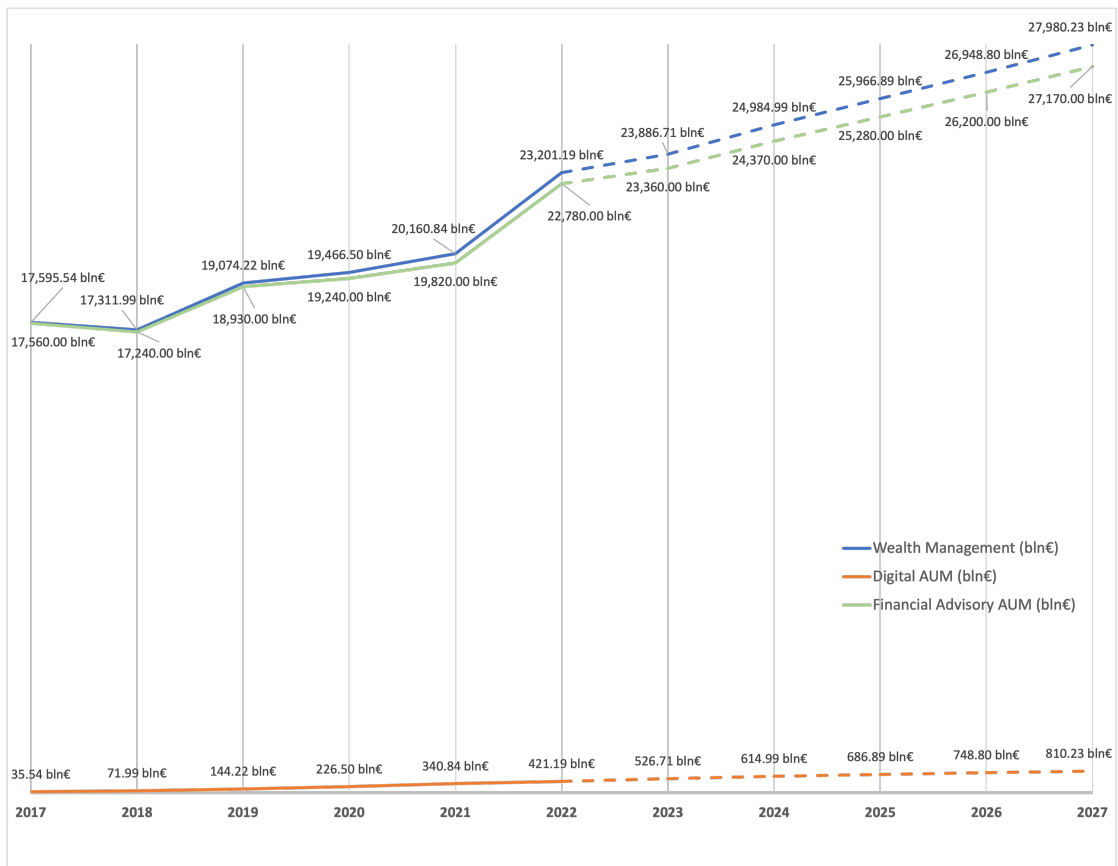


Figure 4.3: EU-27 total Wealth Management overtime [1]

Investment management for each country. The graph shows an increasing tendency throughout the time horizon: it is expected that the total AUM will be 27,903 billion € in 2027. It is possible to observe that only in 2018 there was a decrease in the AUM, the value reached was of 17,240 billion€. Another interesting fact is that in the difficult years of the pandemic (2020/2021), this value still (slightly) increased (approximately 3% each year) and in the beginning of the 2023 (when the majority of word governments decided to relax the social distance measures) there was a 15.08% increase with respect to the previous year (the yearly absolute change of AUM with respect to the

previous year is shown in Fig. 4.4);

- *Financial Advisory service.* It is possible to observe that this is the element that affects the most the outcome of the Wealth Management service. This fact can be explained looking at the amount of AUM in the case of Digital Investment and Financial Advisory services: the latter is thousands times grater than the other one over the time horizon considered. This evidence suggests that retail investors prefer to invest their money and asset being supported by a financial advisor (that is, the traditional consulting service) and, in the near future, it is not expected a full switch to the fully digital consulting services;
- *Digital Investment service.* As mentioned before, the total amount of asset managed by Digital Investment services is considerably low with respect to the ones managed by Financial Advisory services; this fact is also illustrated in the Fig. 4.5: it is expected that roughly 3% of AUM will be under management of Digital Investment services in 2027. However, it is possible to observe the total AUM related to the Digital Investment increases each year, and during the years of SARS-CoV-2 pandemic as well. Looking also at the Fig. 4.4, it is possible to observe that the total amount of AUM doubles in 2018 and 2019; instead, after those years, the rate of growth decreases up to 8.2% in 2027. Ultimately, these two figures tell that: the curve of total amount of asset under Digital Investment management is a S-shape type; Digital Investment services are relatively important in the financial industry; retail investors adopt this new digital service but there is a preference towards traditional advisory services and it is expected that this preference will remain true at

least in the near future.

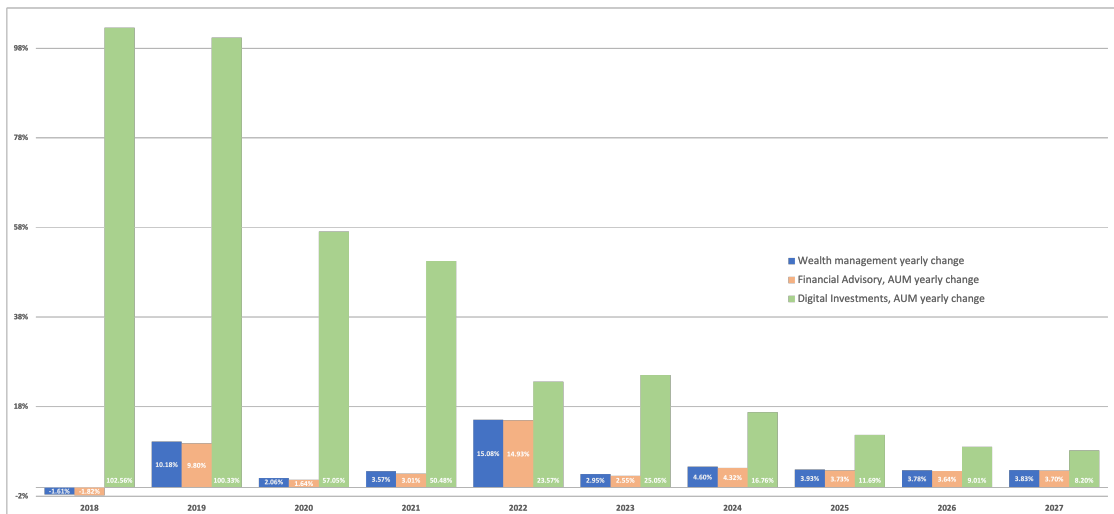


Figure 4.4: EU-27 total absolute yearly change of asset under Wealth Management services with respect to the previous year [1]

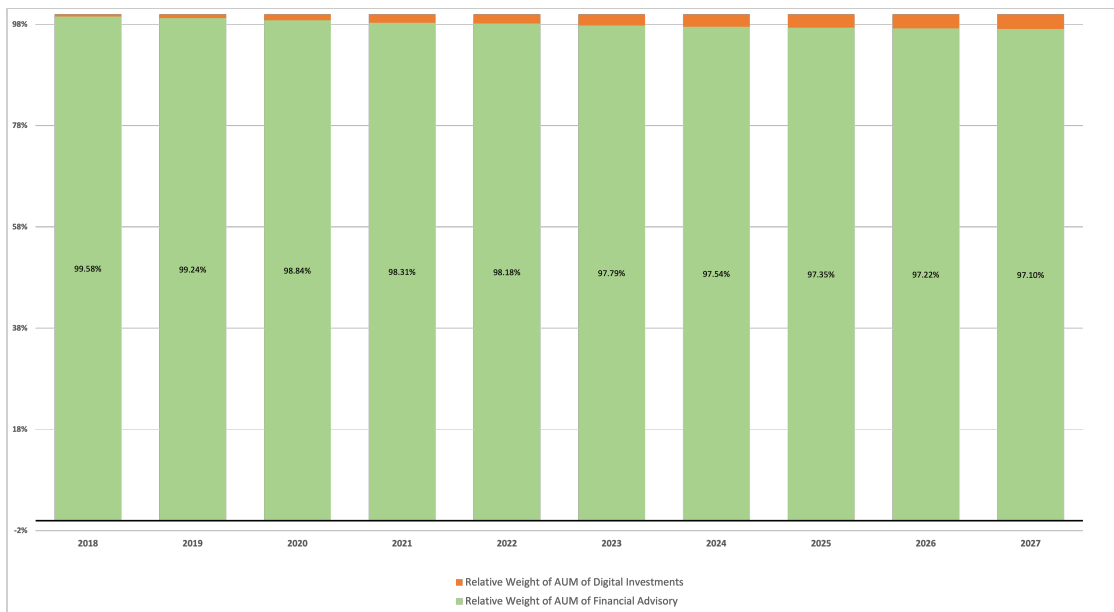


Figure 4.5: Relative weights overtime of Financial Advisory and Digital Investment services with respect to Wealth Management [1]

For the sake of completeness, it is fair to remind that these data are aggregated

at a country level, which means that do not explain deeper the whole socio-economic status, individuals' behaviour and the evidence of group of people. Therefore, even though the data suggests a growth in the volume of retail investors' asset managed by Wealth Management services, it must be reminded that the data presented do not discriminate between investors with low/middle income and high income. This could implies that high income retail investors have more assets to invest than low/middle income, as suggested by a Oxfam report [39] that highlights an increased inequality between people with high and low/middle income during the SARS-CoV-2 pandemic. Another bias of these data is related to the different relative weights between the two Wealth Management services: there is an evidence of an increasing amount of AUM, but there is no discrimination about which individual decides to have his/her asset managed by a traditional advisory service rather than the digital one; each individual has different preferences, socio-economic status, level of financial and digital literacy, different objectives, and so on. Therefore, the tremendous weight got by Financial Advisory services could be explained by the fact that people with high level of wealth are over 50s, which have low level of digital literacy (as suggested by a press release by UN [40]); as a consequence, these people (with greater amount of asset investable than under 50s) tend to prefer physical, traditional services rather than Digital Investment services.

4.3.1 Wealth Management services as a whole: differences and analogies among EU-27 counties

Considering the Fig. 4.6⁷ it is possible to observe that the tendency of the yearly change of the amount of asset managed by Wealth Management services in each EU country follows approximately the one shown in Fig. 4.4. This means that the amount of AUM is growing and it is still expected to grow in the near future.

A further evidence is that Croatia, Lithuania and Poland do not experienced a decrease in the amount of AUM with respect to the past year in 2018. Furthermore, Croatia and Poland are the only two country that each year (even during the pandemic years) that do not show a decrease throughout the time horizon considered as well as are among the countries that have a value grater than the EU-27 average value (of at least 5%).

Other evidences can be found during the pandemic years. In 2020, Italy, Netherlands, Slovenia, Spain and Sweden are the countries that not only show a value lower than the EU-27 average, but they are the countries within the EU that experienced a decrease in the AUM with respect to 2019. Analyzing the following year (2021), it is possible to observe that also Austria, Cyprus, Denmark, Finland, Greece, Ireland, Luxembourg and Romania, alongside those countries cited regarding 2020 except Spain (it is the only one among the others that shows a feeble increase in the AUM with respect to the past year).

Eventually, Latvia and Germany shows values greater than the EU-27 average over the years 2019-2027.

⁷The amount of AUM is shown in Fig. A.3

| | 2018 | 2019 | 2020 | 2021 | 2022 | 2023 | 2024 | 2025 | 2026 | 2027 |
|-------------|---------|---------|---------|---------|---------|---------|---------|--------|--------|--------|
| Austria | -3.007% | 7.578% | 0.924% | -0.857% | 13.507% | 1.058% | 2.360% | 1.750% | 1.753% | 1.943% |
| Belgium | -1.395% | 9.919% | 2.987% | 4.200% | 15.919% | 5.195% | 5.755% | 4.279% | 3.622% | 3.573% |
| EU-27 | -1.611% | 10.179% | 2.057% | 3.567% | 15.080% | 2.955% | 4.598% | 3.930% | 3.781% | 3.827% |
| Bulgaria | -3.164% | 7.924% | 0.902% | 0.097% | 17.024% | 5.574% | 6.851% | 5.098% | 3.852% | 2.844% |
| Croatia | 1.774% | 19.172% | 15.356% | 15.689% | 20.548% | 13.864% | 12.076% | 9.350% | 7.736% | 7.105% |
| Cyprus | -2.027% | 8.488% | 0.780% | -0.156% | 14.954% | 2.017% | 3.555% | 2.864% | 2.637% | 2.622% |
| Czechia | -2.242% | 9.065% | 1.982% | 1.527% | 14.492% | 2.201% | 3.155% | 2.265% | 2.073% | 2.108% |
| Denmark | -4.563% | 6.510% | 0.047% | -2.990% | 14.028% | 0.023% | 2.750% | 1.343% | 1.324% | 2.603% |
| Estonia | -1.055% | 11.068% | 2.803% | 4.674% | 16.828% | 6.008% | 6.052% | 4.350% | 3.499% | 3.333% |
| Finland | -3.617% | 7.716% | 0.569% | -0.786% | 13.617% | 1.229% | 2.569% | 1.942% | 1.806% | 1.899% |
| France | -1.423% | 8.257% | 0.700% | 7.212% | 10.869% | 1.754% | 3.513% | 2.867% | 2.897% | 3.048% |
| Germany | -0.203% | 16.365% | 6.097% | 5.158% | 21.146% | 6.486% | 7.697% | 6.735% | 6.514% | 6.125% |
| Greece | -1.273% | 8.962% | 1.209% | -0.404% | 15.608% | 2.007% | 3.688% | 3.087% | 3.037% | 3.075% |
| Hungary | -2.357% | 8.486% | 1.281% | 0.200% | 14.684% | 2.346% | 3.566% | 2.788% | 2.553% | 2.567% |
| Ireland | -2.887% | 7.233% | 0.090% | -0.468% | 14.180% | 1.393% | 2.935% | 2.169% | 2.078% | 2.142% |
| Italy | -3.405% | 7.162% | -0.249% | -1.819% | 13.927% | 0.349% | 1.849% | 1.753% | 1.191% | 1.647% |
| Latvia | -0.450% | 11.765% | 6.883% | 8.333% | 18.182% | 9.172% | 8.401% | 5.500% | 4.502% | 4.308% |
| Lithuania | 0.487% | 13.559% | 6.610% | 7.400% | 14.898% | 5.186% | 4.777% | 3.235% | 2.707% | 2.635% |
| Luxembourg | -5.197% | 8.168% | 0.617% | -0.745% | 15.122% | 1.891% | 3.474% | 2.836% | 2.711% | 2.788% |
| Malta | -3.386% | 7.533% | 0.444% | 0.144% | 14.803% | 2.669% | 4.397% | 2.950% | 3.210% | 2.764% |
| Netherlands | -3.824% | 7.119% | -0.589% | -1.801% | 12.940% | 0.306% | 1.419% | 1.356% | 1.313% | 1.291% |
| Poland | 21.388% | 29.144% | 19.753% | 19.210% | 25.512% | 10.350% | 11.016% | 9.446% | 8.534% | 8.016% |
| Portugal | -3.182% | 9.798% | 2.655% | 1.238% | 14.212% | 2.593% | 3.455% | 2.555% | 2.273% | 2.308% |
| Romania | -2.213% | 8.154% | 1.030% | -0.066% | 15.625% | 3.186% | 4.687% | 3.845% | 3.677% | 3.865% |
| Slovakia | -0.985% | 10.282% | 1.955% | 3.392% | 17.047% | 5.424% | 6.012% | 4.308% | 3.398% | 3.084% |
| Slovenia | -3.998% | 6.515% | -0.868% | -2.005% | 13.037% | 0.348% | 1.930% | 1.357% | 1.348% | 1.397% |
| Spain | -2.494% | 6.942% | -0.637% | 0.040% | 12.796% | 1.924% | 2.920% | 2.527% | 2.205% | 2.164% |
| Sweden | -4.353% | 8.521% | -0.930% | -0.754% | 13.997% | 0.672% | 1.840% | 1.731% | 1.653% | 2.874% |

Figure 4.6: Yearly change of AUM for Wealth Management services at country and EU level [1]

4.3.2 Financial Advisory services: differences and analogies among EU-27 countries

To better understand what kind of financial service influences the most the values exhibited in Fig. 4.6, let's start examining the AUM related to Financial Advisory services (Fig. A.4) and their change through the period 2017-2027 (Fig. 4.7).

First of all, placing Fig. 4.6 and Fig. 4.7 side by side and comparing the values of the two tables, it is possible to observe that the two specific trends (of each country) are similar. Therefore, this evidence related to the value compared suggests that there is a strong influence of Financial Advisory services on the AUM as a whole

(i.e., the asset managed in the market of Wealth Management services). This fact is also confirmed taking into considerations the values of the Fig. 4.8. The average EU value varies from 99.798% in 2017 up to the expected value in 97.249% in 2027 (that is, Financial Advisory services are predominant in the Wealth Management market). The countries for which the relative values are well below EU average are respectively: Croatia; Lithuania; Latvia; Belgium; Estonia; Slovakia; Portugal; Czechia. Because of these evidences as well as the tremendous increase of the asset managed by Digital Investment services (Fig. 4.9, the previously mentioned countries (together with Germany and Poland) experienced a mitigated reduction in the annual amount of total AUM (Fig. 4.6) in 2018, 2020 and 2021.

| | 2018 | 2019 | 2020 | 2021 | 2022 | 2023 | 2024 | 2025 | 2026 | 2027 |
|-------------|---------|---------|---------|---------|---------|---------|---------|--------|--------|--------|
| Austria | -3.523% | 6.498% | -0.605% | -2.689% | 13.295% | -0.138% | 1.659% | 1.179% | 1.254% | 1.372% |
| Belgium | -3.286% | 6.751% | -0.775% | -1.297% | 13.537% | 0.075% | 1.865% | 1.416% | 1.457% | 1.578% |
| EU-27 | -1.822% | 9.803% | 1.638% | 3.015% | 14.934% | 2.546% | 4.324% | 3.734% | 3.639% | 3.702% |
| Bulgaria | -3.397% | 7.253% | -0.410% | -2.881% | 13.347% | 0.000% | 1.682% | 1.287% | 1.452% | 1.431% |
| Croatia | -4.119% | 7.160% | -0.445% | -2.013% | 13.699% | 0.402% | 2.200% | 1.761% | 1.731% | 1.890% |
| Cyprus | -2.511% | 7.611% | 0.000% | -1.741% | 14.286% | 0.775% | 2.596% | 2.156% | 2.110% | 2.156% |
| Czechia | -3.437% | 6.578% | -0.909% | -2.602% | 13.403% | -0.058% | 1.758% | 1.291% | 1.331% | 1.462% |
| Denmark | -4.615% | 6.452% | 0.000% | -3.030% | 14.063% | 0.000% | 2.740% | 1.333% | 1.316% | 2.597% |
| Estonia | -3.279% | 6.780% | -0.794% | -2.800% | 13.580% | 0.362% | 1.805% | 1.418% | 1.399% | 1.379% |
| Finland | -4.444% | 6.326% | -1.137% | -2.832% | 13.206% | -0.241% | 1.532% | 1.112% | 1.100% | 1.243% |
| France | -1.520% | 8.062% | 0.476% | 6.951% | 10.783% | 1.600% | 3.412% | 2.792% | 2.840% | 3.001% |
| Germany | -0.436% | 15.974% | 5.660% | 4.643% | 21.160% | 6.197% | 7.560% | 6.658% | 6.474% | 6.080% |
| Greece | -1.404% | 8.742% | 1.019% | -0.792% | 15.463% | 1.698% | 3.462% | 2.928% | 2.932% | 2.989% |
| Hungary | -3.124% | 6.931% | -0.624% | -2.302% | 13.745% | 0.251% | 2.035% | 1.565% | 1.601% | 1.754% |
| Ireland | -3.388% | 6.169% | -0.856% | -2.529% | 13.291% | -0.112% | 1.734% | 1.209% | 1.304% | 1.394% |
| Italy | -3.593% | 6.832% | -0.581% | -2.339% | 13.772% | 0.000% | 1.579% | 1.554% | 1.020% | 1.515% |
| Latvia | -3.738% | 5.825% | -1.376% | -2.791% | 12.919% | -0.424% | 1.277% | 0.840% | 0.833% | 1.240% |
| Lithuania | -3.518% | 6.250% | -1.471% | -2.985% | 13.077% | -0.454% | 1.367% | 0.899% | 0.891% | 1.104% |
| Luxembourg | -5.405% | 7.757% | 0.119% | -1.613% | 14.662% | 1.023% | 2.804% | 2.324% | 2.332% | 2.436% |
| Malta | -3.984% | 6.224% | -1.172% | -2.767% | 13.008% | -0.360% | 1.805% | 0.709% | 1.408% | 1.042% |
| Netherlands | -3.965% | 6.881% | -0.858% | -2.165% | 12.832% | 0.000% | 1.176% | 1.163% | 1.149% | 1.136% |
| Poland | 20.053% | 27.061% | 18.197% | 17.387% | 25.197% | 9.220% | 10.227% | 8.949% | 8.314% | 7.886% |
| Portugal | -4.820% | 7.083% | -0.210% | -2.699% | 13.471% | 0.027% | 1.793% | 1.361% | 1.395% | 1.532% |
| Romania | -2.684% | 7.438% | -0.203% | -1.895% | 14.212% | 0.634% | 2.431% | 1.934% | 1.983% | 2.086% |
| Slovakia | -2.682% | 7.494% | -0.160% | -1.846% | 14.227% | 0.644% | 2.489% | 2.012% | 1.973% | 2.135% |
| Slovenia | -4.328% | 5.833% | -1.800% | -3.322% | 12.441% | -0.843% | 0.956% | 0.526% | 0.628% | 0.728% |
| Spain | -2.985% | 6.154% | -1.449% | -1.471% | 11.940% | 0.000% | 1.333% | 1.316% | 1.299% | 1.282% |
| Sweden | -4.615% | 8.065% | -1.493% | -1.515% | 13.846% | 0.000% | 1.351% | 1.333% | 1.316% | 2.597% |

Figure 4.7: Yearly change of AUM for Financial Advisory services at country and EU level [1]

| | 2017 | 2018 | 2019 | 2020 | 2021 | 2022 | 2023 | 2024 | 2025 | 2026 | 2027 |
|-------------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|
| Austria | 99.551% | 99.021% | 98.028% | 96.542% | 94.758% | 94.581% | 93.462% | 92.822% | 92.300% | 91.848% | 91.333% |
| Belgium | 97.656% | 95.783% | 93.023% | 89.625% | 84.897% | 83.152% | 79.105% | 76.195% | 74.103% | 72.555% | 71.158% |
| EU-27 | 99.798% | 99.584% | 99.244% | 98.836% | 98.309% | 98.185% | 97.795% | 97.539% | 97.355% | 97.221% | 97.104% |
| Bulgaria | 99.879% | 99.639% | 99.019% | 97.732% | 94.825% | 91.845% | 86.996% | 82.788% | 79.786% | 77.942% | 76.871% |
| Croatia | 96.896% | 91.285% | 82.084% | 70.840% | 60.000% | 56.591% | 49.900% | 45.503% | 42.345% | 39.985% | 38.038% |
| Cyprus | 99.590% | 99.097% | 98.296% | 97.536% | 95.987% | 95.429% | 94.268% | 93.395% | 92.752% | 92.276% | 91.857% |
| Czechia | 99.116% | 97.905% | 95.672% | 92.961% | 89.180% | 88.332% | 86.380% | 85.210% | 84.399% | 83.785% | 83.255% |
| Denmark | 99.929% | 99.874% | 99.820% | 99.773% | 99.732% | 99.762% | 99.739% | 99.729% | 99.719% | 99.711% | 99.706% |
| Estonia | 98.133% | 95.927% | 92.223% | 88.996% | 82.642% | 80.345% | 76.065% | 73.019% | 70.968% | 69.528% | 68.213% |
| Finland | 99.241% | 98.389% | 97.120% | 95.471% | 93.503% | 93.164% | 91.811% | 90.883% | 90.143% | 89.518% | 88.942% |
| France | 99.909% | 99.811% | 99.631% | 99.409% | 99.168% | 99.091% | 98.940% | 98.843% | 98.771% | 98.716% | 98.671% |
| Germany | 99.783% | 99.551% | 99.216% | 98.807% | 98.324% | 98.335% | 98.069% | 97.943% | 97.873% | 97.836% | 97.795% |
| Greece | 99.848% | 99.716% | 99.515% | 99.328% | 98.941% | 98.816% | 98.517% | 98.302% | 98.151% | 98.051% | 97.969% |
| Hungary | 99.464% | 98.683% | 97.269% | 95.439% | 93.056% | 92.294% | 90.405% | 89.068% | 88.009% | 87.192% | 86.502% |
| Ireland | 99.613% | 99.099% | 98.116% | 97.188% | 95.175% | 94.434% | 93.033% | 91.948% | 91.085% | 90.394% | 89.731% |
| Italy | 99.822% | 99.628% | 99.321% | 98.991% | 98.466% | 98.333% | 97.991% | 97.731% | 97.540% | 97.376% | 97.249% |
| Latvia | 96.396% | 93.213% | 88.259% | 81.439% | 73.077% | 69.822% | 63.686% | 59.500% | 56.872% | 54.875% | 53.261% |
| Lithuania | 96.837% | 92.978% | 86.994% | 80.400% | 72.626% | 71.475% | 67.643% | 65.441% | 63.960% | 62.829% | 61.892% |
| Luxembourg | 99.774% | 99.555% | 99.177% | 98.686% | 97.823% | 97.432% | 96.601% | 95.976% | 95.498% | 95.146% | 94.820% |
| Malta | 99.588% | 98.972% | 97.767% | 96.194% | 93.398% | 91.937% | 89.225% | 87.010% | 85.117% | 83.631% | 82.229% |
| Netherlands | 99.876% | 99.730% | 99.508% | 99.239% | 98.871% | 98.777% | 98.475% | 98.240% | 98.052% | 97.894% | 97.745% |
| Poland | 99.166% | 98.076% | 96.494% | 95.240% | 93.784% | 93.548% | 92.590% | 91.932% | 91.515% | 91.330% | 91.220% |
| Portugal | 98.409% | 96.744% | 94.352% | 91.719% | 88.152% | 87.580% | 85.390% | 84.017% | 83.038% | 82.325% | 81.700% |
| Romania | 99.473% | 98.994% | 98.339% | 97.140% | 95.362% | 94.196% | 91.867% | 89.887% | 88.232% | 86.791% | 85.304% |
| Slovakia | 97.947% | 96.269% | 93.835% | 91.888% | 87.233% | 85.131% | 81.272% | 78.571% | 76.843% | 75.784% | 75.086% |
| Slovenia | 99.789% | 99.446% | 98.810% | 97.881% | 96.565% | 96.056% | 94.915% | 94.009% | 93.239% | 92.577% | 91.966% |
| Spain | 99.343% | 98.843% | 98.114% | 97.312% | 95.843% | 95.116% | 93.321% | 91.882% | 90.797% | 89.991% | 89.214% |
| Sweden | 99.767% | 99.493% | 99.074% | 98.512% | 97.756% | 97.627% | 96.975% | 96.510% | 96.133% | 95.814% | 95.556% |

Figure 4.8: Annual weight of managed assets by Financial Advisory services relatively to Wealth Management services as a whole, per country and EU level [1]

4.3.3 Digital Investment services: differences and analogies among EU-27 countries

According to the values exhibited in Fig. A.5, the annual values of AUM related to Digital Investment services increased each year (from 2017 to 2022) in each country (minimum: Denmark +278%; EU average: +1548%; maximum: Bulgaria +8247%). This is also confirmed looking at the actual and expected trends related to the annual change asset managed by Digital Investment services in each country are shown in Fig. 4.9. Taking into account what is described in Sec. 4.3.1 and 4.3.2, the annual AUM relative weight per country of Digital Investment services with respect to Wealth Management (Fig. 4.5, it is possible to notice the positive

effect of the asset managed by Digital Investment services in the total amount of annual AUM of each country. As a consequence, the 5 year increase of the total managed assets goes from +12.3% of Slovenia to +180% of Poland (EU-27 average +34.13%).

An additional observation is related Digital Investment annual share of active paying digital investments customers (or accounts) from the total population of the selected market (i.e., Penetration Rate), which values are represented in Fig. 4.10. It can be seen that the more a country experiences a 5 year decrease in the percentage of people with not even basic digital skills⁸ (Fig. A.6, the higher is the Digital Investment Penetration Rate in that country. However, from 2017, all the 27 countries increased the number of people with at least basic digital skills (Minimum: Romania -0.9%; EU average: -2.21%; maximum: Finland -3.54%).

To give a comprehensive overview of the influence of Digital Investment services on the total amount of asset managed by Wealth Management services, all the values cited above and the ones related to low financial knowledge score in 2023 of EU countries (Fig. 4.1 have been normalized to represent the distance from the EU-27 average value (see Fig. 4.11).

Looking at that figure, it is possible to notice an intriguing evidence: the countries which exhibit an increase in 5 years in the asset managed by Digital Investment services greater than EU average (in order: Bulgaria; Croatia; Malta; Poland; Slovenia; Hungary; Ireland; Czechia) are the ones (excluding Ireland) where the 2022 Penetration Rate is smaller than the EU average (6.35%). A possible interpretation

⁸Moreover, as stated in Sec. 4.1, there is a positive correlation between the rate of decrease of digital illiterate people and the percentage of illiterate people: the lower the percentage of digital illiterate people rate, the lower the rate.

of this evidence can be explained from the point of view of Digital Investment companies. To increase the AUM and increase their Penetration Rate, companies need to attract customers' asset lowering management fees. Therefore, where the 2022 Penetration Rate is greater than the EU average, companies imposes greater management fees to improve their profits. High fees attracts less customers' assets than the average (and so a weaker increase of AUM than the average); this could explain the opposite scenario. Another gripping evidence is that Bulgaria, Poland, Slovenia and Hungary are also the countries where in 2022 the percentage of people with not even basic digital skills is at least 75% (EU average: 72%) as well as these countries have the worst digital skills. A possible interpretation of this evidence could be made considering the "Dunning–Kruger effect"⁹ and its opposite effect. In the worst digital literate countries, there are more people that uses Digital Investment services because these individuals overestimate their skills and underestimate/are not aware of potential cyber risks. Because of that, unskilled individual tend to give more assets under (digital) management than skilled people. Those digital-skilled individual are hesitant because they could think to not manage properly cyber- risks.

Considering again the countries which exhibit an increase in 5 years in the asset managed by Digital Investment services greater than EU average (excluding Bulgaria and Poland), it is possible to observe that in these countries the percentage of people with a low financial score is smaller than the average. A possible explanation

⁹The "Dunning–Kruger effect" is defined as the tendency of people with low ability in a specific area to give overly positive assessments of this ability. This is often seen as a cognitive bias, i.e. as a systematic tendency to engage in erroneous forms of thinking and judging. Some researchers also include the opposite effect for high performers: their tendency to underestimate their skills [41].

of this evidence could be: the greater the level of financial knowledge, the more is the interest/trust towards Digital Investment services).

However, a thrilling comparison worth of mention is about Bulgaria and Denmark. The country is the one with the smallest Penetration Rate (1.09% in 2022), the second to last country with the greater percentage of digital illiterate people (84.41% in 2022) and it is among those countries with the worst financial knowledge score, but it is the country with the highest level in 5 year of asset managed by Digital Investment services. On the opposite side, Denmark is the country with the lowest level in 5 year of asset managed by Digital Investment services, but it is the second country with lowest level of financial knowledge score (14.7%), Penetration Rate is among the greatest in 2022 (9.88%¹⁰) and is among the most digital literate countries.

The results in Fig. 4.11 show that those countries with a Penetration Rate above the EU average, are also the most digital skilled countries (values at least lower than 75.58% - slightly above the EU average: 71.85%). A potential explanation of this observation is that the more the number of people with at least basic digital skills, the more is the demand for Digital Investment services. The more is the demand, the greater is the Penetration Rate.

Eventually, it looks like that among the countries which AUM of Financial Advisory services increased with a rate below the EU-27 average (23 countries), 15 achieved a financial literacy score above the EU average. May be that the higher the level of financial literacy, the higher the interest towards Digital Investment services. However, this interest has to be considered as a second choice service.

¹⁰However, it has to be noticed that in absolute term, this value is not so huge.

| | 2018 | 2019 | 2020 | 2021 | 2022 | 2023 | 2024 | 2025 | 2026 | 2027 |
|-------------|----------|----------|----------|----------|---------|---------|---------|---------|---------|---------|
| Austria | 111.494% | 116.848% | 76.942% | 50.283% | 17.342% | 21.928% | 12.385% | 9.144% | 7.734% | 8.375% |
| Belgium | 77.381% | 81.879% | 53.137% | 51.687% | 29.309% | 30.467% | 20.480% | 13.443% | 9.817% | 8.846% |
| EU-27 | 102.560% | 100.333% | 57.052% | 50.481% | 23.574% | 25.053% | 16.761% | 11.691% | 9.013% | 8.204% |
| Bulgaria | 189.631% | 193.386% | 133.299% | 128.369% | 84.394% | 68.358% | 41.428% | 23.431% | 13.324% | 7.838% |
| Croatia | 185.714% | 145.000% | 87.755% | 58.696% | 30.822% | 31.414% | 21.912% | 15.686% | 12.147% | 10.579% |
| Cyprus | 115.816% | 104.808% | 45.763% | 62.575% | 30.940% | 27.938% | 19.323% | 12.881% | 9.380% | 8.189% |
| Czechia | 131.707% | 125.263% | 65.888% | 56.056% | 23.466% | 19.298% | 12.010% | 7.877% | 6.085% | 5.449% |
| Denmark | 69.565% | 52.564% | 26.050% | 14.667% | 1.163% | 9.770% | 6.806% | 4.902% | 4.206% | 4.484% |
| Estonia | 115.809% | 112.076% | 45.459% | 65.125% | 32.288% | 29.088% | 19.550% | 12.284% | 8.632% | 7.789% |
| Finland | 104.651% | 92.614% | 58.112% | 42.351% | 19.528% | 21.272% | 14.195% | 10.214% | 8.261% | 7.498% |
| France | 105.587% | 111.413% | 61.183% | 51.063% | 21.116% | 18.582% | 12.975% | 9.261% | 7.543% | 6.673% |
| Germany | 106.507% | 103.005% | 61.390% | 47.803% | 20.320% | 23.544% | 14.680% | 10.393% | 8.351% | 8.149% |
| Greece | 84.615% | 86.111% | 40.299% | 56.915% | 29.153% | 27.822% | 18.686% | 12.284% | 8.629% | 7.376% |
| Hungary | 140.000% | 125.000% | 69.136% | 52.555% | 27.273% | 27.444% | 17.994% | 12.750% | 9.534% | 8.097% |
| Ireland | 125.806% | 124.286% | 49.363% | 70.789% | 31.710% | 26.919% | 18.969% | 13.120% | 9.989% | 9.183% |
| Italy | 101.678% | 95.507% | 48.340% | 49.225% | 23.837% | 20.956% | 15.015% | 10.310% | 7.951% | 6.540% |
| Latvia | 87.500% | 93.333% | 68.966% | 57.143% | 32.468% | 31.373% | 20.896% | 12.346% | 9.341% | 8.040% |
| Lithuania | 123.077% | 110.345% | 60.656% | 50.000% | 19.728% | 19.318% | 11.905% | 7.660% | 5.929% | 5.224% |
| Luxembourg | 86.667% | 100.000% | 60.714% | 64.444% | 35.811% | 34.826% | 22.509% | 15.060% | 10.733% | 9.693% |
| Malta | 141.001% | 133.546% | 71.170% | 73.726% | 40.196% | 37.203% | 25.859% | 17.957% | 13.512% | 11.566% |
| Netherlands | 109.220% | 95.254% | 53.819% | 45.598% | 22.403% | 25.047% | 17.068% | 12.157% | 9.527% | 8.487% |
| Poland | 180.208% | 135.316% | 62.559% | 55.685% | 30.275% | 26.737% | 20.870% | 15.108% | 10.897% | 9.385% |
| Portugal | 98.113% | 90.476% | 50.500% | 44.850% | 19.725% | 20.690% | 13.175% | 8.836% | 6.572% | 5.925% |
| Romania | 86.667% | 78.571% | 74.000% | 62.069% | 44.681% | 44.608% | 30.169% | 20.833% | 16.379% | 15.556% |
| Slovakia | 80.000% | 82.222% | 34.146% | 62.727% | 36.313% | 32.787% | 21.296% | 12.723% | 8.126% | 6.054% |
| Slovenia | 152.045% | 128.700% | 76.471% | 58.836% | 29.813% | 29.356% | 20.095% | 14.387% | 11.278% | 9.733% |
| Spain | 71.783% | 74.244% | 41.629% | 54.739% | 32.519% | 39.392% | 25.093% | 16.232% | 11.147% | 10.098% |
| Sweden | 107.895% | 98.101% | 59.265% | 49.649% | 20.576% | 28.293% | 17.504% | 12.721% | 10.043% | 9.215% |

Figure 4.9: Yearly change of AUM for Digital Investment services at country and EU level [1]

| Country | WM - 5 years change AUM | FinAdv - 5 years change AUM | DigInv - 5 years change AUM | People with not even basic digital skills - 5 Year Decrease | % People with low Fin. Knowledge score | People with not even basic digital skills - 2022 | % Penetration Rate Dig. Inv. Services - 2022 |
|-------------|----------------------------|--------------------------------|--------------------------------|--|--|---|--|
| Finland | -0.48 | -0.36 | -0.41 | -2.14 | -2.20 | -1.89 | 1.47 |
| Netherlands | -0.60 | -0.29 | -0.37 | -2.11 | -0.86 | -1.87 | 1.58 |
| Ireland | -0.46 | -0.30 | 0.04 | -1.21 | -0.03 | -1.17 | 1.07 |
| Denmark | -0.63 | -0.30 | -0.89 | -1.03 | -1.45 | -1.02 | 1.13 |
| Sweden | -0.52 | -0.24 | -0.33 | -0.83 | -0.71 | -0.84 | 1.45 |
| Spain | -0.50 | -0.31 | -0.55 | -0.61 | 1.00 | -0.65 | 0.63 |
| Luxembourg | -0.47 | -0.20 | -0.22 | -0.57 | 0.26 | -0.62 | 0.29 |
| Croatia | 1.78 | -0.24 | 0.76 | -0.54 | -0.07 | -0.59 | -0.63 |
| Austria | -0.46 | -0.29 | -0.15 | -0.53 | 0.01 | -0.58 | 0.88 |
| France | -0.19 | 0.18 | -0.26 | -0.41 | 0.53 | -0.47 | 0.70 |
| Malta | -0.41 | -0.35 | 0.49 | -0.35 | -0.53 | -0.41 | -0.44 |
| Czechia | -0.23 | -0.28 | 0.01 | -0.21 | -0.15 | -0.28 | -0.16 |
| Estonia | 0.12 | -0.27 | -0.14 | 0.07 | -1.70 | -0.01 | -0.55 |
| EU-27 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Portugal | -0.23 | -0.30 | -0.46 | 0.16 | 1.16 | 0.08 | -0.27 |
| Slovakia | 0.02 | -0.14 | -0.47 | 0.17 | -0.46 | 0.09 | -0.73 |
| Belgium | 0.02 | -0.21 | -0.48 | 0.24 | 0.77 | 0.17 | 1.19 |
| Greece | -0.26 | 0.10 | -0.47 | 0.38 | 1.25 | 0.32 | -0.71 |
| Latvia | 0.53 | -0.36 | -0.26 | 0.51 | 0.57 | 0.45 | -0.45 |
| Cyprus | -0.33 | -0.11 | -0.19 | 0.56 | 1.56 | 0.50 | -0.86 |
| Slovenia | -0.64 | -0.44 | 0.31 | 0.60 | -1.43 | 0.55 | -1.24 |
| Hungary | -0.32 | -0.23 | 0.09 | 0.64 | -0.94 | 0.59 | -1.20 |
| Germany | 0.66 | 1.12 | -0.31 | 0.65 | 0.01 | 0.61 | 1.12 |
| Lithuania | 0.47 | -0.35 | -0.21 | 0.66 | -0.22 | 0.62 | 0.24 |
| Italy | -0.54 | -0.25 | -0.40 | 0.90 | 0.81 | 0.88 | -0.92 |
| Poland | 4.27 | 4.79 | 0.37 | 1.09 | 0.57 | 1.10 | -0.25 |
| Bulgaria | -0.31 | -0.25 | 4.69 | 1.86 | 0.75 | 2.07 | -1.68 |
| Romania | -0.31 | -0.14 | -0.20 | 2.06 | 1.50 | 2.35 | -1.63 |
| Std. Dev. | 0.34 | 0.30 | 14.29 | 0.01 | 5.15 | 0.05 | 2.55 |
| EU27 Avg. | 0.34 | 0.21 | 15.48 | -0.02 | 22.15 | 0.70 | 7.13 |

Figure 4.11: Normalized values of EU countries with EU-27 average values and standard deviations, from highest to lowest country with respect to the percentage of people with not even basic digital skills in 2022 [1], [37]

Chapter 5

Conclusions

In this section are summarized all the findings related to this work. In the first section are described the (potential) relations that could exist between individuals' level of digital and financial literacy, the digitalization in the EU financial industry and the individuals' investment decisions. The second section is about all the secondary findings of this work. Whereas the third section sums up the about what is described in this work with some open points.

5.1 Main findings

As a matter of fact, the Wealth Management market grows and it is expected to grow even more in the near future. As of today, Financial Advisory market segment is the most prevalent. This implies that people still need a human advisor (which is also a professional), especially because of human interaction. The strength of traditional financial advisory services derives precisely from the financial advisor. A professional can find the best financial products for his/her customer as well as

can play the role of a "beacon in the night", helping retail investors to spot their biases and avoid irrational behaviour. The digitalization lead to the arise of new software which become key-tools for their work and decreasing the proximity with customers. During the pandemic years, the lack of physical proximity (due to the social distancing measures) was mitigated thanks to the digitalization of financial processes as whole. Indeed, the lowest decrease in AUM during these years is only of -3.22%.

Thanks also to the digitalization, the role of a professional financial advisor is no more considered as a sort of unique entry point towards the financial market. Indeed, the arise of tech companies supplying new Digital Investment services, lead to a competition with traditional financial companies (incumbents). This lead to a reduction of the market concentration within the financial industry. Digital Investment companies are the firsts firms in the financial industry that reached those customers that want captivating, user-friendly digital platforms with near-real time updates. As a consequence of that, there is an increase of the Penetration Rate of these firms, and it is expected to still increase. By the way, since the core feature of a platform (in which are exchanged financial products) is to connect demand with supply, the digital literacy of individuals is a key element in this scope¹. Indeed, the more the number of people with at least basic digital skills, the more is the demand for Digital Investment services; the more is the demand, the greater is the Penetration Rate. Analyzing the data within the EU, it seems that companies apply different market strategy. To increase the asset managed under their Digital Investment services as well as their Penetration Rate, companies need to attract

¹Analogy: you cannot give an airplane to an unskilled individual because he/she will ruin your products and his/her life because of lack of knowledge and practice.

customers' asset lowering management fees. Therefore, where the 2022 Penetration Rate is greater than the EU average, companies imposes greater management fees to improve their profits. However, high fees attracts less customers' assets than the average (and so a weaker increase of AUM than the EU-27 average).

Switching the focal point towards human biases, it seems that exists a "Dunning–Kruger effect" that has an impact on retail investors' choices. The evidences point out that in the worst digital literate countries, there are more people that uses Digital Investment services than in the countries that are have a higher percent of population that have at least basic digital skills. One of the possible explanations of this evidence is linked the above mentioned effect: these individuals overestimate their skills and underestimate/are not aware of potential cyber risks; because of that, unskilled individual tend to give more assets under (digital) management than skilled people. Those digital-skilled individual are hesitant because they could think to not manage properly cyber-risks. Obviously, it is not only a matter of digital literacy but it is also a matter of the level of financial literacy of individuals. Apparently, there could be a positive relation between individuals' level of financial literacy and the interest toward Digital Investment services, because the higher the level of financial literacy, the higher the interest towards Digital Investment services. However, it has to be taken into consideration that this interest towards autonomous Digital Investment services has to be considered as a second choice because Financial Advisory services still have a relevant role. The latter statement about traditional financial advisory services is confirmed also by a CONSOB paper [31], which points out that the customer-financial advisor interaction remain a critical success factor. As a consequence, the companies within the financial industry are pushing towards the human interaction valorization both in the case of

an automated consulting process² and the case of traditional consulting services (because in this way, a financial advisor is more committed towards customers' needs). In addition to that, even though a majority of retail investors said that (financial) apps have increased their trading frequency (according to a paper of the CFA Institute [14]), it has to be taken in mind that technology is an enabler and it cannot fully replace human judgment. Indeed, a majority of retail investors value an adviser with economic intuition and market experience over one who is data-driven with a highly quantitative skills. These are the added characteristics of human advice that, when paired with technology, can improve investor outcomes. Eventually, the digitalization of the financial industry have not to be considered as a holy gray that allows a decentralization from traditional institutions of financial markets and a safe, cheap, transparent and valuable choice for retail investors (not all that glitters is gold). A first example about that is the biases about gender discrimination inherited by Apple Card and its algorithm linked (previously discussed in section 2.3.1). Another example about that is the collapse of FTX in 2022 because of its business on risky trading options that are not legal in the United States. This affected negatively the retail investors due to the reimbursement of savings deposited in this company and lack of transparency from FTX [42]. These examples want to stress out that Digital Investment services have nowadays a not negligible relevance in the financial industry. Because of that, there is the need of strong regulations about FinTech companies and fully digital financial companies (because checking the box "I accept the terms and conditions" is not enough) in the financial market and its segments. Otherwise, the risk of individuals lacking of

²The hybrid model (both human and only machine interaction with customers) is the preferred business model rather than the one fully automated.

trust in the financial industry could become concrete and the derived effects could be relevant.

5.2 Secondary findings

According to Fig.A.6, it seems to be a positive correlation between the percentage of digital illiterate people and the decrease rate of this percentage overtime. There are evidences that the countries with high share of digital literate people will be more likely to decrease the amount of digital illiterate people in the future (for example: Finland and Netherlands are the most digital literate countries whereas Romania and Bulgaria have the highest percentage of illiterate people).

Considering instead the Fig. 4.11, it could exist another relationship: the higher the number of digital illiterate people in a country, the higher the percentage of people with a low financial score. Indeed, the countries with all the countries with a percentage of digital illiterate people grater than EU average (excluding Slovenia, Hungary and Lithuania) are the countries with the worst financial score achieved that EU-27 average.

5.3 Final considerations and open points

As a matter of fact, the (ongoing) digitalization of the financial industry is a game changer for a number of stakeholders. It leads to innovative processes within firms and products and services for (already and potential) customers. It allows the disintermediation and the decentralization of the financial markets, by dint of FinTech (i.e., the technology applied to the financial industry). Indeed, the market status-quo changed due to FinTech companies and their financial platforms

which forced traditional financial companies (incumbents) to re-think their (legacy) business models, products and services. Both traditional and 'digital' financial companies employ further and further new technologies in their processes/services (for example, Artificial Intelligence, data analysis, and so on) coupled with new business models to decrease the need of intermediaries from their business operations as well as transforming the ways through which customers interact with financial operators. Two key examples are: the employ of technology within the financial service value chain on behalf of human actions as well as the introduction of software tools as a support to the decision making processes of human consultant. Additionally, the digitalization was allowing a cost reduction in terms of both operational expenditures and the amount charged to customers to use a financial service.

Another evidence of the effect of digitalization (broadly speaking) is related to the reduction of information asymmetries, especially encouraging and enhancing financial inclusion in different ways. At first, people do look for any kind of news, products, services, and so on more easily than (at least) 15 years ago through different ways, for example: googling it, asking information through instant messaging services to other people, watching a video, listening to a podcast, looking for disclosure documents within web pages of financial companies. Secondly, the digitalization allows financial inclusion in terms of products and services offered to retail investors. Indeed, some FinTech companies supply financial services and products to a broader market segment and people around the world, giving to people an equal access to financial markets. From the stand point of (traditional and technology) financial companies, the digitalization grants them to collect and access a huge amount of data that allow them to customize their products and

services to customer as well as to lower costs [43]. The key factor (that need to be investigated furthermore) about this evidence is whether FinTech products and services are transparent enough for regulatory oversight and understanding (especially of the algorithm under the bonnet; it is essential for the long-term success and public acceptance of fintech companies [11]).

Furthermore, it is interesting to highlights the change in the type of contents posted on social media platforms: the contents³ within these platforms are no longer something about leisure time but instead those posts were becoming an indispensable source of information on all aspects of life, including news, finance, and investments; alongside, there was rising "FinInfluencers": people which social media contents are about advertisements for financial products (whether or not declared as an advertisement), personal anecdotes about experience with a particular product, service or topic, or personal knowledge sharing on budgeting, financial management services, or investments. Even though the information provided by these people could appear easy to understand, easily accessible, and in many cases, free (or with low charged costs), compared to traditional financial advice, it must to be noted that there are potential risks associated with providing inappropriate financial information on social media platforms (that is, non regulated means of information) and the potential impact that such contents could have on the financial wealth of Finfluencer's followers. In the field of traditional wealth management services, the risks in which retail investor could incur were being addressed through laws and regulations, including consumer protection laws or corporate laws, which stipulate that financial advisory activities must be conducted by licensed parties, and under

³Posts on Facebook or Instagram, Tweets, Reels, and so on.

the supervision of financial regulators. However, many Finfluencers are not even licensed financial advisors, and some of them might not even be aware of these laws and requirements that could be apply to them. The risks they potentially pose to consumers and, in general, to the financial market are areas of concern that need to be prompted through regulatory measures in order to mitigate financial risks [44]. For these reasons, regulatory authorities are not doing enough to govern and regulate (at least until now) this existing phenomena of financial information on social media; they should apply the same level of rigidity implement to the financial industry to protect customers, and they do not have to consider this phenomena such as a peripheral one. On the other hand, regulatory bodies (and financial companies as well) should exploit Finfluencers to increase the level of digital literacy and increase the trust on financial markets. However, it is not only a matter of the level of financial literacy because it should go alongside the level of digital literacy. To decrease the risks linked to web, people should be aware of scam websites, fake-news, aggressive marketing on social media platforms and so on.

Another evidence of the effect of the technology applied to financial industry is that the digitalization were bring people to financial services and products thanks to web platforms and financial apps that can be accessed 24/7 through a smartphone (which is the mostly used object nowadays). These financial platforms are characterized by a simple, lean user experience, the employment of the digital nudge effect (to better guide customers thorough different investment options), the information about financial services and products are easily reachable; they do not have the same level of complecity that characterizes the 'use' of a traditional financial service. However, simple and lean user experience could provide cognitive biases to investors, leading them to rely more on their intuition and less on critical

thinking based on a strong financial knowledge and experience. Disclosure alone is not sufficient to assure good investor outcomes; how information is displayed can both help and hurt retail investors (in particular rookie investors). In a nutshell, simple, user friendly interfaces are not necessarily the solution to problems that arise from complexity; both complexity and simplicity can lead investors astray. Thus, while it is important that investors have access to transparent, pertinent information, disclosure alone is not sufficient to assure good investor outcomes; how information is displayed influences decisions in ways that can both help and hurt investors. It should be investigated further the perceived control derived from the use of these simple apps and the cognitive biases that affects retail investors. Additionally, it can be done a comparison with the support of a human financial advisor in the decision-making process.

As mentioned in the second chapter, BigTech companies play an important role also in the field of financial industry, especially if they employ financial technologies in their business models (for example, Apple Inc.'s financial services and products cited in the paragraph 2.3.1). What distinguishes BigTech companies from FinTech and traditional companies is their capacity to scale up their technologies, applying them to different market segments, together with their business models and financial strength⁴ [43]. Therefore, an interesting research field could be the perceived confidence in BigTech companies (for example Apple) against traditional financial institutions (for example, Goldman Sachs) by retail investors and the final returns obtained from their investments. These two example are not left to chance because

⁴In particular: huge customer base using their hardware/software, wider market presence, the colossal amount of data at their disposal about customers' behaviour and preferences and their ability to process them.

also a partnership could be really challenging for regulatory bodies, and it need to be regulated. As stated by a Financial Times's article: "Would you switch to an Android phone if you banked with Apple, for example? Would you be less likely to look elsewhere for a loan? These questions tiptoe into territory that antitrust regulators at the Federal Trade Commission are interested in. At what point does an incredibly seductive consumer offering become a monopoly issue?" [20].

To conclude, the digitalization has brought with it several pros and cons. From a consumers side, people need to be aware of financial and cyber risks. From a non consumer side, governments must work to increase the level of digital and financial literacy to mitigate financial risks (especially during crisis periods) and increase the level of trust on financial markets. Moreover, they need to regulate also the phenomena of Fininfluencers. Financial companies should be more present on social media platforms, exploiting also partnership with Fininfluencers.

Eventually, the digitalization allow companies to supply different and/or tailored financial services and products, which in turn means more competition in the financial industry than some years ago. This implies that those companies who were incumbents in a quasi-monopoly financial industry, nowadays have to compete in a market with tech startups and BigTech companies challenging them. For example, 15 years ago, if individuals wanted to pay for a good in a physical, the only digital way at their disposal was through either debit or credit card supplied only by Visa Inc., Mastercard Incorporated, American Express and Diners Club International. To use these digital payment methods, shop owners need to have the infrastructure (EPOS) and pay high fees to use them, whereas customers had to pay annual fees to use these cards (a part from different contractual agreements between banks and customers). Nowadays, people have at their disposal several user-friendly

mobile apps that allows them to pay even without owing any kind of electronic card. Moreover, these financial services are either commission free or payments fees are most of the time lowers than credit card fees. I want to cite some of the most important ones: PayPal, Scalapay, Bancomatpay, Satispay. I cited them because the competition is not only within a country (USA: PayPal versus the Credit Card companies cited before), it is also an intercontinental competition: USA vs Europe (Scalapay, Bancomatpay, Satispay which in turn are Italian companies - moreover Scalapay and Satispay are unicorns). Therefore, the digital transition lead also to a geopolitical competition, decreasing the dependency of one region (Europe) from another one (USA) as well.

Appendix A

Appendix

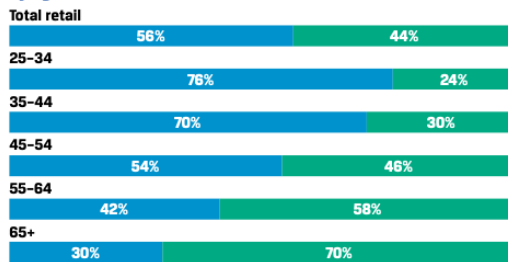
IN THREE YEARS, WHICH OF THE FOLLOWING DO YOU THINK WILL BE MORE IMPORTANT TO YOU?

■ Latest technology platforms and tools ■ Person to help

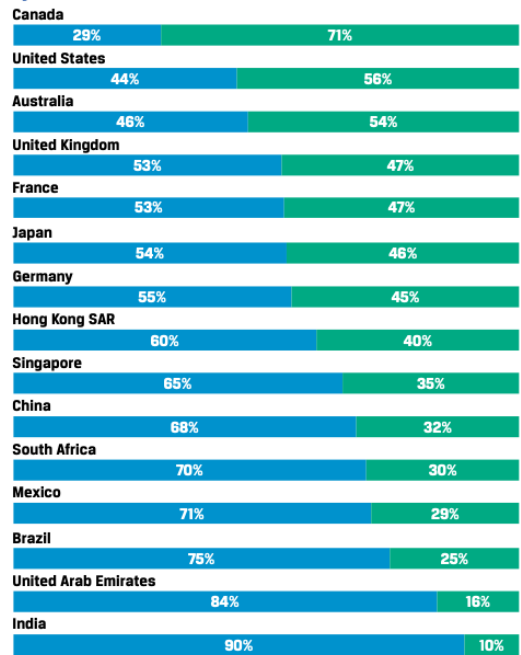
By year



By age



By market



Note: The complete question asked respondents to choose between "having a person to help navigate what is best for me and execute on my investment strategy" and "having access to the latest technology platforms and tools to execute my investment strategy."

Figure A.1: Share of preference between access to technology platforms and tools against assistance of a human being [14]

ARE YOU MORE LIKELY TO TRUST RECOMMENDATIONS FROM ...

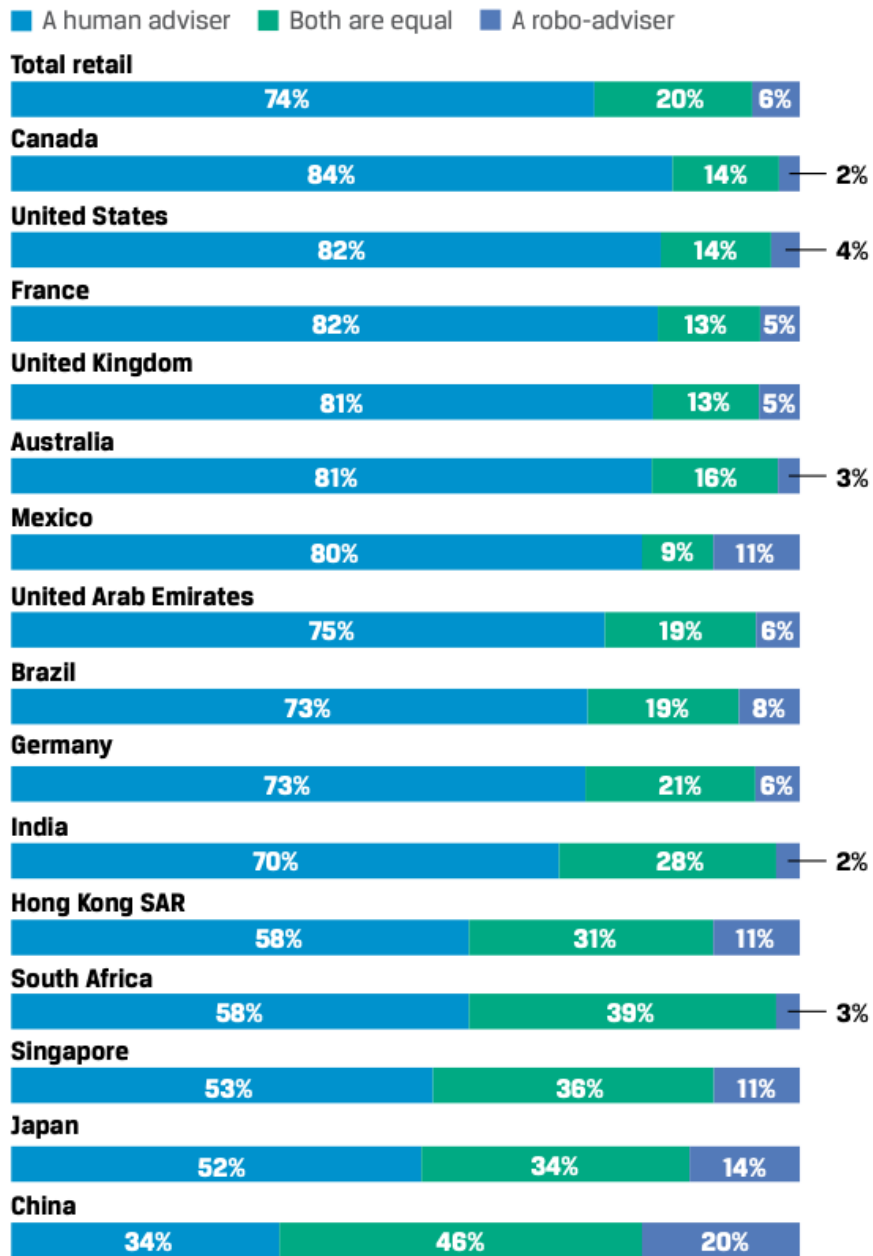


Figure A.2: Share of people trusting human and/or robo advisor [14]

| | 2017 | 2018 | 2019 | 2020 | 2021 | 2022 | 2023 | 2024 | 2025 | 2026 | 2027 |
|--------------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|
| Austria | 193.87 | 188.04 | 202.29 | 204.16 | 202.41 | 229.75 | 232.18 | 237.66 | 241.82 | 246.06 | 250.84 |
| Belgium | 71.67 | 70.67 | 77.68 | 80.00 | 83.36 | 96.63 | 101.65 | 107.50 | 112.10 | 116.16 | 120.31 |
| Bulgaria | 4.72 | 4.57 | 4.93 | 4.97 | 4.98 | 5.83 | 6.15 | 6.57 | 6.91 | 7.17 | 7.38 |
| Croatia | 4.51 | 4.59 | 5.47 | 6.31 | 7.30 | 8.80 | 10.02 | 11.23 | 12.28 | 13.23 | 14.17 |
| Cyprus | 8.80 | 8.62 | 9.35 | 9.42 | 9.41 | 10.81 | 11.03 | 11.42 | 11.75 | 12.06 | 12.38 |
| Czechia | 46.38 | 45.34 | 49.45 | 50.43 | 51.20 | 58.62 | 59.91 | 61.80 | 63.20 | 64.51 | 65.87 |
| Denmark | 650.46 | 620.78 | 661.19 | 661.50 | 641.72 | 731.74 | 731.91 | 752.04 | 762.14 | 772.23 | 792.33 |
| Estonia | 2.49 | 2.46 | 2.73 | 2.81 | 2.94 | 3.44 | 3.64 | 3.86 | 4.03 | 4.17 | 4.31 |
| Finland | 113.36 | 109.26 | 117.69 | 118.36 | 117.43 | 133.42 | 135.06 | 138.53 | 141.22 | 143.77 | 146.50 |
| France | 5,925.37 | 5,841.04 | 6,323.34 | 6,367.62 | 6,826.83 | 7,568.83 | 7,701.62 | 7,972.21 | 8,200.75 | 8,438.35 | 8,695.58 |
| Germany | 4,599.99 | 4,590.63 | 5,341.88 | 5,667.59 | 5,959.90 | 7,220.20 | 7,688.50 | 8,280.30 | 8,838.00 | 9,413.70 | 9,990.30 |
| Greece | 256.79 | 253.52 | 276.24 | 279.58 | 278.45 | 321.91 | 328.37 | 340.48 | 350.99 | 361.65 | 372.77 |
| Hungary | 28.00 | 27.34 | 29.66 | 30.04 | 30.10 | 34.52 | 35.33 | 36.59 | 37.61 | 38.57 | 39.56 |
| Ireland | 160.02 | 155.40 | 166.64 | 166.79 | 166.01 | 189.55 | 192.19 | 197.83 | 202.12 | 206.32 | 210.74 |
| Italy | 1,672.98 | 1,616.01 | 1,731.75 | 1,727.43 | 1,696.01 | 1,932.21 | 1,938.96 | 1,974.81 | 2,009.43 | 2,033.36 | 2,066.85 |
| Latvia | 2.22 | 2.21 | 2.47 | 2.64 | 2.86 | 3.38 | 3.69 | 4.00 | 4.22 | 4.41 | 4.60 |
| Lithuania | 4.11 | 4.13 | 4.69 | 5.00 | 5.37 | 6.17 | 6.49 | 6.80 | 7.02 | 7.21 | 7.40 |
| Luxembourg | 66.38 | 62.93 | 68.07 | 68.49 | 67.98 | 78.26 | 79.74 | 82.51 | 84.85 | 87.15 | 89.58 |
| Malta | 2.52 | 2.44 | 2.62 | 2.63 | 2.63 | 3.02 | 3.10 | 3.24 | 3.34 | 3.44 | 3.54 |
| Netherlands | 2,272.82 | 2,185.90 | 2,341.52 | 2,327.72 | 2,285.80 | 2,581.58 | 2,589.49 | 2,626.23 | 2,661.85 | 2,696.79 | 2,731.61 |
| Poland | 115.16 | 139.79 | 180.53 | 216.19 | 257.72 | 323.47 | 356.95 | 396.27 | 433.70 | 470.71 | 508.44 |
| Portugal | 33.31 | 32.25 | 35.41 | 36.35 | 36.80 | 42.03 | 43.12 | 44.61 | 45.75 | 46.79 | 47.87 |
| Romania | 28.47 | 27.84 | 30.11 | 30.42 | 30.40 | 35.15 | 36.27 | 37.97 | 39.43 | 40.88 | 42.46 |
| Slovakia | 12.18 | 12.06 | 13.30 | 13.56 | 14.02 | 16.41 | 17.30 | 18.34 | 19.13 | 19.78 | 20.39 |
| Slovenia | 8.80 | 8.45 | 9.00 | 8.92 | 8.74 | 9.88 | 9.91 | 10.11 | 10.24 | 10.38 | 10.53 |
| Spain | 674.43 | 657.61 | 703.26 | 698.78 | 699.06 | 788.51 | 803.68 | 827.15 | 848.05 | 866.75 | 885.51 |
| Sweden | 651.52 | 623.16 | 676.26 | 669.97 | 664.92 | 757.99 | 763.08 | 777.12 | 790.57 | 803.64 | 826.74 |

Figure A.3: Wealth Management services, AUM of EU 27 Countries in billion (€) from 2017 to 2027 [1]

| | 2017 | 2018 | 2019 | 2020 | 2021 | 2022 | 2023 | 2024 | 2025 | 2026 | 2027 |
|-------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|
| Austria | 193.00 | 186.20 | 198.30 | 197.10 | 191.80 | 217.30 | 217.00 | 220.60 | 223.20 | 226.00 | 229.10 |
| Belgium | 69.99 | 67.69 | 72.26 | 71.70 | 70.77 | 80.35 | 80.41 | 81.91 | 83.07 | 84.28 | 85.61 |
| Bulgaria | 4.71 | 4.55 | 4.88 | 4.86 | 4.72 | 5.35 | 5.35 | 5.44 | 5.51 | 5.59 | 5.67 |
| Croatia | 4.37 | 4.19 | 4.49 | 4.47 | 4.38 | 4.98 | 5.00 | 5.11 | 5.20 | 5.29 | 5.39 |
| Cyprus | 8.76 | 8.54 | 9.19 | 9.19 | 9.03 | 10.32 | 10.40 | 10.67 | 10.90 | 11.13 | 11.37 |
| Czechia | 45.97 | 44.39 | 47.31 | 46.88 | 45.66 | 51.78 | 51.75 | 52.66 | 53.34 | 54.05 | 54.84 |
| Denmark | 650.00 | 620.00 | 660.00 | 660.00 | 640.00 | 730.00 | 730.00 | 750.00 | 760.00 | 770.00 | 790.00 |
| Estonia | 2.44 | 2.36 | 2.52 | 2.50 | 2.43 | 2.76 | 2.77 | 2.82 | 2.86 | 2.90 | 2.94 |
| Finland | 112.50 | 107.50 | 114.30 | 113.00 | 109.80 | 124.30 | 124.00 | 125.90 | 127.30 | 128.70 | 130.30 |
| France | 5,920.00 | 5,830.00 | 6,300.00 | 6,330.00 | 6,770.00 | 7,500.00 | 7,620.00 | 7,880.00 | 8,100.00 | 8,330.00 | 8,580.00 |
| Germany | 4,590.00 | 4,570.00 | 5,300.00 | 5,600.00 | 5,860.00 | 7,100.00 | 7,540.00 | 8,110.00 | 8,650.00 | 9,210.00 | 9,770.00 |
| Greece | 256.40 | 252.80 | 274.90 | 277.70 | 275.50 | 318.10 | 323.50 | 334.70 | 344.50 | 354.60 | 365.20 |
| Hungary | 27.85 | 26.98 | 28.85 | 28.67 | 28.01 | 31.86 | 31.94 | 32.59 | 33.10 | 33.63 | 34.22 |
| Ireland | 159.40 | 154.00 | 163.50 | 162.10 | 158.00 | 179.00 | 178.80 | 181.90 | 184.10 | 186.50 | 189.10 |
| Italy | 1,670.00 | 1,610.00 | 1,720.00 | 1,710.00 | 1,670.00 | 1,900.00 | 1,900.00 | 1,930.00 | 1,960.00 | 1,980.00 | 2,010.00 |
| Latvia | 2.14 | 2.06 | 2.18 | 2.15 | 2.09 | 2.36 | 2.35 | 2.38 | 2.40 | 2.42 | 2.45 |
| Lithuania | 3.98 | 3.84 | 4.08 | 4.02 | 3.90 | 4.41 | 4.39 | 4.45 | 4.49 | 4.53 | 4.58 |
| Luxembourg | 66.23 | 62.65 | 67.51 | 67.59 | 66.50 | 76.25 | 77.03 | 79.19 | 81.03 | 82.92 | 84.94 |
| Malta | 2.51 | 2.41 | 2.56 | 2.53 | 2.46 | 2.78 | 2.77 | 2.82 | 2.84 | 2.88 | 2.91 |
| Netherlands | 2,270.00 | 2,180.00 | 2,330.00 | 2,310.00 | 2,260.00 | 2,550.00 | 2,550.00 | 2,580.00 | 2,610.00 | 2,640.00 | 2,670.00 |
| Poland | 114.20 | 137.10 | 174.20 | 205.90 | 241.70 | 302.60 | 330.50 | 364.30 | 396.90 | 429.90 | 463.80 |
| Portugal | 32.78 | 31.20 | 33.41 | 33.34 | 32.44 | 36.81 | 36.82 | 37.48 | 37.99 | 38.52 | 39.11 |
| Romania | 28.32 | 27.56 | 29.61 | 29.55 | 28.99 | 33.11 | 33.32 | 34.13 | 34.79 | 35.48 | 36.22 |
| Slovakia | 11.93 | 11.61 | 12.48 | 12.46 | 12.23 | 13.97 | 14.06 | 14.41 | 14.70 | 14.99 | 15.31 |
| Slovenia | 8.78 | 8.40 | 8.89 | 8.73 | 8.44 | 9.49 | 9.41 | 9.50 | 9.55 | 9.61 | 9.68 |
| Spain | 670.00 | 650.00 | 690.00 | 680.00 | 670.00 | 750.00 | 750.00 | 760.00 | 770.00 | 780.00 | 790.00 |
| Sweden | 650.00 | 620.00 | 670.00 | 660.00 | 650.00 | 740.00 | 740.00 | 750.00 | 760.00 | 770.00 | 790.00 |

Figure A.4: Assets under Management in the Financial Advisory market of EU 27 Countries in billion (€) from 2017 to 2027 [1]

| | 2017 | 2018 | 2019 | 2020 | 2021 | 2022 | 2023 | 2024 | 2025 | 2026 | 2027 |
|-------------|------|-------|-------|-------|-------|--------|--------|--------|--------|--------|--------|
| Austria | 0.87 | 1.84 | 3.99 | 7.06 | 10.61 | 12.45 | 15.18 | 17.06 | 18.62 | 20.06 | 21.74 |
| Belgium | 1.68 | 2.98 | 5.42 | 8.30 | 12.59 | 16.28 | 21.24 | 25.59 | 29.03 | 31.88 | 34.70 |
| Bulgaria | 0.01 | 0.02 | 0.05 | 0.11 | 0.26 | 0.48 | 0.80 | 1.13 | 1.40 | 1.58 | 1.71 |
| Croatia | 0.14 | 0.40 | 0.98 | 1.84 | 2.92 | 3.82 | 5.02 | 6.12 | 7.08 | 7.94 | 8.78 |
| Cyprus | 0.04 | 0.08 | 0.16 | 0.23 | 0.38 | 0.49 | 0.63 | 0.75 | 0.85 | 0.93 | 1.01 |
| Czechia | 0.41 | 0.95 | 2.14 | 3.55 | 5.54 | 6.84 | 8.16 | 9.14 | 9.86 | 10.46 | 11.03 |
| Denmark | 0.46 | 0.78 | 1.19 | 1.50 | 1.72 | 1.74 | 1.91 | 2.04 | 2.14 | 2.23 | 2.33 |
| Estonia | 0.05 | 0.10 | 0.21 | 0.31 | 0.51 | 0.68 | 0.87 | 1.04 | 1.17 | 1.27 | 1.37 |
| Finland | 0.86 | 1.76 | 3.39 | 5.36 | 7.63 | 9.12 | 11.06 | 12.63 | 13.92 | 15.07 | 16.20 |
| France | 5.37 | 11.04 | 23.34 | 37.62 | 56.83 | 68.83 | 81.62 | 92.21 | 100.75 | 108.35 | 115.58 |
| Germany | 9.99 | 20.63 | 41.88 | 67.59 | 99.90 | 120.20 | 148.50 | 170.30 | 188.00 | 203.70 | 220.30 |
| Greece | 0.39 | 0.72 | 1.34 | 1.88 | 2.95 | 3.81 | 4.87 | 5.78 | 6.49 | 7.05 | 7.57 |
| Hungary | 0.15 | 0.36 | 0.81 | 1.37 | 2.09 | 2.66 | 3.39 | 4.00 | 4.51 | 4.94 | 5.34 |
| Ireland | 0.62 | 1.40 | 3.14 | 4.69 | 8.01 | 10.55 | 13.39 | 15.93 | 18.02 | 19.82 | 21.64 |
| Italy | 2.98 | 6.01 | 11.75 | 17.43 | 26.01 | 32.21 | 38.96 | 44.81 | 49.43 | 53.36 | 56.85 |
| Latvia | 0.08 | 0.15 | 0.29 | 0.49 | 0.77 | 1.02 | 1.34 | 1.62 | 1.82 | 1.99 | 2.15 |
| Lithuania | 0.13 | 0.29 | 0.61 | 0.98 | 1.47 | 1.76 | 2.10 | 2.35 | 2.53 | 2.68 | 2.82 |
| Luxembourg | 0.15 | 0.28 | 0.56 | 0.90 | 1.48 | 2.01 | 2.71 | 3.32 | 3.82 | 4.23 | 4.64 |
| Malta | 0.01 | 0.03 | 0.06 | 0.10 | 0.17 | 0.24 | 0.33 | 0.42 | 0.50 | 0.56 | 0.63 |
| Netherlands | 2.82 | 5.90 | 11.52 | 17.72 | 25.80 | 31.58 | 39.49 | 46.23 | 51.85 | 56.79 | 61.61 |
| Poland | 0.96 | 2.69 | 6.33 | 10.29 | 16.02 | 20.87 | 26.45 | 31.97 | 36.80 | 40.81 | 44.64 |
| Portugal | 0.53 | 1.05 | 2.00 | 3.01 | 4.36 | 5.22 | 6.30 | 7.13 | 7.76 | 8.27 | 8.76 |
| Romania | 0.15 | 0.28 | 0.50 | 0.87 | 1.41 | 2.04 | 2.95 | 3.84 | 4.64 | 5.40 | 6.24 |
| Slovakia | 0.25 | 0.45 | 0.82 | 1.10 | 1.79 | 2.44 | 3.24 | 3.93 | 4.43 | 4.79 | 5.08 |
| Slovenia | 0.02 | 0.05 | 0.11 | 0.19 | 0.30 | 0.39 | 0.50 | 0.61 | 0.69 | 0.77 | 0.85 |
| Spain | 4.43 | 7.61 | 13.26 | 18.78 | 29.06 | 38.51 | 53.68 | 67.15 | 78.05 | 86.75 | 95.51 |
| Sweden | 1.52 | 3.16 | 6.26 | 9.97 | 14.92 | 17.99 | 23.08 | 27.12 | 30.57 | 33.64 | 36.74 |

Figure A.5: Assets under Management in the Digital Investment market of EU 27 Countries in billion (€) from 2017 to 2027 [1]

Appendix

| | 2017 | 2018 | 2019 | 2020 | 2021 | 2022 |
|-------------------------------|---------|---------|---------|---------|---------|---------|
| Austria | | | | | | |
| Not Even Basic Digital Skills | 70.120% | 69.785% | 69.281% | 69.056% | 68.822% | 68.336% |
| Yearly change | | -0.477% | -0.723% | -0.324% | -0.325% | -0.720% |
| Change in 5 years | -2.544% | | | | | |
| Belgium | | | | | | |
| Not Even Basic Digital Skills | 74.412% | 74.125% | 73.693% | 73.501% | 73.309% | 72.884% |
| Yearly change | | -0.385% | -0.583% | -0.261% | -0.262% | -0.579% |
| Change in 5 years | -2.053% | | | | | |
| EU-27 | | | | | | |
| Not Even Basic Digital Skills | 74.559% | 74.274% | 73.845% | 73.654% | 73.462% | 73.040% |
| Yearly change | | -0.382% | -0.578% | -0.259% | -0.260% | -0.574% |
| Change in 5 years | -2.037% | | | | | |
| Bulgaria | | | | | | |
| Not Even Basic Digital Skills | 85.289% | 85.124% | 84.876% | 84.765% | 84.654% | 84.413% |
| Yearly change | | 0.000% | -0.193% | -0.292% | -0.130% | -0.130% |
| Change in 5 years | -1.030% | | | | | |
| Croatia | | | | | | |
| Not Even Basic Digital Skills | 70.098% | 69.763% | 69.258% | 69.034% | 68.809% | 68.313% |
| Yearly change | | -0.478% | -0.723% | -0.325% | -0.326% | -0.721% |
| Change in 5 years | -2.547% | | | | | |
| Cyprus | | | | | | |
| Not Even Basic Digital Skills | 76.311% | 76.046% | 75.646% | 75.468% | 75.290% | 74.897% |
| Yearly change | | -0.348% | -0.526% | -0.235% | -0.236% | -0.522% |
| Change in 5 years | -1.853% | | | | | |
| Czechia | | | | | | |
| Not Even Basic Digital Skills | 71.837% | 71.522% | 71.047% | 70.835% | 70.623% | 70.156% |
| Yearly change | | -0.439% | -0.665% | -0.298% | -0.299% | -0.661% |
| Change in 5 years | -2.341% | | | | | |
| Denmark | | | | | | |
| Not Even Basic Digital Skills | 67.609% | 67.247% | 66.700% | 66.456% | 66.213% | 65.676% |
| Yearly change | | -0.537% | -0.813% | -0.365% | -0.367% | -0.811% |
| Change in 5 years | -2.860% | | | | | |
| Estonia | | | | | | |
| Not Even Basic Digital Skills | 73.402% | 73.105% | 72.656% | 72.456% | 72.256% | 71.814% |
| Yearly change | | -0.406% | -0.614% | -0.275% | -0.276% | -0.610% |
| Change in 5 years | -2.163% | | | | | |
| Finland | | | | | | |
| Not Even Basic Digital Skills | 62.641% | 62.223% | 61.592% | 61.312% | 61.031% | 60.411% |
| Yearly change | | -0.668% | -1.014% | -0.456% | -0.458% | -1.015% |
| Change in 5 years | -3.561% | | | | | |
| France | | | | | | |
| Not Even Basic Digital Skills | 70.766% | 70.439% | 69.945% | 69.726% | 69.506% | 69.021% |
| Yearly change | | -0.463% | -0.701% | -0.314% | -0.315% | -0.697% |
| Change in 5 years | -2.466% | | | | | |
| Germany | | | | | | |
| Not Even Basic Digital Skills | 76.917% | 76.658% | 76.268% | 76.095% | 75.921% | 75.338% |
| Yearly change | | -0.336% | -0.508% | -0.228% | -0.228% | -0.504% |
| Change in 5 years | -1.792% | | | | | |
| Greece | | | | | | |
| Not Even Basic Digital Skills | 75.239% | 74.961% | 74.543% | 74.357% | 74.171% | 73.760% |
| Yearly change | | -0.369% | -0.558% | -0.250% | -0.250% | -0.554% |
| Change in 5 years | -1.965% | | | | | |
| Hungary | | | | | | |
| Not Even Basic Digital Skills | 76.836% | 76.577% | 76.186% | 76.011% | 75.837% | 75.453% |
| Yearly change | | -0.338% | -0.511% | -0.229% | -0.229% | -0.507% |
| Change in 5 years | -1.800% | | | | | |
| Ireland | | | | | | |
| Not Even Basic Digital Skills | 66.740% | 66.368% | 65.806% | 65.556% | 65.306% | 64.755% |
| Yearly change | | -0.558% | -0.846% | -0.380% | -0.381% | -0.845% |
| Change in 5 years | -2.975% | | | | | |
| Italy | | | | | | |
| Not Even Basic Digital Skills | 78.487% | 78.246% | 77.883% | 77.721% | 77.559% | 77.202% |
| Yearly change | | -0.307% | -0.464% | -0.208% | -0.208% | -0.460% |
| Change in 5 years | -1.636% | | | | | |
| Latvia | | | | | | |
| Not Even Basic Digital Skills | 76.029% | 75.761% | 75.356% | 75.176% | 74.995% | 74.598% |
| Yearly change | | -0.353% | -0.534% | -0.239% | -0.240% | -0.530% |
| Change in 5 years | -1.882% | | | | | |
| Lithuania | | | | | | |
| Not Even Basic Digital Skills | 76.956% | 76.697% | 76.308% | 76.135% | 75.962% | 75.580% |
| Yearly change | | -0.335% | -0.507% | -0.227% | -0.228% | -0.503% |
| Change in 5 years | -1.788% | | | | | |
| Luxembourg | | | | | | |
| Not Even Basic Digital Skills | 69.902% | 69.565% | 69.057% | 68.830% | 68.604% | 68.105% |
| Yearly change | | -0.482% | -0.730% | -0.328% | -0.329% | -0.728% |
| Change in 5 years | -2.571% | | | | | |
| Malta | | | | | | |
| Not Even Basic Digital Skills | 71.112% | 70.788% | 70.301% | 70.084% | 69.866% | 69.387% |
| Yearly change | | -0.455% | -0.689% | -0.309% | -0.310% | -0.686% |
| Change in 5 years | -2.425% | | | | | |
| Netherlands | | | | | | |
| Not Even Basic Digital Skills | 62.752% | 62.325% | 61.706% | 61.426% | 61.146% | 60.528% |
| Yearly change | | -0.665% | -1.009% | -0.454% | -0.456% | -1.010% |
| Change in 5 years | -3.544% | | | | | |
| Poland | | | | | | |
| Not Even Basic Digital Skills | 79.746% | 79.520% | 79.178% | 79.025% | 78.873% | 78.537% |
| Yearly change | | -0.284% | -0.430% | -0.192% | -0.193% | -0.426% |
| Change in 5 years | -1.516% | | | | | |
| Portugal | | | | | | |
| Not Even Basic Digital Skills | 73.904% | 73.611% | 73.171% | 72.975% | 72.779% | 72.346% |
| Yearly change | | -0.396% | -0.598% | -0.268% | -0.269% | -0.595% |
| Change in 5 years | -2.108% | | | | | |
| Romania | | | | | | |
| Not Even Basic Digital Skills | 86.873% | 86.726% | 86.504% | 86.406% | 86.307% | 86.089% |
| Yearly change | | -0.169% | -0.256% | -0.114% | -0.114% | -0.252% |
| Change in 5 years | -0.902% | | | | | |
| Slovakia | | | | | | |
| Not Even Basic Digital Skills | 73.963% | 73.672% | 73.232% | 73.036% | 72.841% | 72.409% |
| Yearly change | | -0.394% | -0.597% | -0.267% | -0.268% | -0.593% |
| Change in 5 years | -2.102% | | | | | |
| Slovenia | | | | | | |
| Not Even Basic Digital Skills | 76.564% | 76.301% | 75.906% | 75.729% | 75.553% | 75.165% |
| Yearly change | | -0.343% | -0.518% | -0.232% | -0.233% | -0.514% |
| Change in 5 years | -1.827% | | | | | |
| Spain | | | | | | |
| Not Even Basic Digital Skills | 69.725% | 69.386% | 68.875% | 68.647% | 68.420% | 67.918% |
| Yearly change | | -0.486% | -0.737% | -0.330% | -0.332% | -0.734% |
| Change in 5 years | -2.592% | | | | | |
| Sweden | | | | | | |
| Not Even Basic Digital Skills | 68.613% | 68.261% | 67.732% | 67.496% | 67.260% | 66.739% |
| Yearly change | | -0.512% | -0.776% | -0.348% | -0.350% | -0.774% |
| Change in 5 years | -2.731% | | | | | |

Figure A.6: Share of people per country with not even basic digital skills, from 2017 to 2022 [2]

Appendix

| | 2017 | 2018 | 2019 | 2020 | 2021 | 2022 |
|------------------------------------|--------|--------|--------|--------|--------|--------|
| Austria | | | | | | |
| DESI-At least Basic Digital Skills | 29.88% | 30.21% | 30.72% | 30.94% | 31.17% | 31.66% |
| DESI-Above basic digital skills | 10.23% | 10.47% | 11.13% | 11.51% | 11.90% | 12.61% |
| Belgium | | | | | | |
| DESI-At least Basic Digital Skills | 25.59% | 25.87% | 26.31% | 26.50% | 26.69% | 27.12% |
| DESI-Above basic digital skills | 8.09% | 8.28% | 8.81% | 9.11% | 9.42% | 9.98% |
| EU-27 | | | | | | |
| DESI-At least Basic Digital Skills | 25.44% | 25.73% | 26.16% | 26.35% | 26.54% | 26.96% |
| DESI-Above basic digital skills | 8.13% | 8.32% | 8.85% | 9.15% | 9.46% | 10.02% |
| Bulgaria | | | | | | |
| DESI-At least Basic Digital Skills | 14.71% | 14.88% | 15.12% | 15.24% | 15.35% | 15.59% |
| DESI-Above basic digital skills | 2.40% | 2.46% | 2.61% | 2.71% | 2.80% | 2.96% |
| Croatia | | | | | | |
| DESI-At least Basic Digital Skills | 29.90% | 30.24% | 30.74% | 30.97% | 31.19% | 31.69% |
| DESI-Above basic digital skills | 9.58% | 9.81% | 10.42% | 10.79% | 11.15% | 11.81% |
| Cyprus | | | | | | |
| DESI-At least Basic Digital Skills | 23.69% | 23.95% | 24.35% | 24.53% | 24.71% | 25.10% |
| DESI-Above basic digital skills | 6.44% | 6.59% | 7.00% | 7.25% | 7.49% | 7.94% |
| Czechia | | | | | | |
| DESI-At least Basic Digital Skills | 28.16% | 28.48% | 28.95% | 29.17% | 29.38% | 29.84% |
| DESI-Above basic digital skills | 7.39% | 7.57% | 8.04% | 8.32% | 8.60% | 9.11% |
| Denmark | | | | | | |
| DESI-At least Basic Digital Skills | 32.39% | 32.75% | 33.30% | 33.54% | 33.79% | 34.32% |
| DESI-Above basic digital skills | 11.48% | 11.76% | 12.49% | 12.93% | 13.36% | 14.16% |
| Estonia | | | | | | |
| DESI-At least Basic Digital Skills | 26.60% | 26.90% | 27.34% | 27.54% | 27.74% | 28.19% |
| DESI-Above basic digital skills | 8.50% | 8.71% | 9.25% | 9.57% | 9.90% | 10.48% |
| Finland | | | | | | |
| DESI-At least Basic Digital Skills | 37.36% | 37.78% | 38.41% | 38.69% | 38.97% | 39.59% |
| DESI-Above basic digital skills | 14.79% | 15.14% | 16.09% | 16.65% | 17.21% | 18.23% |
| France | | | | | | |
| DESI-At least Basic Digital Skills | 29.23% | 29.56% | 30.05% | 30.27% | 30.49% | 30.98% |
| DESI-Above basic digital skills | 9.60% | 9.83% | 10.45% | 10.81% | 11.17% | 11.84% |
| Germany | | | | | | |
| DESI-At least Basic Digital Skills | 23.08% | 23.34% | 23.73% | 23.91% | 24.08% | 24.46% |
| DESI-Above basic digital skills | 5.79% | 5.93% | 6.30% | 6.52% | 6.74% | 7.14% |
| Greece | | | | | | |
| DESI-At least Basic Digital Skills | 24.76% | 25.04% | 25.46% | 25.64% | 25.83% | 26.24% |
| DESI-Above basic digital skills | 6.67% | 6.82% | 7.25% | 7.51% | 7.76% | 8.22% |
| Hungary | | | | | | |
| DESI-At least Basic Digital Skills | 23.16% | 23.42% | 23.81% | 23.99% | 24.16% | 24.55% |
| DESI-Above basic digital skills | 6.62% | 6.77% | 7.20% | 7.45% | 7.70% | 8.16% |
| Ireland | | | | | | |
| DESI-At least Basic Digital Skills | 33.26% | 33.63% | 34.19% | 34.44% | 34.69% | 35.25% |
| DESI-Above basic digital skills | 12.20% | 12.48% | 13.27% | 13.73% | 14.19% | 15.04% |
| Italy | | | | | | |
| DESI-At least Basic Digital Skills | 21.51% | 21.75% | 22.12% | 22.28% | 22.44% | 22.80% |
| DESI-Above basic digital skills | 6.92% | 7.08% | 7.53% | 7.79% | 8.05% | 8.53% |
| Latvia | | | | | | |
| DESI-At least Basic Digital Skills | 23.97% | 24.24% | 24.64% | 24.82% | 25.00% | 25.40% |
| DESI-Above basic digital skills | 7.31% | 7.48% | 7.95% | 8.23% | 8.51% | 9.01% |
| Lithuania | | | | | | |
| DESI-At least Basic Digital Skills | 23.04% | 23.30% | 23.69% | 23.86% | 24.04% | 24.42% |
| DESI-Above basic digital skills | 7.07% | 7.24% | 7.69% | 7.96% | 8.23% | 8.71% |
| Luxembourg | | | | | | |
| DESI-At least Basic Digital Skills | 30.10% | 30.44% | 30.94% | 31.17% | 31.40% | 31.90% |
| DESI-Above basic digital skills | 9.77% | 10.01% | 10.63% | 11.00% | 11.37% | 12.05% |
| Malta | | | | | | |
| DESI-At least Basic Digital Skills | 28.89% | 29.21% | 29.70% | 29.92% | 30.13% | 30.61% |
| DESI-Above basic digital skills | 10.90% | 11.16% | 11.86% | 12.28% | 12.69% | 13.44% |
| Netherlands | | | | | | |
| DESI-At least Basic Digital Skills | 37.25% | 37.67% | 38.29% | 38.57% | 38.85% | 39.47% |
| DESI-Above basic digital skills | 15.91% | 16.28% | 17.31% | 17.91% | 18.51% | 19.61% |
| Poland | | | | | | |
| DESI-At least Basic Digital Skills | 20.25% | 20.48% | 20.82% | 20.97% | 21.13% | 21.46% |
| DESI-Above basic digital skills | 6.34% | 6.49% | 6.90% | 7.14% | 7.38% | 7.82% |
| Portugal | | | | | | |
| DESI-At least Basic Digital Skills | 26.10% | 26.39% | 26.83% | 27.03% | 27.22% | 27.65% |
| DESI-Above basic digital skills | 8.77% | 8.98% | 9.54% | 9.87% | 10.21% | 10.81% |
| Romania | | | | | | |
| DESI-At least Basic Digital Skills | 13.13% | 13.27% | 13.50% | 13.59% | 13.69% | 13.91% |
| DESI-Above basic digital skills | 2.68% | 2.74% | 2.92% | 3.02% | 3.12% | 3.31% |
| Slovakia | | | | | | |
| DESI-At least Basic Digital Skills | 26.04% | 26.33% | 26.77% | 26.96% | 27.16% | 27.59% |
| DESI-Above basic digital skills | 6.40% | 6.55% | 6.96% | 7.20% | 7.45% | 7.89% |
| Slovenia | | | | | | |
| DESI-At least Basic Digital Skills | 23.44% | 23.70% | 24.09% | 24.27% | 24.45% | 24.84% |
| DESI-Above basic digital skills | 6.06% | 6.20% | 6.59% | 6.82% | 7.05% | 7.47% |
| Spain | | | | | | |
| DESI-At least Basic Digital Skills | 30.27% | 30.61% | 31.13% | 31.35% | 31.58% | 32.08% |
| DESI-Above basic digital skills | 11.69% | 11.97% | 12.72% | 13.16% | 13.61% | 14.42% |
| Sweden | | | | | | |
| DESI-At least Basic Digital Skills | 31.39% | 31.74% | 32.27% | 32.50% | 32.74% | 33.26% |
| DESI-Above basic digital skills | 10.96% | 11.22% | 11.93% | 12.34% | 12.76% | 13.51% |

Figure A.7: DESI Individual Indicator At least Basic Digital Skills and DESI Individual Indicator Above basic digital skills per country, from 2017 to 2022 [2]

| | 2017 | 2018 | 2019 | 2020 | 2021 | 2022 | 2023 | 2024 | 2025 | 2026 | 2027 |
|-------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|
| Austria | 8.797 | 8.841 | 8.88 | 8.908 | 8.922 | 8.94 | 8.959 | 8.977 | 8.994 | 9.01 | 9.024 |
| Belgium | 11.38 | 11.45 | 11.51 | 11.56 | 11.61 | 11.66 | 11.69 | 11.72 | 11.74 | 11.77 | 11.8 |
| EU-27 | 434 | 435.8 | 437.5 | 438.8 | 439.9 | 440.8 | 441.5 | 441.9 | 442.3 | 442.7 | 443.2 |
| Bulgaria | 7.182 | 7.117 | 7.053 | 6.979 | 6.886 | 6.782 | 6.688 | 6.619 | 6.565 | 6.511 | 6.457 |
| Croatia | 4.192 | 4.16 | 4.13 | 4.097 | 4.06 | 4.03 | 4.009 | 3.987 | 3.964 | 3.942 | 3.919 |
| Cyprus | 1.209 | 1.219 | 1.229 | 1.238 | 1.244 | 1.251 | 1.26 | 1.268 | 1.277 | 1.284 | 1.292 |
| Czechia | 10.53 | 10.53 | 10.54 | 10.53 | 10.51 | 10.49 | 10.5 | 10.5 | 10.51 | 10.51 | 10.52 |
| Denmark | 5.737 | 5.767 | 5.796 | 5.826 | 5.854 | 5.882 | 5.911 | 5.94 | 5.968 | 5.997 | 6.025 |
| Estonia | 1.318 | 1.322 | 1.327 | 1.329 | 1.329 | 1.326 | 1.323 | 1.319 | 1.315 | 1.31 | 1.306 |
| Finland | 5.508 | 5.515 | 5.522 | 5.529 | 5.536 | 5.541 | 5.545 | 5.55 | 5.554 | 5.558 | 5.56 |
| France | 64.14 | 64.28 | 64.4 | 64.48 | 64.53 | 64.63 | 64.76 | 64.88 | 65 | 65.12 | 65.23 |
| Germany | 82.62 | 82.9 | 83.15 | 83.33 | 83.41 | 83.37 | 83.29 | 83.25 | 83.2 | 83.13 | 83.06 |
| Greece | 10.69 | 10.63 | 10.57 | 10.51 | 10.45 | 10.38 | 10.34 | 10.3 | 10.26 | 10.22 | 10.18 |
| Hungary | 9.789 | 9.776 | 9.772 | 9.751 | 9.71 | 9.967 | 10.16 | 9.995 | 9.871 | 9.79 | 9.741 |
| Ireland | 4.772 | 4.835 | 4.896 | 4.946 | 4.987 | 5.023 | 5.057 | 5.089 | 5.121 | 5.151 | 5.181 |
| Italy | 60 | 59.88 | 59.73 | 59.5 | 59.24 | 59.04 | 58.87 | 58.7 | 58.52 | 58.33 | 58.15 |
| Latvia | 1.955 | 1.936 | 1.917 | 1.897 | 1.874 | 1.851 | 1.83 | 1.81 | 1.791 | 1.772 | 1.754 |
| Lithuania | 2.904 | 2.876 | 2.849 | 2.82 | 2.787 | 2.75 | 2.718 | 2.693 | 2.668 | 2.645 | 2.623 |
| Luxembourg | 0.5963 | 0.6079 | 0.62 | 0.6304 | 0.6393 | 0.6476 | 0.6548 | 0.6616 | 0.6681 | 0.6743 | 0.6802 |
| Malta | 0.4795 | 0.4916 | 0.5036 | 0.5154 | 0.5267 | 0.5333 | 0.5351 | 0.5367 | 0.5383 | 0.5397 | 0.541 |
| Netherlands | 17.21 | 17.29 | 17.36 | 17.43 | 17.5 | 17.56 | 17.62 | 17.67 | 17.72 | 17.77 | 17.82 |
| Poland | 38.53 | 38.52 | 38.49 | 38.43 | 38.31 | 39.86 | 41.03 | 40.22 | 39.62 | 39.24 | 39.05 |
| Portugal | 10.31 | 10.29 | 10.29 | 10.3 | 10.29 | 10.27 | 10.25 | 10.22 | 10.2 | 10.17 | 10.15 |
| Romania | 19.7 | 19.61 | 19.52 | 19.44 | 19.33 | 19.66 | 19.89 | 19.62 | 19.42 | 19.29 | 19.21 |
| Slovakia | 5.439 | 5.447 | 5.454 | 5.457 | 5.448 | 5.643 | 5.795 | 5.703 | 5.635 | 5.596 | 5.579 |
| Slovenia | 2.098 | 2.106 | 2.113 | 2.118 | 2.119 | 2.12 | 2.12 | 2.119 | 2.118 | 2.116 | 2.114 |
| Spain | 46.58 | 46.79 | 47.13 | 47.36 | 47.49 | 47.56 | 47.52 | 47.47 | 47.42 | 47.36 | 47.3 |
| Sweden | 10.06 | 10.16 | 10.27 | 10.37 | 10.47 | 10.55 | 10.61 | 10.67 | 10.73 | 10.79 | 10.85 |

Figure A.8: Number of EU citizens (in mln), from 2017 to 2022 [2]

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