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Vanguard's Digital Advisor and the European Robo-Advisory Market

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Master in, Business Administration

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Abstract (Portuguese)

Os Robo-advisors baseiam a sua estratégia de investimento em fundos índice de baixo custo. O Vanguard Group anunciou o lançamento do seu Robo-advisor norte-americano no terceiro trimestre de 2020. Sendo um dos maiores fornecedores de fundos índice, o grupo Vanguard concentra quer a prestação de serviços de consultoria automatizada quer a gestão dos veículos de investimento subjacentes. **Este estudo visa determinar se o modelo da Vanguard resulta numa redução relevante de custos para os investidores e, portanto, numa vantagem competitiva em relação aos concorrentes**.

O nosso foco é o **mercado europeu**, onde a Vanguard está atualmente a expandir os seus serviços de investimento e os principais Robo-advisors lutam para aumentar a sua penetração no mercado. Para testar a hipótese de se um Robo-advisor europeu da Vanguard poderá ter uma vantagem de custos determinante, fazemos uma simulação dos seus custos extrapolando os custos incrementais dos serviços da Vanguard no Reino Unido face aos dos EUA. Os **resultados** mostram que os Robo-advisors independentes não podem competir com o Vanguard Digital Advisor numa base de custos.

Keywords: Robo-advisor, Vanguard Group, Mercado europeu; Novo serviço
JEL classification: M13, M16

Abstract

Robo-advisors base their investment strategy on low-cost indexed funds. Vanguard Group announced the launch of its US Robo-advisor in the third quarter of 2020. Being one of the largest providers of indexed funds, Vanguard concentrates both the provision of automated advisory services and the management of the underlying investment vehicles. **This study aims to determine if Vanguard's model results in a relevant reduction of costs for investors** and therefore in a competitive advantage against competitors.

Our focus is on the **European market**, where Vanguard is currently expanding its investment services and the leading Robo-advisory providers struggle to expand. To test the hypothesis that a European Robo-advisor by Vanguard would have a determinant cost advantage, we simulate its costs by extrapolating the incremental costs of Vanguard services in the UK against the ones in the US. The **results** show that independent Robo-advisors cannot compete with Vanguard Digital Advisor on a cost basis.

Keywords: Robo-advisor, Vanguard Group, European market; New service
JEL classification: M13, M16

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1. Introduction

Robo-advisors are one of the outputs of the so-called 'FinTech revolution' that has followed after the financial crisis of 2008. The term FinTech refers to the application of digital technologies to the financial sector. FinTech innovations, such as mobile banking and payments, not only have digitalized most business processes of the existing financial industry but have also led to new financial services and business models that are reshaping the sector (Jung, Dorner & Glaser, 2018). From peer-to-peer lending services to free online brokers or cryptocurrency exchanges and blockchain solutions, the 2010 decade has witnessed the spark of hundreds of FinTech start-ups.

The digitalization of financial services allows for important cost-savings and economies of scale. While at the same time, it exponentially increases their potential market thanks to the ubiquity of digital services (Jung, Glaser & Köpplin, 2019). This combination has led some FinTechs to target the investment services for retail investors. Both online brokers and Robo-advisors are examples of the 'democratization' of investment services that were once hardly accessible to the average citizen due to their high costs and minimum investment requirements (Ludden, Thompson & Mohsin, 2015; Jung et al. 2018).

Robo-advisors allow clients to easily, quickly and cheaply build and maintain investment portfolios that are meant to be adequate to their risk profile and financial objectives (Sironi, 2016; Ludden et al., 2015; Cocca, 2016). Robo-advisors make use of indexed funds and passive investment strategies, which have also been gaining popularity in the last decade (Jung et al., 2018).

The spark and growth of Robo-advisory services have also benefited from a decade of fast growth in the financial markets (Jung et al., 2019). This, together with a low-interest rates environment in the developed economies, has increased the interest of average citizens in financial markets as opposed to more traditional and conservative alternatives, such as bank deposits that are no longer yielding interests.

After more than a decade since the launch of the first automated financial advisor, the Robo-advisory market remains in a developing stage (Backend Benchmarking, 2020). This fintech revolution that was first led by emerging start-ups has seen how incumbent financial institutions have progressively entered the market (Backend Benchmarking, 2021).

Vanguard Group, the largest provider of mutual funds and the second-largest provider of exchange-traded funds, announced, in the second half of 2020, the launch of its Digital Advisor[1].

Given that Robo-advisors invest through ETFs, the direct provision of Robo-advisory services by one of the largest ETF providers represents an alternative value chain model in which intermediary service providers are removed. We study whether the cost-savings consequence of this model could lead to an unbeatable cost advantage for Vanguard Digital Advisor.

The US Robo-advisory market is, by far, the most developed and mature one with over USD 600 billion assets under management as of the end of 2019 (BVI, 2020; Backend Benchmarking, 2020). Its leading participants include both independent firms, that emerged as start-ups, and established financial institutions, that have either acquired or developed their own Robo-advisory solution. Nevertheless, none of the American Robo-advisors has yet tried to expand to any foreign market. We regard the entry of Vanguard as a major event in the sector with the potential to disrupt the current American Robo-advisory market and to be the first US Robo-advisor that expands into Europe.

Therefore, the objective of our study is to assess the potential for disruption of Vanguard Digital Advisor in the European Robo-advisory market.

Our study begins with a literature review. The irruption of 'FinTech' innovations in the last decade has attracted much attention both from the business and academic point of view. The literature available about Robo-advisory services is extensive and serves as a solid foundation for our study, as it allows us to understand the characteristics and competitive advantages of this new financial advisory service.

Similarly, the size and relevance of Vanguard within the financial industry, together with the continuous growth of passive investment strategies, has also drawn increasing attention to the Vanguard Group and its investment services. The second part of our literature review focuses on analysing the history and characteristics of the Vanguard Group. This allows us to better understand how the provision of Robo-advisory services may fit within Vanguard's mission and business strategy. At the same time, it also

[1] https://investor.vanguard.com/advice/digital-advisor/

provides us with insight on how the characteristics of Vanguard may benefit or expose its Digital Advisor to the different strengths and weaknesses of Robo-advisory services.

In the third chapter, we define our research hypotheses and provide contextualization of why we assess the hypothetical launch of a Vanguard Digital Advisor in European markets as both a likely and relevant scenario. This begins with a review of whether Robo-advisors need to expand to other markets as part of their growth strategy and how the entrance of international financial institutions, such as Vanguard, in the provision of Robo-advisory services may spark the process. The contextualization also includes an overview of the current European Robo-advisory landscape, the main European Robo-advisory providers and their expansion strategies across the different European markets. Finally, we also review Vanguard's international expansion, which allows us to contextualize whether the launch of its digital advisor to European markets would fit within its expansion process and strategy.

After describing the applied methodology in the fourth chapter, the results of the study and the data used to achieve them are presented in the fifth one. Our data and results are mainly focused on the total costs incurred by investors in the leading European Robo-advisors. Their low fees are one of the main advantages that have driven the growth of Robo-advisory services (Jung et al., 2019). Similarly, Vanguard Group has always focused its business on the provision of diversified and passively managed funds at the lowest possible cost for investors (Bogle, 2014; Bernstein, 2010). These types of funds are indeed the investment vehicles used by Robo-advisors in their low-cost investment strategies.

With the launch of its Robo-advisor in the US, Vanguard concentrates within the group the provision of the automated advisory services and the management of the funds that the Robo-advisor invests in. We use the available data to simulate the potential pricing of a European version of Vanguard Digital Advisor to establish a comparison with the Robo-advisors currently available in Europe.

Additionally, we also consider Vanguard's proposition in regards to the rest of the strengths and weaknesses that characterize Robo-advisory services. With this, we perform an additional assessment on whether a potential cost advantage could be strengthened with other competitive advantages or result less relevant due to other weaknesses against its competitors. Finally, the conclusions of the study are presented in chapter number six.

2. Literature Review

2.1 Robo-Advisors

Robo-advisors have been defined by academic research as digital platforms, which comprise interactive and intelligent user assistance components (Maedche, Morana, Schacht, Werth & Krumeich, 2016). By using algorithms and information technology, they guide customers through an automated investment advisory process (Sironi, 2016; Ludden et al., 2015) to determine the most appropriate asset allocation (Cocca, 2016). Robo-advisory services also create and afterwards rebalance the portfolios, by automatically executing the trade orders according to the advised asset allocation (Cocca, 2016).

One of the main characteristics of Robo-advisors, and their major disruption, is the total absence of human interaction (Cocca, 2016) along the whole customer journey and investment advisory and execution process. Robo-advisors have emerged in the last decade in the context of the development and success of digitalized financial services, the so-named 'FinTechs', which evidence the demand for uncomplicated financial services affordable to average citizens (Jung et al., 2018).

Robo-advisors result from the combination of continuous digitalization, the growth of e-commerce, and the introduction of algorithmic trading. The outcome is a fully automated investment service with the potential to reach the vast majority of customer segments (Jung et al., 2018). Therefore, Robo-advisors offer a completely innovative approach to traditional financial advisory services by digitalizing the entire process (Cocca, 2016).

The phases required to produce the investment advice are the same as in traditional advisory services and Jung et al., (2018) summarize them in the following three steps: "Configuration, Matching and Customization, and Maintenance".

Following the fundamental principle that portfolios have to be designed according to the risk-appetite of each client (Cocca, 2016; Jung et al., 2019), the Configuration phase consists of an exchange of information to mainly assess the customer's investment goals, risk aversion and returns expectations (Kilic, Heinrich & Schwabe, 2015). Traditionally, this information exchange was conducted through face-to-face interviews and bilateral interaction. Robo-advisors replace human communication with online questionnaires, where investors are responsible for autonomously reporting their financial situation and

investment preferences. Depending on the Robo-advisor, questionnaires may include varying topics to assess customer's profiles beyond their risk aversion, such as ethical and sector preferences (Jung et al., 2018). Tertilt & Scholz (2017) present a detailed analysis of how Robo-advisors profile their customers.

The information gathered in the first step is transformed into investment advice in the "Matching and Customization" phase. Based on their risk profile, investors are matched with a strategic asset allocation (Jung et al., 2018). This automated advice is produced by the more or less complex algorithms that each Robo-advisor develops (Cocca, 2016).

Given that the characteristics of financial products, mainly their value and risk, fluctuates over time, the "Maintenance" phase consists of monitoring the portfolio and the market to automatically rebalance the securities weights to keep the portfolio in line with the risk level and its advised asset allocation (Jung et al.. 2019).

Another common trait of Robo-advisors is their passive investment strategy, as they all make use of a mix of indexed products in their portfolios. The most common products are Exchange Traded Funds (ETFs), which passively track market benchmarks by replicating index behaviours (Jung et al., 2018). The simple and low-cost structure of ETFs also allows for reducing the total investment costs (Cocca, 2016) and the complexity to report them. Passive mutual funds are less common, although also used, as they cannot be constantly traded in the market, which facilitates the automated portfolio rebalancing process, and are not suitable for tax-loss harvesting (Sironi, 2016). However, tax-loss harvesting strategies differ in each country depending on their tax regulations.

The use of passive investment strategies eliminates the need for securities selection, which simplifies the asset allocation process, as the algorithm just needs to balance the weight of each asset class depending on the profile assigned to each investor (Jung et al., 2018). The strategy behind the assigned weight to each ETF in a portfolio is based on Modern Portfolio Theory (Cocca, 2016). This theory is a mathematical framework that calculates the exposure that a portfolio should have to each asset class in order to maximize its return within each level of risk (Lam, 2016). The Modern Portfolio Theory of Markowitz (1952) is referenced as the most modern and efficient approach to estimate the optimal asset allocation.

One of the common characteristics of Robo-advisors is their relatively low-cost structure. As described above, Robo-advisors can reduce their personnel and assets costs by completely digitalizing their service, and removing human interaction (Jung et al., 2018). Besides replacing the human effort of advising and managing customer's portfolios individually with an algorithm, Robo-advisors also benefit from their complete digital self-on boarding and self-assessment process. The automation of the asset allocation process, and the posterior portfolio monitoring and management, enables the absence of human interaction along the whole customer lifecycle.

Robo-advisors are then able to translate their low-cost structure into considerable low fees and minimum investment requirements (Jung et al., 2017), which is one of their main strengths as covered in the SWOT analysis (Table 1) by Jung et al. (2019). This disruptive approach to financial advisory services, allows Robo-advisors to target a larger number of retail clients, with lower investable amounts than the ones traditional advisory services require as a minimum investment (Ludden et al., 2015). The average portfolio size in Robo-advisors such as Wealthfront or Betterment is between 20 and 40 thousand USD (Cocca, 2016).

Besides their low fee structure and minimum investment, Robo-advisors also base their disruption on the simplicity of their products. Their passive investment strategy, based on indexed ETFs, results easy to explain (Jung et al., 2018), while their digital platforms and processes are very graphical, informative, and user friendly. The result is a very attractive service for the younger and tech-savvy generation of investors (Jung et al. 2019). The advised asset allocation is also presented in a way that results logical to the investor, according to their risk questionnaire answers, increasing their level of trust as when receiving financial advice from an individual (Sironi, 2016).

Therefore, millennials are the main target group for Robo-advisors (Sironi, 2016). However, in their expansion process, Robo-advisors have also started targeting wealthy investors, and thus, beginning to steal clients from traditional wealth management services (Sironi, 2016). This has led traditional advisors to start integrating Robo-advisory solutions into their services (Jung et al., 2019), which highlights the success and potential of their disruption.

Like every financial product, their final assessment is always determined by their performance. Robo-advisors' portfolios are created and automatically rebalanced

according to established algorithms (Jung et al., 2019) that have been developed based on the modern portfolio theory from Markowitz (1952). According to a study by Reher and Sun (2016) Robo-advisors have outperformed self-managed and mutual fund portfolios. The main reasons for their better performing application of modern portfolio theory are their low-cost passive investment strategy, their automated rebalancing and the lack of human emotionality in their decision-making (Jung et al., 2019).

Indeed, the absence of human emotions is regarded as the biggest advantage of relying on an algorithm. The major struggle for average investors is not building an indexed portfolio, but maintaining the strategy and periodically rebalancing, especially during market downturns (Traff, 2016). Robo-advisors completely remove emotional decisions from portfolio management, guaranteeing that the portfolio stays within the advised allocation by selling more of the asset classes that go up and buying more from the ones that go down.

TABLE 1.1 ROBO-ADVISORY SWOT ANALYSIS

	Helpful Positive Characteristics	Harmful Negative Characteristics
Internal	**Strengths**	**Weaknesses**
	Lower fees and minimum investment	Investment costs are not minimized
	Tax-loss harvesting	Conflict of interests
	Investment experience	Poor assessment of risk tolerance and lack of personalization
	Portfolio construction by algorithms and automated rebalancing	No personal contact
	Less emotional decision making	Unfulfilled fiduciary duty
External	**Opportunities**	**Threats**
	Ubiquity of Digital Services	Competitive environment
	Opportunity to standardize and integrate Goal-based investing	No acceptance of users
	Complement traditional advisors	Possible threat from regulators
		Bearish market and crisis

Source: Jung et al. (2019) Overview of the SWOT analysis of Robo-advisory.

Another advantage of Robo-advisors is their tax-loss harvesting capacity (Jung et al., 2019). This feature, however, is dependent and limited to the tax regulations of each territory.

Nevertheless, Robo-advisory services also present weaknesses. In their attempt to attract new customers with their low-cost fees, some Robo-advisors even advertise their services as "zero-fee", which according to Fein (2015) is far from accurate. Robo-advisors incur in brokerage, custody, and other expenses that end up being charged to the final customer, either directly or indirectly. Indeed, these costs may include retrocession fees that contribute to financing the Robo-advisors. In some cases, total costs are not properly disclosed to customers and are hidden behind lower portfolio performances. Moreover, Fein (2015) also argues that according to the analysed terms and conditions, Robo-advisors reserve the right to modify the fees at any time. Therefore, very low fees could just be an initial strategy to gain clients to, when the customer base is large enough, increase fees. As Jung et al. (2019) argue, Robo-advisory services can never be at no cost for customers, as they have to remain a sustainable and profitable business.

Following Robo-advisors relationship with brokers or custodians, FINRA (2016) released a report warning customers that Robo-advisors incur the same conflict of interests as any other financial advisory services. As Fein (2015) highlights, these conflicts of interest are most evident in "Zero fees" Robo-advisors, as their source of revenues is retrocession fees. This not only means higher final costs for consumers, but also the choice of brokers, assets, or custodians which may not be in their best interest.

Another report from FINRA, jointly with the SEC (2015), also pointed out the poor risk assessment of Robo-advisors questionnaires and the lack of personalization of their portfolios. As in the examples described by Marotta (2015), Robo-advisors assign customers to a set of predefined portfolios according to their assigned risk level, ignoring any individual particularities.

The absence of personal contact is also regarded as a limiting weakness by Jung et al. (2019) and Fein (2015). According to the survey conducted by Nicoletti (2017) in Italy, only 11 per cent of the polled people were willing to trust their investments to the algorithm of a Robo-advisor. Fein (2015) emphasises that Robo-advisors' customers are left on their own to evaluate whether the advised portfolio is suitable for their needs and circumstances. The author does not see how this is a specific weakness of Robo-advisors,

as investors will also have to make a similar assessment when receiving advice from human financial advisors.

Finally, and according to Fein (2015), Robo-advisors do not meet the Fiduciary Standard of Care, required in the U.S. for the provision of investment management services according to the Investment Advisers Act of 1940 (SEC, 1940). Fein (2015) analyses the factors considered as the standard of care by the Uniform Prudent Investor Act (UPIA) and concludes that none of the main Robo-advisors meets the required criteria. Mainly, because Robo-advisors do not take into account the overall assets of clients outside the platform, and only limitedly consider individual client conditions or general economic factors. Moreover, Robo-advisors make no effort to verify the individual information provided by their clients. Therefore, based on this limited and unverified information, clients are assigned a portfolio, which is monitored and rebalanced, to keep the initial asset allocation, and weights, and ignoring any changes in the general economy or the client's overall financial situation.

Among the external opportunities that Robo-advisors can leverage, Jung et al., (2019) highlight their digitalized approach to investment advisory services. Robo-advisors are initially targeting the younger generations that have grown up more used to technology and digital devices (Gauthier, Laknidhi, Klein & Gera, 2015; Sironi, 2016). The study conducted in Europe by Cocca (2016) shows how the percentage of surveyed citizens that would rely on an automated investment advisor rises from 30 to 45 per cent when excluding the population over 60 years old. As Wong (2015) points out, the potential market represented by the younger investors is significantly low with respect to the total assets under management of the industry. However, it is a naturally growing market, as younger generations gradually replace older and digital services penetrate every society and generation.

A second opportunity for Robo-advisors comes from expanding their current offering to include further services that are common in the traditional investment advice industry, such as cross-border tax advice (Jung et al., 2019). The complexity and variety of tax laws among countries turn the standardization of such services into a complex challenge.

Jung et al. (2019) also point at Goal-based investing as another potential point for development. Instead of only considering modern portfolio theories for the portfolio assigned to each customer, questionnaires can be developed to dig deeper into the

individual characteristics, objectives, and values of each client making up for the initial lack of personalization of Robo-advisors (Sironi, 2016). Gauthier et al. (2015) and Ludden et al. (2015) also point to the increased level of personalization as an opportunity that should follow from the development of Robo-advisors' algorithms and data analytics capabilities.

Finally, Robo-advisors could also diversify their sources of revenue by collaborating with traditional investment advisors. Gauthier et al. (2015) analyse the possibility of offering Robo-advisory services through established banks to get access to an increased number of traditional clients with higher average wealth. In exchange, banks could make use of Robo-advisors advisory services without having to develop their own platform and algorithm.

Regarding the threats for the sector, Jung et al. (2019) point to the highly competitive environment of the Robo-Advisory market. Only in the U.S., the number of Robo-advisors surpassed two hundred, while Burnmark (2017) accounted for more than 70 in Europe by the time of his study. The already high local market competitiveness could turn even more aggressive when Robo-advisors start their international expansion.

In the race for achieving a sufficient number of clients and assets under management to become profitable, Robo-advisory-only platforms are also threatened by the entrance of traditional investment firms, such as Schwab or Vanguard, which benefit from their large customer base and reputation (Jung et al., 2019). Although the entrance of big traditional investment advisory firms in the Robo-advisory services is a clear signal of the market's growth. The potential market size is still unknown, as it is unclear how many current and future investors will be willing to become Robo-advisors users. As the study by Reher and Sun (2016) shows, many investors may not be willing to change their investment product choices even when a Robo-advisor would have provided better performance for a comparable strategy.

Jung et al. (2019) also point at future regulations as an important threat for Robo-advisors business model. As it happens with disruptions, regulations only arrive at a later stage. Regulatory authorities, especially in the U.S., have already put their focus on Robo-advisory's potential conflict of interests, light risk tolerance assessments, and eventual unfulfilled fiduciary duty (Jung et al., 2019).

Finally, it is also worth considering that Robo-advisors have emerged in bullish market times. Although they are expected to perform better given their absence of emotionally driven decisions and their automated rebalancing (Traff, 2016), the behaviour of the average Robo-advisor investor is yet to be seen. A market downturn will eventually become a test to prove whether the small retail investors keep their trust in Robo-advisors or if they panic and prefer to sell their positions (Jung et al., 2019).

2.3 The Vanguard Group

The Vanguard Group, Inc. is an American registered investment advisor based in Malvern, Pennsylvania with about USD 6.2 trillion in global assets under management, as of January 31, 2020[2]. It is the largest provider of mutual funds and the second-largest provider of exchange-traded funds (ETFs) in the world after BlackRock's iShares.

Vanguard was founded in 1975 by John Bogle. The history and impact of the company cannot be explained without the influence and vision of its founder. As chairperson of the Wellington funds, (after being fired as chairperson and CEO of Wellington Management Company) Bogle decided to mutualize the funds and form a new subsidiary that would be owned by the mutual funds (Bogle, 2014). Thus, Vanguard was born under a revolutionary structure in which the funds' shareholders are also Vanguard's owners. Such a structure encourages the reduction of fees and removes any incentive for the company to overcharge its funds' investors (Bernstein, 2010).

The newly created company was set to merely administer the funds, without entering into the provision of investment advisory, marketing or distribution services. Its independent ownership structure together with its unique mission allowed Vanguard to minimize most of the conflicts of interest that fund management companies face (Bogle, 2014).

Nevertheless, Bogle's and Vanguard's biggest revolution was the launch of the first index fund, the Vanguard 500 Index Fund. As defined by Bogle (2014), the idea was a fund "that apes the whole market, requires no load, and keeps commissions, turnover, and management fees to the feasible minimum". Bogle (2011), who had already investigated the differences in returns between Mutual Funds and the market in his thesis in 1951, was finally inspired by Paul Samuelson. This Nobel Laureate in Economic Sciences had

[2] https://about.vanguard.com/who-we-are/fast-facts/

proved that there had been no fund manager capable of getting better returns than the market on a repeatable and sustainable basis (Samuelson, 1974). Bogle himself calculated the average return of mutual funds and concluded that they had performed 1.5% below the American market (Bernstein, 2010). Although the idea of indexing, that is investing in a whole market with market capitalization weights to get the same result as the market, had been under discussion in the sixties, it was Bogle who made it real and available to investors with the launch of the Vanguard 500 Index Fund (Blitzer, 2012).

As Bogle (2014) explains, any fund manager could have started the first index fund. However, only Vanguard had the motive, following their mission and unique ownership structure. Whereas the rest of the industry was primarily focused on their profitability, and therefore not willing to reduce their fee structures. Indeed, Vanguard's index fund was initially ridiculed by the financial industry. However, as Vanguard's strategy started giving results, together with its investors' satisfaction, who saw their fees continuously reduced, Vanguard's reputation and assets under management increased at a pace that could no longer be ignored by the rest of the industry. Consequently, in 1991 Fidelity Group followed the trend and started its own indexed fund (Bernstein, 2010).

During the nineties, indexed funds assets grew at a yearly rate of 60%, reaching 356 USD billion of assets under management in 2000 (Bogle, 2014). Between 2007 and May 2017, U.S. equity-indexed funds received inflows for a value of 1.8 USD trillion, while the American actively managed funds had new capital outflows of USD 800 billion (Bogle, 2017).

Nowadays, there are hundreds of indexed funds and, as described above, these represent the main and almost unique investment product type for Robo-advisors. Just Vanguard administrates about 190 U.S. funds and about 230 other funds in markets outside the United States[3]. While the same indexes are tracked by many different funds from different companies, Vanguard has remained unique in its ownership structure. Large financial institutions own most fund companies. iShares, the largest provider of exchange-traded funds, belongs to BlackRock, the world's largest asset manager. As a public traded company, BlackRock has the difficult challenge of balancing shareholders and fund investors interests. This is the same case for the rest of the big fund management companies, such as UBS Group, State Street or Allianz Global Investors. The only

[3] https://about.vanguard.com/who-we-are/fast-facts/

exception here is Fidelity Investments Inc., which is privately owned by its founders, the Johnson family, and its employees. Although not publicly traded, the trade-off between owners and fund investors interests remains the same.

As Bogle (2017) and Bernstein (2010) explain, the trade-off in interests is quite simple since investors benefit from the lowest possible costs, while owners of fund management companies benefit from charging higher fees. Bogle (2014) remarks the importance of reducing costs to the minimum for investors as he explains that, since index and active investors receive as a group the same market return before costs, index investors must outperform the average active investor returns after cost deduction. Following this rationale, in 1977 all Vanguard funds started being distributed without any load fee (Bogle, 2014). As Vanguard grew, their funds' shareholders benefited from economies of scale, which allowed Vanguard to further reduce their fees, resulting in higher returns for investors and attracting yet more assets. The fee for Vanguard's S&P 500 index fund fell below 0.30% in 1983 and below 0.20% by 1992 (Bernstein, 2010).

The commitment to serve investors with the lowest possible fee has not only allowed Vanguard to increase the returns of their funds' shareholders and to attract more investors. Carrying the lowest fee of the market has also given an edge to Vanguard when other corporations launched their indexed funds. As all funds tracking an index hold the same portfolio, the impact of costs becomes the main factor that caters for differences in performance (Bogle, 2014). Vanguard funds offer the lowest fees in their respective classes (Bernstein, 2010), averaging just 0.10% of assets for 2019[4].

Besides increasing the offer of mutual funds and ETFs, Vanguard services also now include variable and fixed annuities, educational account services, financial planning, asset management, and brokerage and trust services.

As part of their increased product range, and following the trend of digitalization in financial services, in 2015 Vanguard launched its Personal Advisor Services[5]. Vanguard's PAS is considered a hybrid model between Robo and traditional advisory services, as it

[4] U.S. asset-weighted fund expenses as a percentage of 2019 average net assets. https://about.vanguard.com/who-we-are/fast-facts/

[5] https://investor.vanguard.com/advice/financial-advisor/personal-advisor-services

combines the use of algorithms for asset allocation and portfolio rebalancing with access to human advisors (Novack, 2015).

Finally, in the second half of 2020, Vanguard launched its own full Robo-advisor, Vanguard Digital Advisor[6], which will be an object of further study in this research.

[6] https://investor.vanguard.com/advice/digital-advisor/

3. Research hypothesis and contextualization of the study

The research hypothesis of the study is whether a European version of the recently launched Vanguard Digital Advisor could have considerable competitive advantages over the current European Robo-advisory services providers, and therefore potentially disrupt the European Robo-advisory market.

This hypothesis is based upon the hypothetical scenario in which Vanguard Group would expand the offer of its new Robo-advisory services to European markets. To contextualize the logic and validity of the hypothesis, we have taken into consideration the following series of factors from both Vanguard Group and the Robo-advisory market.

3.1 Robo-advisors need for exponential growth

Following Wong's (2015) research on the financials of Robo-advisory companies, it comes clear that, despite their rapid growth, Robo-advisory providers are far from being profitable. Wong (2015) estimated the break-even point for Robo-advisors in the range of 16 to 40 USD billion of assets under management. At the time of his study, this was from 8 to 20 times higher than the level of assets of the leading Robo-advisors.

According to their latest ADV[7], the independent Robo-advisor Wealthfront had reached over USD 15.8 billion assets under management by the second half of 2020 (Wealthfront, 2020), while Betterment surpassed the USD 28.2 billion figure at the end of the first quarter of 2021 (Betterment, 2021). At this level of assets, both American leading independent Robo-advisors could have reached their first periods of net benefits (Backend Benchmarking, 2020).

Nevertheless, the need for exponential growth of clients and assets also means that Robo-advisors need to invest heavily in marketing. So, even after they become profitable, it could take them even more than 10 years to recover all the previous marketing costs (Wong, 2015). Therefore, Robo-advisors could be pushed to expand into other markets to achieve the necessary volume of assets under management.

3.2 Competition from established financial institutions

Robo-advisors initially emerged as start-ups in the context of fintech innovations that sparked after the global financial crisis of 2008. Betterment and Wealthfront are the two

[7] Form ADV is the form used by investment advisers to register with both the SEC and state securities authorities.

most representative examples of such independent platforms. However, following their continuous growth, more established companies have entered the Robo-advisory market, which results in increased competition.

In the US, the current market leader is Schwab Digitally Advised Assets with USD 57.9 billion AUM (Backend Benchmarking, 2021). This Robo-advisory service was launched by Charles Schwab Corporation, a financial services company that offers banking, trading, and wealth management services to both retail and institutional clients. Vanguard would already be leading this ranking depending on whether we consider their Vanguard Personal Advisor as Robo-advisory services.

Vanguard is not the only large financial institution that has entered the Robo-advisory market. Its main competitor, BlackRock, joined in 2015 through the acquisition of FutureAdvisor, a digital advisor that had been founded in 2010 (BlackRock, 2016).

During 2020, we have seen other major acquisitions, which are resulting in an increased concentration of Robo-advisory services under large institutions. TD Ameritrade, including its Robo-advisory service TD Ameritrade Essential Portfolios, and Motif, a Robo-advisory services provider, were acquired by Charles Schwab. In the same year, Personal Capital, with USD 16 billion of assets under management, was acquired by Empower, the second-largest retirement plan provider in the United States (Business Wire, 2020).

As Wong (2015) highlights in his study, stand-alone Robo-advisors need to consolidate their business with continuous exponential growth or be acquired by large financial institutions. Given that these big financial corporations operate globally, it is likely that they will end up leveraging their Robo-advisory services to their internationally spread customer base.

3.3 European Robo-advisors struggle to expand

With about 14 EUR billion AUM in 2018, European Robo-advisory services have grown relatively slow in comparison to the US and represent a small percentage of the total Robo-advisory market (Tondreau, van Gysegem, & Bohlke, 2019). By country, the UK is the largest market with about 7 EUR billion in AUM in 2018 and over 13 in 2019. According to the estimations of BVI (2020), the EU Robo-advisory market, already excluding the UK, was also estimated at 13 EUR billion for 2019. For that year, Germany

concentrated about 60% of the EU market with around 7.5 EUR billion assets under management.

Given its great fragmentation among small private companies, the European Robo-advisory market size can only be estimated. Only in Germany, the number of firms offering Robo-advisory services is around 30 (Banking Hub, 2020). The relatively slow development of Robo-advisory in Europe, and its fragmentation among countries, could explain why no American Robo-advisor has yet tried to expand its services directly to Europe. As long as the European market remains small, American Robo-advisors may maintain their focus trying to capture the high growth rates of the American market. On the contrary, European Robo-advisors are bound to expand outside their native market to continue their growth and achieve a profitable volume.

By 2021, the internationalization of European Robo-advisors remains timid with mixed results and models. Scalable Capital, the leading Robo-advisor in Germany is currently also directly available for retail investors in Austria. However, its service for retail investors in the UK, which was launched in 2016, was shut at the beginning of 2021 (Mortimer, 2021). Similarly, Scalable Capital also closed its business in Switzerland at the end of 2019, less than two years after starting its activity in the country (Giannoni, 2019).

Nonetheless, the German Robo-advisor maintains its activity in the UK through its B2B partnership with Barclays. The British bank launched its own Robo-advisor, Barclays Plan & Invest, powered by the technology of Scalable Capital (Scalable Capital, 2020 a). Scalable Capital has also operations in Spain, where it offers a similar white-label solution for Openbank, the Spanish digital bank of Santander's Group (Scalable Capital, 2018). In March 2020, Scalable announced its partnership with Raiffeisen, Austria's largest banking group, to strengthen its expansion in the neighbour country. As stated by its co-founder and co-CEO, Erik Prodzuweit, the B2B white-label solution is the chosen strategy for the further expansion of Scalable Capital into other European markets (Scalable Capital, 2020 b). The first B2B agreement between Scalable Capital and an established bank was in its home market. Since September 2017, the Robo-advisor of Scalable Capital has been available to ING-DiBa customers directly through its web-banking solution (Scalable Capital, 2017).

With similar levels in terms of AUM, Nutmeg leads the Robo-advisory market in the UK. By the end of 2019, Nutmeg reported over 2 GBP billion of assets under management from eighty thousand clients (Tew, 2020). Despite its increase in revenues, Nutmeg reported 21.3 GBP million in losses for 2019, the highest in its eight years of existence. As analysed by Thorpe (2019), in 2018 Nutmeg spent almost three pounds in marketing to generate each pound of revenue. At the time of this study, Nutmeg has not expanded to other markets and remains only available for UK residents. While incumbent financial institutions, such as Goldman Sachs, are among its shareholders, Nutmeg has not yet announced any B2B services. Nutmeg case is a clear example of how stand-alone Robo-advisors are in a difficult position, as they require years of exponential growth to reach AUM levels in order to, first break-even, and then recover the accumulated losses from the heavy spending in marketing required for their growth.

The third European Robo-advisor that has surpassed the benchmark of 1 EUR billion of assets under management is Moneyfarm. Launched in Italy in 2012, Moneyfarm expanded to the UK in 2016 and Germany in 2019 (Moneyfarm, 2020). However, it shut its retail services in Germany just one year after. With the support of Allianz group as a shareholder since 2016 (Moneyfarm, 2016), Moneyfarm acquired Vaamo, an already established German Robo-advisor, in 2018 (Moneyfarm, 2018). However, at the beginning of 2021, the originally Italian Robo-advisor announced its stepdown from the German retail market and handed its clients to Fidelity Wealth Expert, the new Robo-advisor service of Fidelity. With this move, Moneyfarm claimed to focus its efforts in its current main markets, UK and Italy, and to redirect its European expansion through the B2B business (Märkl, 2020). A closely similar strategy to the one adopted by Scalable Capital.

Finally, the also German Robo-advisor, Visualvest reported one EUR billion AUM at the beginning of 2021 (Baudzus, 2021). The Robo-advisor from Union Investment had reported 500 EUR million of assets under management in July 2020 and managed to double its business by extending its Robo-advisory services, through a white label solution, to its partners of the cooperative Genossenschaftliche FinanzGruppe[8]. The cooperative includes the second biggest German bank, DZ Bank, with more than 10 thousand branches.

[8] https://www.finanzgruppe.de/finanzgruppe/

In the rest of the European markets, leading Robo-advisors have not yet surpassed the benchmark of one billion euros. Such as the Spanish Indexa Capital that reported 0.9 EUR billion AUM as of April 2021 or the French Yomoni with 0.32 EUR billion as of January 2021.

3.4 Vanguard International Expansion

As described in the literature review, Vanguard is an American company that launched its activity in 1975. Despite its success and quick growth in the US, its international expansion has been rather slow. Unlike its main competitor BlackRock, Vanguard has not made any acquisitions to enter new markets (Flood, 2020). Vanguard first international operation was in Australia, where it opened its first office outside the US in 1996. By 1998, it had also expanded operations to Japan and Europe, yet its international business managed less than USD 100 billion with a team of not even 50 people. By mid-2020, Vanguard's international business had grown to USD 442 billion of assets under management with a team of over 1,400 people (Flood, 2020).

Vanguard's business in Europe reached close to EUR 150 billion at the end of 2019. A relatively small figure compared to its global business, which was reaching EUR 5.5 trillion by that time (Vanguard, 2020). The firm has over 600 employees in Europe, with offices in London, Frankfurt, Paris, Amsterdam, Dublin and Zurich, while all its European funds are based in Ireland. Unlike in the US, Vanguard's European funds have long been only available to and through institutional investors. It was not until 2017 that Vanguard first launched retail operations in the UK. As Vanguard's International Chief, Jim Norris, stated in his interview with Flood (2020), Vanguard plans to launch its direct to consumers offer also to other European markets.

Being able to reach European retail investors directly would allow Vanguard to bypass the European funds' distribution channels, which as stated by Vanguard's International Chief (Flood, 2020) have been a major impediment for Vanguard's expansion outside the US, given that Vanguard pays no fees to its distributors and sellers. Following its mission to bring market returns at a low cost to individual investors, Vanguard's main strategy in Europe is the same that has allowed them to succeed in the US: providing the lowest cost index funds. This has been reflected in different expense ratios cuts in its European funds (Flood, 2019)

In April 2021, Vanguard expanded its offer in the UK with the launch of its Personal Advisory services (Vanguard, 2021). The expansion of Vanguard's hybrid advisor to the UK is Vanguard's first move in leveraging its digital technology into the European market and resembles the process followed in the US, where the hybrid advisor was then followed by the launch of the full digital advisor.

As analysed previously, the current Robo-advisory market in Europe remains small. However, the potential market size for Vanguard to capture in the continent goes beyond Robo-advisory. According to ESMA (2021), the total sum of equity funds in the European Union accounted for EUR 3.2 trillion at the end of 2019, of which 12% and 17% corresponded to passive funds and ETFs respectively. Therefore, index-tracking products represented 29% of the market, increasing from the 25% of the previous year. The market size for bonds funds was EUR 2.3 trillion in 2019, of which 15% corresponded to passively managed funds.

Passive funds are expected to continue increasing their market share against the actively managed ones, as it has also been happening in the US, where passive equity funds surpassed active ones in assets under management by August 2019 (Gittelsohn, 2019).

4. Methodology

For our study of the European Robo-advisory market and the potential impact of the hypothetical launch of Vanguard Digital Advisor in Europe, we have used a predictive approach. By analysing the characteristics of Robo-advisory services, the European Robo-advisory market and the competitive advantages of the recently launched Vanguard Digital advisor we have developed a speculative scenario where we simulate the characteristics of an eventual European Vanguard Digital Advisor and compare these against the ones from the current market leaders.

Our study begins with a review of the available research and literature that has been produced in recent years about Robo-advisory. Primarily based on the SWOT analysis of Robo-advisors performed by Jung et al. (2019) available in Table 1.1, we have been able to identify the main characteristics of Robo-advisory services. We have then split these into two different categories depending on whether the described strengths and weaknesses apply equally to every Robo-advisor or they allow for differentiation between the different service providers. Based on this, we have put our focus on the characteristics that allow for differentiation, since these are the ones that a hypothetical Vanguard's European Digital advisor could use to build a competitive advantage over the current leading European Robo-advisors.

From all the different strengths and weaknesses, we have especially focused our attention on the lower fees and investment costs. As described in the literature review, the low cost of Robo-advisory services is one of the key elements that explain their rapid expansion. Additionally, the quantitative nature of economical costs and prices permits us a more accurate and objective analysis.

Since Robo-advisors are digital service providers targeting retail clients, we have been able to collect extensive data about their service offering from their websites. This includes quantitative data such as their volume of assets under management, the cost of their service, and the total costs of the underlying assets of their portfolios. By collecting and comparing the cost of the leading service providers in the different jurisdictions, together with all the underlying costs incurred when investing through a Robo-advisory service, we have been able to establish relevant comparisons on the cost competitiveness of the different providers.

Besides Vanguard Digital Advisor, the Robo-advisors analysed (Table 4.1) have been chosen for their leading position, in terms of assets under management, in their respective markets. Our main focus is on the UK and German markets since these are the most developed in terms of AUM in Europe. Indeed, Vanguard already launched its hybrid advisor in the UK market. Additionally, we have also included data of the leading Spanish and Italian Robo-advisors, since these are not far in AUM levels from some of the leading UK and British advisors, and permit a more global view of the European markets. The data was collected during the first quarter of 2021 and could have been modified since then.

TABLE 4.1 ROBO-ADVISORS ANALYSED

Robo-advisor (Country)	Source of data
Vanguard Digital Advisor (US)	https://investor.vanguard.com/advice/digital-advisor/
Betterment (US)	https://www.betterment.com/
Wealthfront (US)	https://www.wealthfront.com/
Nutmeg (UK)	https://www.nutmeg.com/
Moneyfarm (UK)	https://www.moneyfarm.com/uk/
Barclays Plan & Invest (UK)	https://www.barclays.co.uk/investments/plan-and-invest/
Scalable Capital (DE)	https://de.scalable.capital/
VisualVest (DE)	https://www.visualvest.de/
Moneyfarm (IT)	https://www.moneyfarm.com/it/
Indexa Capital (ES)	https://indexacapital.com/es/esp/

To simulate the cost that the hypothetical European Robo-advisor of Vanguard would have, in order to establish valid comparisons with its European peers, we have extrapolated the incremental pricing of Vanguard's hybrid advisor. Thanks to the similarities of the product, the recent launch of Vanguard's Personal Advisor in the UK market provided us with a valuable reference of how more expensive Vanguard's Robo-advisory services could result in a European market.

Given the different pricing models of Robo-advisors and their strategies on how to communicate their pricing, we could not directly compare the costs that they advertise on their websites. Instead, we went through all their product brochures where financial service providers are legally obliged by their regulatory bodies to report all the direct and indirect costs incurred by investors. Our price comparison was built to reflect the final total cost incurred by investors independently of the source of the cost.

Besides the management fee, the other main cost of investing through Robo-advisors is the underlying fee of the investment vehicles used, usually ETFs. While the final cost incurred by an investor will depend on his asset allocation and the weight of each financial instrument on the portfolio, Robo-advisors report an average of the cost of the funds used for their different portfolios.

To be able to assess whether Vanguard funds are more competitive in terms of pricing, we have compared the cost of the funds that the two leading independent Robo-advisors in the US use for their portfolios. Thanks to that both Wealthfront and Betterment make public all the different asset classes, and the up to three funds per asset class, that they use for their portfolios, we have been able to compare the cost of Vanguard funds for each of these asset classes against the ones from their main competitors.

Both Wealthfront and Betterment not only provide more detailed information about their services and portfolios than their European competitors do but are also legally bonded to fill in the ADV form. This form is used by investment advisers to register with both the SEC and state securities authorities in the US and is available to the public. ADV forms have also been used as a source of quantitative data, such as the number of assets under management, for US Robo-advisors. In the case of European Robo-advisors, we have found less official information available, especially because all the analysed companies are not publicly traded. For these, we have relied on the information publicly shared by the companies or reported by the media.

Besides the main cost comparison of Robo-advisory services, we have also made a qualitative analysis that has helped us to assess whether a European Vanguard Digital Advisor could also be more or less competitive in other terms than the total cost of the service. This analysis is lighter as it is only meant to complement the cost comparison analysis to provide a wider context of the competitiveness and potential impact of a Vanguard Digital Advisor launch in Europe.

Based on the characteristics of Robo-advisors, from the strengths and weaknesses analysis performed by Jung et al. (2019), which we assessed that can be exploited to build competitive advantage, we have reviewed how well-positioned a European Vanguard Digital Advisor would be for each of them against its main competitors.

For this analysis, we have followed the criteria established by Jung et al. (2019) and the information publicly available for and by Vanguard Group. For the Minimum Investment comparison, we have relied again on the information that each Robo-advisor provides on their websites (Table 4.2). Vanguard's Digital advisor website and brochure are also the source for the conflict of interests information of the product.

Thanks to the relevance in the financial industry of Vanguard Group and its founder John Bogle, we have found extensive qualitative and quantitative information about the company, its history, mission and values, including extensive literature written by John Bogle himself. The review of Vanguard Group performed in the literature review has served as the primary source of information for the assessment of Vanguard and its potential European Robo-advisor in regards to the remaining characteristics: Ubiquity of Digital Services, Competitive environment, Bearish market and crisis, Possible threat from regulators, Complement traditional advisors.

5. Data presentation and discussion of results

Following the Robo-advisory characteristics research performed by Jung et al. (2019), we have established a classification of Robo-advisory strengths and weaknesses, depending on whether they allow, or not, differentiation among service providers.

From our analysis, we consider the following characteristics (Table 5.1) of Robo-advisory services apply equally to every service provider, and therefore they cannot be exploited to create a competitive advantage. Thus, we have not included them in our comparison between European Robo-advisors and a hypothetical European version of Vanguard Digital Advisor.

TABLE 5.1 EQUAL CHARACTERISTICS OF ROBO-ADVISORY

Not allow competitive advantage	Portfolio construction by algorithms and automated rebalancing.
	Less emotional decision-making.
	Investment experience.
	Poor assessment of risk tolerance and lack of personalization.
	No personal contact.
	Unfulfilled fiduciary duty.
	Opportunity to standardize and integrate Goal-based investing.
	No acceptance of users.

Source: table of own creation.

Additionally, we have also excluded the tax-loss harvesting capacity of Robo-advisors from our comparison study. Every Robo-advisory provider includes the capacity for tax-loss harvesting among the benefits of its services. The minimisation of incurred taxes is achieved differently in each country depending on the tax regulations. For instance, Robo-advisors in the US invest in more than one ETF that tracks the same index. This way, they can sell from one to generate losses that offset earnings generated from a different asset class and buy from the second ETF to keep the assigned allocation to the index. In Spain however, Robo-advisors invest through traditional index funds instead of ETFs since the regulation allows for transfers between funds without incurring capital gains or losses. Every Robo-advisor's algorithm is designed to maximize the tax-loss harvesting possibilities of each jurisdiction. While the tax-loss harvesting results may differ depending on the provider, we have excluded this from our comparison study, as it

would require a specific and in-depth study of the tax regulations of each jurisdiction, which is out of our scope of the study.

Finally, Table 5.2 includes the characteristics that we have considered in our comparison between a hypothetical European version of Vanguard Digital Advisor and the current leading European Robo-advisors.

TABLE 5.2 ROBO-ADVISORY CHARACTERISTICS THAT PERMIT DIFFERENTIATION

Allow competitive advantage	Lower fees and investment costs
	Minimum Investment
	Conflict of Interests
	Ubiquity of Digital Services
	Competitive environment
	Bearish market and crisis
	Possible threat from regulators
	Complement traditional advisors

Source: table of own creation.

5.1 Lower fees and investment costs

Their low-cost structure is one of the defining characteristics of Robo-advisory services, as well as one of their main advantages. As described in the literature review, their digitalized service and automated portfolio management allow them important cost savings in comparison to traditional advisors. Additionally, the use of low-cost investment funds helps to minimize the total costs incurred by the final investor, therefore increasing the net returns.

As we have previously covered, Vanguard Group is well known for providing the lowest-cost funds. We have analysed all the funds that the leading US independent Robo-advisors use to build their different portfolios and we have found that Vanguard funds are the most common investment vehicles.

Betterment makes use of up to 14 different asset classes to build its portfolios. In eight of them, it uses a Vanguard fund as its primary investment vehicle. Betterment uses up to three different funds for the same asset class for tax-loss harvesting purposes. Betterment claims to make its choices based on the cost of the funds, their bid-ask spread, and liquidity. Vanguard funds carry the lowest fee in nine out of the ten categories in

which Betterment invests through Vanguard. The only exception is for the Emerging Market Stocks, where Vanguard is just one point basis more expensive than the SPDR fund from StateStreet.

TABLE 2.3 BETTERMENT ASSET CLASSES WITH VANGUARD AS PRIMARY FUND PROVIDER

Category	Fund Name	Fund Cost
US Stocks	VTI Vanguard Total Stock Market ETF	0,03%
	ITOT iShares Core S&P Total U.S. Stock Mkt ETF	0,03%
	SCHB Schwab U.S. Broad Market ETF	0,03%
US Value Stocks Large Cap	VTV Vanguard Value ETF	0,04%
	SCHV Schwab U.S. Large-Cap Value ETF	0,04%
	IVE iShares S&P 500 Value ETF	0,18%
US Value Stocks Mid Cap	VOE Vanguard Mid-Cap Value ETF	0,07%
	IWS iShares Russell Mid-Cap Value ETF	0,24%
	IJJ iShares S&P Mid-Cap 400 Value ETF	0,18%
US Value Stocks Small Cap	VBR Vanguard Small-Cap Value ETF	0,07%
	IWN iShares Russell 2000 Value ETF	0,24%
	SLYV SPDR® S&P 600 Small Cap Value ETF	0,15%
Developed Economies Stocks	VEA Vanguard FTSE Developed Markets ETF	0,05%
	SCHF Schwab International Equity ETF	0,06%
	IEFA iShares Core MSCI EAFE ETF	0,07%
Emerging Markets Stocks	VWO Vanguard FTSE Emerging Markets ETF	0,12%
	IEMG iShares Core MSCI Emerging Markets ETF	0,14%
	SPEM SPDR® Portfolio Emerging Markets ETF	0,11%
TIPS	VTIP Vanguard Short-Term Inflation-Protected Securities ETF	0,05%
International Developed Market Bonds	BNDX Vanguard Total International Bond ETF	0,08%

Table of own creation. Data source: https://www.betterment.com/recommended-portfolio-funds/
Vanguard funds highlighted in blue.
The lowest fund fee per asset class highlighted in green.

Betterment also invests through BlackRock's funds iShares, Vanguard's main competitor in the fund industry. Betterment uses up to 12 iShares' funds, however, these are the primary fund in only four of the 14 asset classes. In two of the options, Betterment does not make use of any Vanguard alternative; while in the other two, iShares are the primary option despite being more expensive than the Vanguard fund.

Betterment also uses four funds from StateStreet (SPDR included), three from Schwab, one from Deutsche Bank (Xtrackers), one from JPMorgan, and one from Invesco (PowerShares). While some of them may carry the same fee as Vanguard, or even one

basis point lower for a specific category, Vanguard is the only fund manager that consistently carries a low fee for each asset class.

For four asset classes, Betterment does not invest through a Vanguard fund (Table 5.4). In the Municipal Bonds case, Betterment could make use of the 'VTEB Vanguard S&P National AMT-Free Muni' fund that Wealthfront uses for this category. This Vanguard fund carries a fee of 0.08%, which is just one basis point higher than the one from iShares, but almost three times cheaper (15 basis points) than the one from StateStreet.

TABLE 5.4 BETTERMENT ASSET CLASSES WITHOUT VANGUARD FUNDS

Category	Fund Name	Fund Cost
Municipal Bonds	MUB iShares S&P National AMT-Free Muni	0,07%
	TFI State Street Barclays Capital Muni	0,23%
US High-Yield Corporate Bonds	HYLB Xtrackers USD High Yield Corp Bd ETF	0,15%
	JNK SPDR® Blmbg Barclays High Yield Bd ETF	0,40%
	HYG iShares iBoxx $ High Yield Corporate Bond ETF	0,49%
US Short-Term Treasury Bonds	SHV iShares Short Treasury Bond ETF	0,15%
US Short-Term Investment-Grade Bonds	JPST JPMorgan Ultra-Short Income ETF	0,18%

Table of own creation. Data source: https://www.betterment.com/recommended-portfolio-funds/
Vanguard funds highlighted in blue.
The lowest fund fee per asset class highlighted in green.

For the 'US High-Yield Corporate Bonds' category, Betterment invests through funds from Xtrackers, SPDR and iShares with fees of 0.15%, 0.40% and 0.49% respectively. At the time of this study, Vanguard does not offer an ETF tracking this index. However, its alternative mutual fund, 'Vanguard High-Yield Corporate Fund Admiral Shares' carries a fee of just 0.13%[9]. Nonetheless, in the 'US Short-Term Treasury Bonds' Betterment reports using only the ETF from iShares with fees of 0.15%, while 'Vanguard Short-Term Treasury ETF' carries an expense ratio of just 0.05%[10]. Finally, the 'Vanguard Short-Term Bond ETF' with a fee of 0.05%[11] would also result in

[9] https://investor.vanguard.com/mutual-funds/profile/overview/vweax
[10] https://investor.vanguard.com/etf/profile/VGSH
[11] https://investor.vanguard.com/etf/profile/BSV

a more than three times cheaper choice (13 basis points) than the 'JPST JPMorgan Ultra-Short Income ETF'.

In the remaining two asset classes, Vanguard funds are the second option (Table 5.5). While in the 'US High Quality Bonds' category Vanguard is just one basis point cheaper, for the International Emerging Market Bonds, Vanguard carries a 14 basis points lower fee than the iShares fund and 25 basis points cheaper than the third alternative, which makes it half the price.

TABLE 5.5 BETTERMENT ASSET CLASSES WITH VANGUARD AS NON-PRIMARY FUNDS

Category	Fund Name	Fund Cost
US High Quality Bonds	AGG iShares Core U.S. Aggregate Bond ETF	0,05%
	BND Vanguard Total Bond Market ETF	0,04%
International Emerging Market Bonds	EMB iShares JPM EMBI Global Core	0,39%
	VWOB Vanguard Emerging Markets Government Bond ETF	0,25%
	PCY PowerShares DB EM USD Liquid Balanced	0,50%

Table of own creation. Data source: https://www.betterment.com/recommended-portfolio-funds/
Vanguard funds highlighted in blue.
The lowest fund fee per asset class highlighted in green.

Wealthfront, the other main independent Robo-Advisor in the United States, uses up to ten different asset classes for its portfolios, and Vanguard funds are present in eight of the ten (Table 5.6).

TABLE 5.6 WEALTHFRONT ASSET CLASSES WITH VANGUARD AS PRIMARY FUND PROVIDER

Category	Fund Name	Fund Cost
US Stocks	VTI Vanguard Total Stock Market ETF	0,03%
	ITOT iShares Core S&P Total U.S. Stock Mkt ETF	0,03%
	SCHB Schwab U.S. Broad Market ETF	0,03%
Developed Economies Stocks	VEA Vanguard FTSE Developed Markets ETF	0,05%
	IXUS iShares Core MSCI Total Intl Stk ETF	0,09%
	SCHF Schwab International Equity ETF	0,06%
Emerging Markets Stocks	VWO Vanguard FTSE Emerging Markets ETF	0,12%
	IEMG iShares Core MSCI Emerging Markets ETF	0,14%
	SCHE Schwab Emerging Markets Equity ETF	0,13%
Dividend Stocks	VIG Vanguard Dividend Appreciation	0,09%
	DVY iShares Dow Jones Select Dividend Index ETF	0,39%
	SCHD Schwab Dow Jones U.S. Dividend 100 Index	0,06%
Municipal Bonds	VTEB Vanguard S&P National AMT-Free Muni	0,08%
	TFI State Street Barclays Capital Muni	0,23%
	MUB iShares S&P National AMT-Free Muni	0,07%

Corporate Bonds	VCIT Vanguard Intermediate-Term Corporate Bond	0,05%
	LQD iShares iBoxx IG Corp Bond	0,15%
	SPIB SPDR Portfolio Intermediate Term Corporate Bond ETF	0,07%
U.S. Gov Bonds	BND Vanguard Total Bond Market ETF	0,04%
	AGG iShares Core U.S. Aggregate Bond ETF	0,05%
	BIV Vanguard Intermediate-Term Bond ETF	0,07%
Real Estate	VNQ Vanguard REIT ETF	0,12%
	IYR iShares Dow Jones U.S. Real Estate ETF	0,42%
	SCHH Schwab U.S. REIT ETF	0,07%

Table of own creation. Data source: https://www.wealthfront.com/investing-guide
Vanguard funds highlighted in blue.
The lowest fund fee per asset class highlighted in green.

Again, Vanguard funds are equally economic or cheaper than its competitors are in five of the eight categories. While Vanguard may result in up to five basis points more expensive in the Real Estate category, Vanguard funds are consistently economic in every category. Wealthfront does not make use of a Vanguard fund for the TIPS asset class (Table 5.7). However, Vanguard's fund in this category, the 'VTIP Vanguard Short-Term Inflation-Protected Securities ETF', which is used by Betterment, carries a fee of only 0.05%. Compared to the funds used by Wealthfront, this is as economic as the 'SCHP Schwab Barclays Capital U.S. TIPS' fund, less than half the price than the SPDR alternative and almost four times more economic than the iShares fund. Similarly, for the emerging market bonds asset class, Vanguard charges a fee of 0.25% with its 'VWOB Vanguard Emerging Markets Government Bond ETF' fund. However, Wealthfront has selected three non-Vanguard funds that charge fees of 0.30%, 0.39% and 0.50% respectively (Table 5.7).

TABLE 5.7 WEALTHFRONT ASSET CLASSES WITHOUT VANGUARD FUNDS

Category	Fund Name	Fund Cost
TIPS	IPE SPDR Barclays TIPS ETF	0,12%
	TIP iShares Barclays TIPS Bond ETF	0,19%
	SCHP Schwab Barclays Capital U.S. TIPS	0,05%
Emerging Market Bonds	EMB iShares JPM EMBI Global Core	0,39%
	PCY PowerShares DB EM USD Liquid Balanced	0,50%
	EMLC Market Vectors Emerging Markets Local Currency Bond ETF	0,30%

Table of own creation. Data source: https://www.wealthfront.com/investing-guide
Vanguard funds highlighted in blue.
The lowest fund fee per asset class highlighted in green.

On top of the underlying fund costs, both Betterment and Wealthfront charge a management fee of 0.25%. The total fund cost varies among the different portfolio models depending on the funds and their assigned weights. Wealthfront informs that the weighted

average annual expense ratio of its portfolios is between 0.07% and 0.16%. Additionally, other costs -like the bid-ask spread- also drag the portfolio performance.

Vanguard Digital Advisor charges a net advisory fee of approximately 0.15%. Vanguard defines the advisory fee as approximate. That is because its model consists of charging an annual gross advisory fee of 0.20% and then refunding its clients for all the incurred costs that result in revenues for Vanguard group. Since Vanguard Digital Advisor uses Vanguard funds and Vanguard Brokerage Accounts for its clients, investors in Vanguard's Robo-advisor not only benefit from the lowest advisory fee but are also refunded for all the additional incurred costs. Hence, the total net fee of just 0.15% approximately. Assuming all costs incurred, Vanguard's Digital Advisor is less than half the price of the current US independent Robo-Advisors (Table 5.8).

TABLE 5.8 US ROBO-ADVISORS COST COMPARISON

Robo-Advisor	Total Cost	Management fee	Funds cost
Vanguard Digital Advisor (US)	0,15%	0,15%	0%
Betterment (US)	0,32% - 0,41%	0,25%	0,07% - 0,16%[2]
Wealthfront (US)	0,32% - 0,41%	0,25%	0,07% - 0,16%[1]

[1]The exact amount depends on the mix of funds according to the assigned portfolio.
[2]Approximate amount, as this is not disclosed by Betterment. The exact amount depends on the mix of funds according to the assigned portfolio.
Data sources: https://investor.vanguard.com/advice/digital-advisor/ https://www.betterment.com/ https://www.wealthfront.com/

Vanguard Digital Advisor pricing model is just the opposite of its competitor Schwab Intelligent Portfolios. As previously covered, the Robo-advisor of Charles Schwab is the leading Robo-advisor in terms of AUM in the United States (excluding Vanguard's hybrid advisor). Similar to Vanguard's case, this Robo-advisor is also provided by an established financial institution that manages all the value chain within the group companies. Thus, Schwab Intelligent Portfolios invests mainly through Schwab's ETFs and makes use of its group affiliated companies for the brokerage or cash depositary services. As stated by Charles Schwab in its disclosure brochures (2021), the affiliated companies of the group receive revenues from the indirect costs incurred by investing through Schwab Intelligent Portfolios. These are mainly the expense ratios of the Schwab ETFs, retrocession fees paid by external ETF providers and income on cash deposits. Contrary to its main competitors, Schwab Robo-advisor portfolios allocate from 6% to 30% of the portfolio value in cash accounts deposited at Schwab Bank, from which the affiliated bank is able to earn revenue.

Instead of charging a management fee for its Robo-advisory services, Schwab offers this at no direct cost for investors and generates revenue for the group through the above-mentioned indirect costs. This pricing model complicates the calculation of the total revenues generated by Schwab Intelligent Portfolio to the group as well as the total costs borne by the client. According to its disclosure brochures, Charles Schwab establishes a benchmark fee for Robo-advisory services of 0.30% of the client's assets. If the revenue generated within the group from a client would result higher than the benchmark, any exceeding amount would be refunded back to the client or used to cover the account administrative expenses. While the actual cost will depend on the allocation of each portfolio, a final cost of 0.30% would be two times higher than Vanguard's Digital Advisor net fee.

None of the described US Robo-advisors mentions the effect of bid-ask spreads in the final portfolio performance. In its brochure, Vanguard discloses that market spreads are incurred on top of the gross advisory fee. However, since Vanguard Digital Advisor uses Vanguard Brokerage accounts, any amounts of the bid-ask spread that are retained by the broker as revenue would also be refunded back to the investor. Hence, the impact of bid-ask spreads can be expected to be lower with Vanguard Digital Advisor.

To compare Vanguard Digital Advisor costs with the current European Robo-advisors, we need to rely on a hypothesis on what the cost would be for the European version of a Vanguard Robo-advisor. The recent launch of Vanguard's hybrid advisor in the UK allows for a direct cost comparison with its US version, which we will use to guide our estimations.

As disclosed in Vanguard's Personal Advisor Services Brochure (2021), the hybrid Robo-advisory service charges a fee of 0.30% of the client's assets. Additionally, investors also incur indirect costs, mainly the underlying fund fees. The final fund fees for each portfolio depends on the mix of funds and their assigned weights. Vanguard does not disclose any specific or average fund fees. However, these can be estimated in the range of 0.05% to 0.10%. Finally, an account fee of 20 USD may also apply, although this can easily be avoided under certain conditions.

In the case of the Vanguard Personal Financial Planning service recently launched for UK residents, and according to its disclosure document (2021), Vanguard offers a total fee of 0.79% (Table 5.9), which is disclosed as follows. The advisory fee is set at

0.50%, which represents an increase of 67% from its US version. Given the lower volume of assets under management in the British market, it is understandable that Vanguard does not benefit from the same economies of scale as it does in the US and therefore needs to charge higher fees for its services. The incurred fund costs are established at 0.14%, which are also higher than the ones in the US. Again, this is mainly a matter of scale since Vanguard funds nominated in British pounds are much smaller than the US ones. Finally, Vanguard also charges an account fee for its British hybrid Robo-advisor of 0.15%, which is capped at 375 GBP.

TABLE 5.9 VANGUARD HYBRID ADVISOR COMPARISON

Service	Country	Total Cost	Advisory Fee	Fund Costs	Account Fee
Vanguard Personal Advisor	US	0,35% - 0,40%	0,30%	0,05% - 0,10%[1]	0 - 20 USD
Vanguard Personal Financial Planning	UK	0,79%	0,50%	0,14%	0,15%

Table of own creation. Data sources: https://investor.vanguard.com/advice/financial-advisor/personal-advisor-services and https://www.vanguardinvestor.co.uk/financial-advice

[1] Estimated.

Given the available comparison, we can assume that Vanguard's Digital Advisor, in the event of its expansion to Europe, would carry a higher total cost than the one currently available in the US. By extrapolating the incremental cost of 67% in its hybrid advisor, we can estimate a management fee in the area of 0.25% (0.15% x 1.67). Given the higher fund costs and account fees of Vanguard in the UK, it is likely that these would not be fully refunded to the clients, as is the case in the US. To estimate the final total cost, we can consider the following two scenarios:

- Indirect costs fully borne by clients: fund costs (0.14%) and the account fee (0.15%) would be at the expense of the investor driving the total fee to the area of 0.54%.
- Indirect costs refunded to clients: Vanguard could also follow the same pricing strategy as in the US and advertise a single net fee with all the indirect costs, which remain as revenue within the group, refunded to the clients. In this scenario, we find a fee of twenty-five basis points as quite low, given the higher costs relative to the volume that Vanguard faces in the British market. Therefore, we estimate a total fee in the range of 0.25% to 0.50%, also including any incurred bid-ask spread.

Assuming a total net fee at a maximum of 0.50%, Vanguard's Digital Advisor would be the cheapest option in the European market. Nutmeg carries a total fee of 0.69% for its full digital option in the UK market, while this can be as high as 1.04% in the case of Moneyfarm. The originally Italian Robo-advisor charges a decreasing management fee according to the value of the portfolio. With a management fee of 0.75% for any amount up to 10,000 GBP and 0.60% for amounts between 10,000 and 50,000 GBP, a portfolio with a valuation of 30.000 GBP would have an actual management fee of 0.65% (0.75% x 1/3 + 0.6% x 2/3). With fund costs at an additional 0.20% and an advised average market spread of 0.09%, the total cost would add up to 0.94%. Even with a portfolio valuation of 150,000 GBP, the management fee would remain at 0.49% (0.75% x 1/15 + 0.6% x 4/15 + 0.5% x 5/15 + 0.35% x 5/15) resulting in a total fee of 0.78%. Barclays Plan & Invest costs are in the range of 1.39% to 1.59%, including only the management fee and underlying fund costs.

TABLE 5.10 UK ROBO-ADVISORS COMPARISON

Robo-Advisor	Total Cost	Management fee	Funds cost	Avg. Market Spread
Vanguard Digital Advisor (UK)[1]	0,35% - 0,50%	0,35% - 0,50%	0%	0%
Nutmeg (UK)	0,69%	0,45%	0,19%	0,05%
Moneyfarm (UK)	0,64% - 1,04%	0,35% - 0,75%	0,20%	0,09%
Barclays Plan & Invest (UK)	1,39% - 1,59%	1,14%	0,25% - 0,45%	n/a

[1] Estimated based on the described hypothesis.
Data sources: https://www.nutmeg.com/ https://www.moneyfarm.com/uk/ https://www.barclays.co.uk/investments/plan-and-invest/

In the case of the leading German Robo-advisors, the total fee for Scalable Capital is at 0.95%. We also estimate the final total cost of Visualvest in the range of 0.90%. The total cost for the Italian clients of Moneyfarm surpasses 1.30% including VAT for portfolios below 20,000 EUR. The Spanish Indexa Capital advises a total fee of 0.63% for portfolios between 3,000 and 10,000 EUR, 0.61% between 10,000 and 100,000 EUR and 0.58% for portfolios over 100,000 EUR. Indexa does not include market spread costs in its total calculation, which would raise its actual total cost by at least 5 basis points. Following the same hypothesis as for the UK and with a total cost in the 0.35% area, Vanguard's full digital advisor would result from two to three or even more times cheaper than its European competitors (Table 5.11).

TABLE 5.11 EUROPEAN ROBO-ADVISORS COMPARISON

Robo-Advisor	Total Cost	Management Fee	Funds Cost	Avg. Market Spread
Vanguard Digital Advisor (UK)[1]	0,25% - 0,50%	0,25% - 0,50%	0%	0%
Scalable Capital (DE)	0,95%	0,75%	0,15%	0,05%
VisualVest (DE)	0,80% - 0,95%	0,60%	0,15% - 0,30%	0,05%
Moneyfarm (IT)	0,68% - 1,28%	0,40% - 1,00%	0,20%	0,08%
Indexa Capital (ES)	0,34% - 0,63%	0,27% - 0,56%	0,07%	n/a

[1] Estimated based on the described hypothesis.
Data sources: https://de.scalable.capital/ https://www.visualvest.de/ https://www.moneyfarm.com/it/ https://indexacapital.com/es/esp/

5.2 Minimum Investment

The relatively low minimum investments required by Robo-advisors is one of its main disruptions in the industry, facilitating access to financial advisory services to the big mass of average-wealth citizens.

Vanguard's Digital Advisor in the US is available from only 3,000 USD. Whereas the hybrid advisor requires at least 50,000 USD in the US and GBP in the UK. Following this, the minimum investment for the European version of Vanguard Digital Advisor could also be expected at 3,000 GBP or EUR. Some European Robo-advisors require as little as 500 EUR in the case of Visualvest or 500 GBP for Nutmeg. Moneyfarm offers its services from 1,500 GBP in the UK, while in Italy this increases to 5,000 EUR. In Spain, Indexa Capital recently increased its required initial investment from 1,000 to 3,000 EUR. Meanwhile, Scalable Capital is only available from 10,000 EUR, although its Robo-advisory services are also available to the clients of its bank partner ING Diba from 5,000 EUR. In the US, competitors such as Wealthfront are available from 500 USD.

TABLE 5.12 EUROPEAN ROBO-ADVISORS MINIMUM INVESTMENT

Robo-advisor	Minimum Investment
Vanguard Digital Advisor (US)	3,000.00 USD
Scalable Capital (DE)	10,000.00 EUR
Nutmeg (UK)	500.00 GBP
Moneyfarm (UK)	1,500.00 GBP
Moneyfarm (IT)	5,000.00 EUR
Barclays Plan & Invest (UK)	5,000.00 GBP
OpenBank (ES)	500.00 EUR
Fidelity Wealth Expert (DE)	5,000.00 EUR
VisualVest (DE)	500.00 EUR
Betterment (US)	- USD

Wealthfront (US)	500.00 USD
Indexa Capital (ES)	3,000.00 EUR

Data sources: https://investor.vanguard.com/advice/digital-advisor/ https://de.scalable.capital/ https://www.nutmeg.com/ https://www.moneyfarm.com/uk/ https://www.moneyfarm.com/it/ https://www.barclays.co.uk/investments/plan-and-invest/ https://www.openbank.es/inversiones/robo-advisor-gestion-carteras https://www.fidelity.de/produkte-services/fidelity-wealth-expert/ https://www.visualvest.de/ https://www.betterment.com/ https://www.wealthfront.com/ https://indexacapital.com/es/esp/

Having minimum investment amounts as low as 500 EUR/USD/GBP can certainly help to attract the youngest or cautious investors. However, these are far from profitable. We estimate a minimum investment of 3,000 EUR/GBP as the most likely scenario for a Vanguard Digital Advisor in Europe.

5.3 Conflict of Interests

As disclosed in the Digital Advisor brochure (Vanguard, 2021), Vanguard's Robo-advisor incurs in conflict of interests by establishing activities only within companies of the group. The Robo-advisor describes affiliations with The Vanguard Group, Inc., Vanguard Marketing Corporation, Vanguard Fiduciary Trust Company, and Vanguard National Trust Company. We assume that a European version of the Digital Advisor would be articulated in the same way, therefore incurring the same conflicts of interest. Among the different conflicts of interests that may arise, perhaps the most evident is the recommendation of only Vanguard funds, which Vanguard justifies in the following manner:

> "We address the competing interests that arise between us and our Clients as a result of recommending proprietary funds by relying on our time-tested investment philosophies and beliefs, such as the benefits of low costs, diversification, and indexing, when formulating target allocations for Clients. We disclose to prospective Clients that we recommend Vanguard Funds prior to, or at the establishment of, the advisory relationship. Acting in accordance with our advice to purchase Vanguard's proprietary funds will result in the payment of fees to the Vanguard Funds that are separate from, and in addition to, any advisory fees assessed by us."

5.4 Ubiquity of Digital Services

Robo-advisors are, by definition, full digital platforms accessible by the internet. This makes them more oriented to younger generations that are considered digital natives and used to deal with online technologies. While all Robo-advisors equally benefit from the current easy and widespread access to digital services, we believe this represents an

increased advantage for Vanguard. In their attempt to offer market returns at the minimum cost to investors, Vanguard barely invests in marketing and retrocedes no fees to distributors and business intermediaries. This strategy has always lagged Vanguard's growth and international expansion, especially to the smaller retail investors.

Financial advisors working in traditional financial institutions, such as retail banks, do not recommend Vanguard funds to their clients, as these bring no revenue to distributors. Indeed, Vanguard funds are not accessible through most European retail banks, even upon client's request. Therefore, thanks to the benefits of digital services, Robo-advisors allow retail investors to directly access low-cost indexed funds. As we have previously covered, Vanguard funds have traditionally carried the lowest fees and have a long track record in outperforming competitors and closely tracking the respective indexes performance. Hence, Vanguard Digital Advisor may not just be a very competitive alternative for retails investors interested in a Robo-advisory service. Through its Robo-advisor, Vanguard will be able to directly reach new retail investors, that want to build a passively managed portfolio at the lowest possible cost, that until now had no way to access Vanguard funds.

5.5 Competitive environment

In its first decade of existence, the Robo-advisory market has been through increasing levels of competition as new entrants have continuously tried to capture the new market growth, and incumbent financial institutions have started to include Robo-advisory services among their offerings. As previously analysed, both the US and European markets have been ground of competition for hundreds of Robo-advisors. This highly competitive environment forces the prices down and increases the need to invest in marketing campaigns to capture new clients. This has led to a decade of fierce competition in which almost every Robo-advisor has been far from reaching profitability levels. The continuous need for capital and the growth of Robo-advisors has led to the entry of traditional financial institutions, such as BlackRock or Goldman Sachs, through the acquisition or participation in the equity of different Robo-advisors.

As opposed to independent Robo-advisors, Vanguard makes part of the group of incumbent financial institutions that could disrupt the Robo-advisory market and bring smaller service providers out of business. As previously analysed, Vanguard's capability of providing the whole value chain within the group, from the use of own funds to the

brokerage services, allows them to charge the lowest fees of the market. Offering the best price, together with the trust and reputation built on decades of experience, turns Vanguard Digital Advisor into one of the biggest threats that could increase the competitive environment of the European Robo-advisory markets.

Despite the increased competition of the past years, Vanguard Digital Advisor offers the most competitive pricing in the US market and has the potential to be so as well if it is finally launched in European markets.

5.6 Bearish market and crisis

As covered in the literature review, the authors see a threat for Robo-advisors in the eventuality of a bearish market and financial crisis. Robo-advisors raised in the post-financial crisis times of 2008 and had since then not experienced any continued bearish market until most of the relevant studies were published. Authors have considered bearish markets as a relevant threat to Robo-advisors mainly because investors in Robo services are mostly young and have just experienced bullish market times in their Robo-advisory portfolios.

The authors warn that a prolonged bearish market has traditionally been difficult to stand by inexperienced investors, who could end up selling their positions and closing their portfolios. Financial crises also tend to hit most the economic stability of lower and middle classes who are a big part of the Robo-advisory clientele. Therefore, such investors could also be forced to stop contributing to their portfolios and eventually close them before expected to obtain liquidity.

This time finally came in the spring of 2020, when the outbreak of the COVID-19 pandemic crashed all the financial market indexes. We have not had access to data regarding Robo-advisory clients' behaviour during the crisis. However, the market recovery was surprisingly fast, with almost every index in new historic highs in less than a year from the crash. Therefore, while the crash was abrupt, markets have not remained at low levels for long and Robo-advisory investors must have recovered their pre-pandemic portfolio valuations quickly.

While the consequences on Robo-advisors of a long bearish market remain to be seen, Vanguard's group history and track record offer sufficient credibility to believe that its Digital advisor will be able to navigate difficult market periods. On the contrary, the

smaller Robo-advisors, that lack the support of bigger institutions, and are dependent on continuous financing rounds, could be forced out of business in case of a prolonged financial crisis. This general threat for independent Robo-advisors can eventually turn into an advantage for Vanguard Digital Advisor, as the number of competitors would eventually diminish.

5.7 Possible threat from regulators

As in the literature review, various authors have pointed to the need for specific regulations for Robo-advisory services. The disruption brought by their automated risk profiling, asset allocation and portfolio rebalancing raise doubts on whether these services remain compliant with the different regulations that apply for asset and wealth management services. As is always the case, disruptions and technological advancements are always ahead of regulations. New measures regarding conflicts of interests or fiduciary requirements are a threat for this developing sector as these could force them to increase their compliance efforts.

In the case of new regulations, Vanguard would also have to adapt its Digital Advisor within the new requirements. However, we believe that Vanguard stands in a better position to adapt its Robo-advisory services to whatever new compliance regulations may be enforced. Thanks to its group size and market-leading position, Vanguard counts with both the resources and compliance expertise that would allow them to adapt its services to new regulatory requirements in a timely and fully compliant manner. Similarly, Vanguard also benefits from leading economies of scale and low-cost structures that have allowed them to price its Digital Advisor at the lowest cost of the market. Should new compliance regulations increase the costs of providing Robo-advisory services, Vanguard would also be in a better position to minimize these new costs in comparison to the small independent European and American Robo-advisors. Additionally, the current gap between Vanguard's Digital Advisor fee and its competitors would allow Vanguard to reflect new costs on its pricing while remaining a low-cost service, which we have regarded as fundamental in the Robo-advisory market.

5.8 Complement traditional advisors

The reviewed authors also pointed to the extension of Robo-advisory services to B2B business models as an opportunity for growth and future development. As we have covered in our analysis, the leading European Robo-advisors have shifted their

international expansion efforts to B2B partnerships, through which Robo-advisors offer their technology to banks and established financial institutions. This way, Robo-advisors are able to enter new markets and get access to their partners' large client base without incurring the massive marketing efforts that entering a new market as a standalone advisor requires.

Traditional financial institutions like banks are able to offer Robo-advisory solutions to clients without having to develop their own technology. This allows them to expand their service offering and to target clients that are either too small for traditional financial advice models or that were planning to move their assets to automated advisors.

In the US, however, we have also seen the opposite move in which leading independent Robo-advisors, such as Betterment, have also expanded their offering by including live human advisors. Including human advisors allows them to target the wealthier and more traditional clients that are sceptical to move to a fully digital and automated solution.

We regard Vanguard as an established financial institution that, as opposed to its competitors, has opted to develop its own Robo-advisory solution. Therefore, Vanguard Digital Advisor is not only a new product that will allow Vanguard to target directly a new set of smaller investors. Vanguard's Robo-advisor is also an in-house developed technology that can be leveraged by the traditional financial advisory services of the firm.

5.9 Strengths and weaknesses excluded from the comparison study

- Portfolio construction by algorithms and automated rebalancing: the use of algorithms to produce investment advice and the automated rebalancing of the portfolios to stay within the assigned asset allocation are the main disruptions that Robo-advisors have introduced to the asset and wealth management industry. While every Robo-advisor develops its own algorithm, they all equally benefit from the massive cost reduction that result from the automation of the whole advisory process. This is a common trait of Robo-advisory technology and we do not believe that, at this stage, could be exploited by Vanguard to build further competitive advantage.
- Less emotional decision-making: one of the main advantages of Robo-advisory is attributed to the absence of human emotions in the management of the portfolio. Once the investment strategy and portfolio allocation have been defined, the algorithm will make sure that the portfolio remains balanced independently of the feeling of the market,

the investor's confidence or the economic situation. This capacity to maintain the strategy no matter what has proven to deliver superior performance than trying to time the market or guess the next period winning asset class. Since every Robo-advisor relies on an automated investment process, this characteristic leaves no chance to build a competitive advantage upon it.

- Investment experience: thanks to the development of digital services, Robo-advisors benefit from very easy and user-friendly platforms, which allow even new investors to understand quickly the investment strategy, portfolio performance, etc. Since each platform is different, its usability and design differ, which can turn into a key argument to convince a potential investor. We believe that the design and user experience of each platform provides an opportunity to excel and create a competitive advantage. However, an in-depth enough user experience analysis is out of the scope of this study and has been excluded from the assessment.
- Poor assessment of risk tolerance and lack of personalization: according to the reviewed authors, Robo-advisors perform a too superficial risk assessment based only on online questionnaires. Robo-advisors make little or no effort in verifying clients' answers and thus, they never really get to know the whole reality of their clients. Instead of trying to understand fully the situation and needs of each client and building a portfolio that best matches those, Robo-advisors just allocate clients to predefined risk levels that will match them with a prebuilt portfolio. This is a consequence of the automatization of the whole advisory process and therefore, the criticism is equally extended to all the Robo-advisory services.
- No personal contact: by definition, Robo-advisors provide automated investment advice and portfolio management services without the need for direct human interaction. Some Robo-advisory providers have expanded their offer by including mixed services, in which investors have access to human advisors. Usually, such services charge higher management fees and require higher minimum investments. This would be the case of Vanguard's Personal Advisor. While all the client risk profile assessment, asset allocation and portfolio rebalancing still rely on an algorithm, the possibility of speaking with a human advisor provides an extra level of confidence for the less tech-savvy clients or the more risk-averse ones, especially when the portfolio is underperforming the expectations.

Mixed advisors may be a good addition to the service offering and may help to reach a bigger and wealthier audience. Although they make use of the Robo-advisory

algorithms and technology, we have excluded these from our study, as they do not completely fall under the Robo-advisory definition. Therefore, Vanguard Digital Advisor completely lacks personal contact and, in this way, it does not differentiate itself from its competitors.

- Unfulfilled fiduciary duty: based on the analysis performed by Fein (2016), Robo-advisors in the US would be breaching the fiduciary standards established by the SEC and the Investment Advisers Act of 1940. The author argues that the lack of individualized client analysis performed by the algorithms is not sufficient to meet the established criteria. From this point of view, Vanguards' Digital Advisor offer would fall under the same criticism as the rest of automated advisory services.
- Opportunity to standardize and integrate Goal-based investing: the automation of risk profiling, asset allocation and portfolio rebalancing could just be the first set of wealth management services that Robo-advisors have incorporated into their offering. With further development of their platforms and algorithms, Robo-advisors could potentially automate more complex and individualized requirements; however, this is still far from the offering of current Robo-advisors, including Vanguard.
- No acceptance of users: the authors refer to the no acceptance of users as the threat for Robo-advisory services of not reaching a wide enough consumer base. The analysed business model of Robo-advisors requires continuous years of exponential growth to reach a level of assets under management that can turn them into profitable businesses. By the first quarter of 2021, only Schwab, Wealthfront and Betterment, all in the US market, have reached AUM levels that could be in their break-even area. Meanwhile, European Robo-advisory markets grow at a slower pace and therefore are at a higher risk of not reaching a sufficient number of users. Although the potential advantages of the European version of Vanguard Digital Advisor could boost the European Robo-advisory market, Vanguard is equally exposed to the threat of lack of demand and acceptance for Robo-advisory services.

6. Conclusion and Recommendations

In our analysis of Vanguard's new Robo-advisory service and its potential expansion to European markets, we first note a divergence in the size and growth between the US Robo-advisory market and the European ones. In the US, among the leading Robo-advisory services we find independent firms, such as Betterment and Wealthfront, which have reached AUM levels in their estimated break-even range without expanding outside their national market nor collaborating with established financial institutions. Additionally, we also find incumbent financial institutions that have developed their own Robo-advisor, such as Charles Schwab and, more recently, Vanguard Group.

European markets, however, have not yet reached similar levels of growth, which has forced European independent Robo-advisors to expand their services to other European jurisdictions. Leading European Robo-advisors first tried to directly expand their offering to other markets, however, this has proven to be too resource consuming and most Robo-advisors have shut their direct to consumers offering in foreign markets and switched to a B2B while label model for their international expansion. The European financial institutions that have entered in the provision of Robo-advisory services have opted for leveraging the technology of existing Robo-advisors rather than developing their own.

Therefore, we conclude that there is not one single European market for Robo-advisory and that even the leading European markets are very far from the US one in terms of size and growth, which has led to two different realities in the expansion of European and American Robo-advisory providers.

In this context, Vanguard launched Vanguard Digital Advisor, which we believe has the potential to disrupt the US Robo-advisory market. Similar to Schwab, Vanguard is a financial institution that manages the whole Robo-advisory value chain within the group. This has allowed Charles Schwab to quickly accumulate more assets under management than Wealthfront and Betterment combined. However, we assess Vanguard's Robo-advisor potential as larger.

As analysed, Vanguard Digital Advisor charges a fee that is approximately half the cost of Schwab Intelligent Portfolios and even less in the case of the leading independent Robo-advisors. Vanguard is currently the largest indexed funds and second-largest ETF provider, and as we have seen, Vanguard is the main source of ETFs for independent

Robo-advisors. Thanks to its size and economies of scale, but also to its unique structure and purpose covered in the literature review, Vanguard is able to offer the lowest cost ETFs for almost every index or asset class used by Robo-advisors. Given that, independent Robo-advisors always need to add up the underlying cost of the funds as well as transactions related costs, such as bid-ask spreads or brokerage fees, we conclude that independent Robo-advisors cannot compete with Vanguard Digital Advisor on a cost basis. Indeed, even financial institutions with their own in-house Robo-advisor, such as Charles Schwab, are not currently able to match Vanguard's offering.

Our study is based on the hypothesis that Vanguard could expand its Robo-advisory services to European markets. As argued in the Research hypothesis and contextualization of the study section, we believe that the expansion of the Digital Advisor to the UK could be the next move of Vanguard in Europe after the launch of its hybrid advisor to the British market in the first half of 2021. Given our estimations, and the current costs of the leading European Robo-advisors, we believe that the pricing gap between Vanguard and its eventual competitors would be even larger in the UK than the current one in the US.

Indeed, we find that leading European Robo-advisors are still too far from profitable assets under management levels. Consequently, they have already given up on their unsustainable direct to consumer expansion across Europe and are moving to a B2B white label solution offered through traditional banks and financial institutions. Given their unprofitable business models, European independent Robo-advisors may keep reducing, even more, their direct to consumer offerings and turn just into technology providers to established financial institutions. This means an additional intermediary in the distribution channel, which results in even higher fees. Especially compared to Vanguard's model, in which the whole value chain is managed within the group.

Therefore, we conclude that Vanguard Digital Advisor maximizes one of the key strengths of Robo-advisors by consistently offering the lowest fees in an already low fees environment. We also find that Vanguard's Robo-advisor has a clear cost structure with no hidden fees and third-party payments at the expense of its investors, which is one of the criticisms that Robo-advisors have received in regards to their investment costs. Thus, we believe that Vanguard Digital Advisor has a clear competitive advantage in its pricing and cost structure both in the US market, as well as in its hypothetical future launch in the UK or other European markets.

We believe that investors' final interest is maximizing their returns. This study does not include a comparison of annualized returns of the different Robo-advisors. Partially, because we do not have access to all the information required to run the simulation, such as the asset allocation of the different portfolios for the recently launched Vanguard Digital Advisor. However, we understand that other Robo-advisors could offset Vanguard's low fees with superior portfolio returns. Each Robo-advisor makes use of different asset allocations to obtain the maximum possible return within the risk level assigned to each portfolio. Betterment, for instance, invests in up to 14 different asset classes, while Wealthfront makes use of only 10. Our study could be well complemented with a comparison of the risk-adjusted returns obtained by the different portfolios of the leading Robo-advisors against the ones from Vanguard Digital Advisor. However, given the long record of Vanguard in investment research, asset management and passive investment strategies, we believe it is unlikely that other Robo-advisors may design index-tracking portfolios that consistently deliver higher net returns, despite their higher costs, without incurring higher volatilities or non-passive strategies, such as market timing or the use of actively managed funds.

Besides the pricing and investment costs comparison, we understand that an additional analysis should be performed on the incremental costs that Vanguard would have to face to adapt, launch, promote and maintain its Digital Advisor into a European market. The costs analysis would allow estimating the necessary assets under management required at different fee levels to break even and become profitable. For our hypothesis, we have estimated a wide fee range that could go from as low as 0.25% to 0.50%. Vanguard Digital Advisor would still be the lowest cost offering in any European market even with its maximum estimated fee, despite this being two times higher than the minimum one. Such analysis would also allow assessing the required market size for Vanguard to launch its Robo-advisory services into a new country and the estimated market share that they would need to capture at different expansion stages.

To contextualize better our study, in addition to our Robo-advisory pricing and investment costs analysis, we have also considered the rest of Robo-advisors strengths and weaknesses covered in the literature review. We have divided these into whether they are currently standard for every Robo-advisor or whether they allow differentiation to provide a competitive advantage. On top of the cost related strengths and weaknesses, we have identified other seven characteristics that may give advantage to some Robo-

advisors and we conclude that Vanguard is either neutral on these or in a position to build further competitive advantage.

Regarding the minimum investment costs, we consider that Vanguard Digital Advisor is available from a reasonable and competitive amount in the US. In our hypothesis, we estimate an equivalent minimum amount in its eventual expansion to a European market. Therefore, we regard Vanguard as competitive.

In regards to the conflict of interests, we understand that the use of Vanguard only funds not only is well disclosed and properly communicated but also has a very limited negative impact on the client's interest. Vanguard funds have a long track record of closely tracking their indexes of reference. As previously analysed, Vanguard funds always carry one of the lowest fees for each asset class and are the main fund provider choice for leading independent Robo-advisors. Therefore, we conclude that, while Vanguard is incurring in conflict of interests, these are not at the expense of clients' returns or higher indirect costs to generate additional revenues. Hence, we believe that conflicts of interests are not a weakness in the case of Vanguard Robo-advisor.

Since Vanguard is not just a Robo-advisory service provider, we also believe that Vanguard Digital Advisor represents more than an independent product to compete in a newly created market. The fully digitalized characteristic of Robo-advisory allows Vanguard to finally make its funds directly accessible to retail investors. Therefore, Vanguard's Robo-advisor represents a new distribution channel for the group that gives access to a whole new segment of clients and, potentially, to new markets as well.

We also believe that Vanguard Digital Advisor is better prepared to face some of the threats described in the literature review. We regard Vanguard Group as one of the incumbent financial institutions that threaten to increase the competitiveness of the Robo-advisory market. Given its reputation, size and expertise, we also conclude that Vanguard is better prepared to face the potential threats of bearish markets and crisis as well as new regulations.

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