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ROBO-ADVISORS IN THE ASSET MANAGEMENT INDUSTRY: HOW START-UPS PROFILE THEIR CUSTOMERS

Supervisor: Prof. Marco Giorgino

Co-supervisor: Prof.ssa Laura Grassi

Master Thesis of:

Alessandro Cappello 872000

Davide Ruffoni 876589

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Estratto

La crescita di strategie passive nell'asset management e i cambiamenti nelle preferenze dei clienti stanno favorendo la nascita di start-up che si occupano di robo-advisory. Essendo un fenomeno rilevante, la letteratura che se ne occupa è in crescita, ma, nonostante l'interesse sull'argomento, viene data meno attenzione alla fase di profilazione dei clienti. La maggior parte delle start-up che hanno un modello di business orientato al B2C offre la possibilità di creare portafogli di investimento online. Di conseguenza, l'obiettivo di questo lavoro è quello di comprendere come queste start-up profilano i propri clienti. Il campione dell'analisi è composto da start-up da tutto il mondo, e ambisce ad analizzare con il massimo livello di dettaglio le domande che vengono chieste ai clienti per definire il loro profilo e le informazioni mostrate con il portafoglio simulato. Sono stati analizzati gli ambiti sui quali le start-up si focalizzano di più, sia per tutto il campione che per specifici sottogruppi. Infatti, i risultati sono mostrati anche per ogni singolo continente e per sei diversi cluster. Sono poi discusse differenze e somiglianze. Un'ulteriore analisi presentata definisce la conformità a MiFID II per quelle start-up che ne sono soggette. Inoltre, i risultati di questa ricerca sono confrontati con la letteratura per evidenziare principali differenze tra teoria e pratica.

Abstract

The rise of passive asset management and the changes in customers' preferences are favouring the birth of new robo-advisor start-ups. Since the phenomenon is relevant, the literature focused on this topic is growing. Despite this increasing interest, less attention is given to the phase of customer profiling. Most of the start-ups that have a B2C business model offer the possibility to build online portfolios and start to invest directly online. Therefore, the objective of this work is to understand how these start-ups profile their customers. The sample of the analysis is built with a worldwide scope and the aim is to analyse at the highest level of detail the questions that are asked to customers to assess their profile and the information shown with the outcome of the portfolio simulation. In this work a categorization of the questions asked and the information shown is presented. The areas on which start-ups focus the most are analysed, both for the whole sample and for specific subdivisions. In fact, the results are provided also for each continent and for six specific clusters. Differences and similarities among groups are discussed. A further analysis presented is an assessment of the compliance with MiFID II of those in the sample that are subject to this regulation. Moreover, the results of this research are compared with the literature to highlight the differences between theory and practical application.

Sommario Esteso

La tecnologia ha sempre giocato un ruolo importante nel settore dei servizi finanziari, nonostante ciò si è iniziato a parlare del fenomeno FinTech solo nell'ultima decina di anni, grazie anche ai relativamente recenti progressi tecnologici e innovazioni. "*FinTech è l'abbreviazione per Financial Technology, ovvero l'applicazione della tecnologia per la fornitura di servizi di finanziamento, pagamenti, investimenti e consulenza, che è diventato un potente fattore di innovazione nel mercato dei servizi finanziari*" (Bank of Italy, 2017). Molte start-up sono nate e hanno sfidato gli incumbent con maggiore velocità e flessibilità, adottando modelli che si concentrano sul cliente migliorandone l'esperienza.

Diversamente dai settori di prestiti e finanziamenti, e da quello dei pagamenti, il mondo dell'asset management non è ancora stato (completamente) rivoluzionato, essendo più difficile allontanare i clienti dai paradigmi tradizionali. "*In questo contesto, un certo numero di disruptor, dai servizi automatizzati di wealth management alle piattaforme di social trading, sono emersi per fornire alternative a basso costo e sofisticate ai wealth manager tradizionali. Queste soluzioni raggiungono un'ampia base di clienti, ai quali permettono di avere un maggior controllo sulla gestione del loro patrimonio*" (World Economic Forum, 2015). Perciò, il trend più importante è la democratizzazione dell'asset management dovuta

a nuovi player digitali e robo-advisor, che possono essere definiti come piattaforme automatizzate che offrono la gestione di portafogli tramite algoritmi. I motivi per il loro attuale successo sono ascrivibili a diversi fattori, come la perdita di fiducia negli attori tradizionali dopo la crisi finanziaria globale, la crescita di strategie passive di asset management, cambiamenti nelle caratteristiche dei clienti (che sono più ricettivi verso le tecnologie digitali). Hanno inoltre importanti vantaggi sui player tradizionali: maggiore accessibilità grazie alle piattaforme online e bassi (se non nulli) investimenti minimi richiesti, costi minori grazie all'elevato livello di automazione e l'uso di strumenti finanziari a basso costo, migliore *customer experience*. Nonostante la rapida crescita, soprattutto negli Stati Uniti, in termini di Asset under Management (AuM) questi nuovi player sono ancora molto più indietro rispetto ad alcuni incumbent (ad esempio Vanguard, Charles Schwab, BlackRock), i quali hanno reagito rapidamente adottando la propria soluzione di robo-advisory, sviluppata in-house o attraverso acquisizioni esterne, essendo in grado di sfruttare la propria base clienti e il proprio brand.

Al momento, le start-up nel settore dell'asset management offrono servizi relativamente basici di consulenza finanziaria e gestione di portafogli, in particolare quando la componente umana è assente, attirando una clientela meno sofisticata. Una delle maggiori criticità secondo gli esperti del settore è infatti l'eccessiva semplicità, che potrebbe scontrarsi con i principi quali "agisci nel miglior interesse del tuo cliente" o "fornisci un servizio che sia coerente con le caratteristiche e i bisogni del cliente" richiesti dalla regolamentazione. Una certa mole di leggi già in vigore (ad esempio MiFID in Europa e l'Investment Advisers Act negli Stati Uniti) si applica ai consulenti digitali, ma potrebbero non essere efficaci nel considerare certe peculiarità. Le autorità regolatrici, in generale, non si sono ancora occupate del problema, stanno ancora monitorando l'evoluzione del fenomeno, riconoscendo che i recenti trend di digitalizzazione e automatizzazione degli investimenti hanno benefici per i clienti ma anche potenziali rischi. La European Securities and Markets Authority (ESMA) e la Division of Investment Management della SEC hanno suggerito alcune linee guida per essere conformi alle leggi in vigore. Nonostante ciò, i nuovi player potrebbero sfruttare ulteriori sviluppi riguardo al machine learning, l'intelligenza artificiale e la data analytics per offrire servizi più

personalizzati, rendendo la propria offerta più attraente per investitori con bisogni più sofisticati come la pianificazione patrimoniale e il trasferimento inter-generazionale della ricchezza, con importanti ripercussioni sugli attori tradizionali.

Precedenti studi accademici si sono focalizzati sul descrivere i nuovi trend nel settore dell'asset management, proponendo una tassonomia dei nuovi modelli/player, evidenziando i vantaggi degli incumbent, confrontando diversi robo-advisor rispetto ai costi, i segmenti target, gli investimenti minimi richiesti, ma non molto è stato detto rispetto a come operano. L'obiettivo di questa dissertazione è di colmare questi buchi, in particolare rispetto ad una delle fasi più importanti del processo, la profilazione dei clienti. Questa fase, in genere attuata con questionari online, è critica sia perché impatta direttamente sulla definizione di una soluzione che rispetti il principio di adeguatezza, per il quale ci sono requisiti specifici definiti dalle regolamentazioni, sia perché raccoglie informazioni sulle caratteristiche dei clienti usate per definire il prodotto (es. i portafogli).

Il campione di start-up utilizzato per questa ricerca è stato definito a partire dai database delle analisi degli anni precedenti, includendo compagnie fondate di recente o che hanno recentemente ricevuto finanziamenti, applicando i dovuti filtri su CrunchBase. Dopo aver eliminato quelle compagnie che non ricadono nell'ambito dell'analisi, sia perché sono incumbent o non sono parte del settore dell'asset management, sono state raccolte per tutte le 96 start-up informazioni riguardo l'anno di fondazione, la posizione geografica, i finanziamenti ricevuti, gli asset under management, i metodi di allocazione, gli strumenti finanziari utilizzati/raccomandati, le classi di asset utilizzate e i canali utilizzati. Inoltre, per ogni variabile è stata analizzata la distribuzione del campione per fornire una visione generale dello stato attuale del settore. Successivamente il focus è stato ristretto alla parte principale di questo lavoro, che è, appunto, come i robo-advisor profilano i propri clienti.

Innanzitutto, è stato necessario raccogliere tutti i dati necessari: per questo motivo, sono state eseguite tutte le simulazioni di portafogli disponibili sui siti delle start-up ed è stata tenuta traccia con degli screenshot di tutte le domande chieste agli utenti e di tutti i risultati

del processo di profilazione (profilo di rischio, allocazione del portafoglio, indicatori di rischio e di prestazione). Delle 96 start-up nel campione, 52 permettono di costruire un portafoglio sul proprio sito web; sono state escluse quelle che richiedono la registrazione di un conto corrente o di una carta di credito prima di iniziare. Su questo sottoinsieme sono state poi eseguite le stesse analisi sulle variabili descritte precedentemente.

Tutte le informazioni richieste per profilare i clienti e raccomandare un portafoglio adeguato sono state suddivise in 5 macro-categorie (informazioni personali, situazione finanziaria, propensità al rischio, conoscenza/esperienza, riguardanti l'investimento), che sono state poi ulteriormente suddivise in categorie e singole domande. Lo stesso è stato fatto per i dati riguardanti l'output, identificandone 7 diverse tipologie (scelta tra alternative, allocazione del portafoglio, ritorno, rischio, costi, confronti, dettagli). Basandosi su queste due categorizzazioni, tutti gli screenshot sono stati collocati in due presentazioni PowerPoint e in parallelo è stato costruito un database per ulteriori analisi, raggiungendo il massimo livello di dettaglio, inclusa la rappresentazione grafica. Considerando le domande, si è riscontrato che in media le domande più frequenti sono quelle riguardanti l'investimento, la propensione al rischio e la situazione finanziaria, mentre domande sulle informazioni personali e la conoscenza/esperienza hanno un peso minore. Rispetto all'output, l'allocazione del portafoglio e i ritorni sono le informazioni più mostrate (rispettivamente l'83% e il 79% delle start-up). Le stesse analisi sono state eseguite considerando altre tre diverse dimensioni: le società soggette a MiFID II (presenti nel registro ESMA), diversi gruppi geografici e cluster. Considerando i due continenti che sono maggiormente rappresentati nel campione, si è notato che le start-up europee e nordamericane chiedono in media circa lo stesso numero di domande (10.82 contro 10.67), anche se ci sono grosse differenze rispetto alle macrocategorie o ai singoli stati: nello specifico, le start-up europee chiedono il 260% in più di domande sulla conoscenza/esperienza, ma il 125% in meno di domande legate alle informazioni personali rispetto alle start-up nordamericane; inoltre, le società canadesi chiedono in media il 67% in più di domande rispetto a quelle statunitensi. Le statistiche di quelle soggette a MiFID II sono simili al campione europeo. Considerando invece l'output, le start-up europee e quelle soggette a MiFID II in genere mostrano più informazioni delle altre

riguardo al portafoglio: rispettivamente il 55% e l'81% in più del gruppo formato da nordamericane.

Un'altra analisi è stata condotta suddividendo il campione in 6 cluster, considerando gli strumenti utilizzati come approssimazione della strategia applicata per il portafoglio, e il numero di classi di asset come approssimazione della complessità del portafoglio. Nonostante si siano riscontrate alcune differenze tra i cluster, è importante evidenziare che i cluster non sono omogenei.

È importante sottolineare che per tutte le suddivisioni fatte (geografiche o in cluster) le deviazioni standard dei risultati sono piuttosto alte. Infatti, anche se ci sono alcune differenze rispetto al numero di domande fatte, alle specifiche categorie e macro-categorie e al numero di informazioni mostrate, le elevate deviazioni standard delle medie di ogni gruppo implicano che non c'è omogeneità.

Data la recente introduzione di MiFID II nell'Unione Europea, è stata condotta un'analisi sul livello di conformità delle società soggette a tale direttiva. Sulla base di risultati di alcuni studi accademici, è stata identificata una lista di item che devono essere domandati ai clienti secondo la Direttiva, i quali sono stati classificati in 3 aree (conoscenza ed esperienza, situazione finanziaria, obiettivi di investimento), dopodiché ogni item è stato collegato a specifiche categorie e domande del database. Ciò ha permesso di comprendere se certe informazioni sono chieste o meno da ciascuna start-up e, di conseguenza, di calcolarne la percentuale di conformità. Nessuna delle 19 compagnie sono risultate conformi al 100%; nello specifico, la media è 31.58%.

Alcune intuizioni sulla profilazione del cliente sono state ricavate anche tramite un questionario inviato a tutte le 52 compagnie del campione e un workshop organizzato dall'Osservatorio Fintech & Insurtech per player del settore.

Infine, è stata condotta un'analisi simile cercando di valutare la coerenza dei questionari con la letteratura accademica. Il vantaggio principale è fare un'analisi su tutte e 52 le start-up e

non solo su quelle soggette alla Direttiva europea. Dopo aver elencato le variabili considerate dalla letteratura, che sono state divise in 5 aree principali (caratteristiche sociodemografiche, esperienza e conoscenza, situazione finanziaria, obiettivi di investimento e tolleranza del rischio), e collegate agli elementi del database, è stato analizzato a che livello il campione copre tali item. I risultati sono anche peggiori di quelli sulla conformità a MiFID II: la media di item coperti è solo del 26.5% e solo 2 start-up su 52 superano il 50%. Va considerato che la letteratura è più stringente delle regolamentazioni, visto che include più variabili che sono raramente chieste nei questionari. È interessante sottolineare che alcuni concetti base per i mercati finanziari come la diversificazione dei portafogli, le dimensioni di rischio, il trade-off rischio-ritorno, l'eccessiva confidenza e l'avversione alle perdite sono praticamente ignorate nella profilazione dei clienti. Dopo questa analisi quantitativa, sono stati analizzati alcuni errori comuni che minano la validità e l'affidabilità di detti strumenti. Sono state identificate alcune domande doppie, tali per cui più di un argomento viene chiesto in un'unica domanda causando ambiguità; poche domande imprecise, caratterizzate dall'uso di aggettivi vaghi per descrivere l'approccio d'investimento del cliente, che potrebbero indurre il cliente a scegliere la risposta ritenuta più socialmente accettabile invece di quella corretta; alcune domande che mischiano gli obiettivi d'investimento con le preferenze sul rischio, mentre la letteratura suggerisce di tenerli separati; molti casi di auto-valutazione, in cui agli investitori viene richiesto di valutare la loro conoscenza finanziaria o il loro profilo di rischio, che potrebbero essere distorti dall'eccesso di sicurezza, dall'ottimismo, dall'esito di precedenti investimenti o dalla tendenza di migliorare la propria immagine.

Executive summary

Technology has always played an important role in the financial services industry, nevertheless only roughly in the last 10 years we have started talking about the FinTech phenomenon, thanks to the relatively recent technological advancements and innovations. "*FinTech is the abbreviation for Financial Technology, namely the application of technology to the delivery of financing, payment, investment and consulting services, which has become a powerful driver of innovation in the financial services market*" (Bank of Italy, 2017). Many start-ups have risen and challenged incumbents with superior speed and agility, adopting client-centric models in order to enhance customer experience.

Unlike lending & financing and payment industries, the asset management world has not been (completely) disrupted yet, as it is more difficult to undock investors from more traditional paradigms. "*In this environment, a number of disruptors, from automated wealth management services to social trading platforms, have emerged to provide low-cost, sophisticated alternatives to traditional wealth managers. These solutions cater to a broader customer base and empower customers to have more control of their wealth management*" (World Economic Forum, 2015). Therefore, the most relevant trend is the democratization of asset management by means of digital players and robo-advisors, which can be defined as

automated platforms offering portfolio management services through algorithms. The reasons for their current success are ascribable to several factors such as loss of customer trust in traditional actors after the global financial crisis, rise of passive management, change of consumers' characteristics (they are more receptive to digital technologies). Moreover, they have significant advantages over conventional players: higher accessibility thanks to online platforms and low (or null) minimum investment amount, lower fees due to high level of automation and use of cheap financial instruments, enhanced customer experience. Despite growing fast, especially in US, in terms of Assets under Management (AuM) these new players are lagging behind some incumbents (i.e. Vanguard, Charles Schwab, BlackRock), who have been quick to react, adopting their own robo-advisory solutions via in-house development or external acquisition, being able to count on their already-existing customer base and their brand.

At the moment, start-ups in the asset management industry are offering only relatively simple financial advice and portfolio management services, in particular when the human component is absent, thus catering to non-sophisticated investors. One of the main criticisms made by industry practitioners is indeed related to this over-simplicity, which may be inconsistent with the principles "act in the best interest of your client" or "provide a service that is coherent with the client's characteristics and needs" required by regulations. A number of already-existing laws (for example MiFID in Europe and the Investment Advisers Act in US) apply to digital advisors but may fail to consider some of their peculiarities. Regulatory authorities, in general, have not addressed these issues yet; they are monitoring the evolution of the phenomenon, recognizing that the recent trends of automation and digitalization in investment advice carry both benefits for consumers and potential risks. The European Securities and Markets Authority (ESMA) and the Division of Investment Management of the SEC have suggested some guidelines in order to be more compliant with existing regulatory frameworks. Even so, the new players might exploit further developments in machine learning, artificial intelligence and data analytics to offer more customized services, making their value proposition more attractive to investors with sophisticated needs

such as estate planning and wealth transfer management, with important repercussions on traditional actors.

Previous works in literature focused on describing the new trends in the asset management industry, proposing taxonomies of new models/players, highlighting the advantages over incumbents, comparing different robo-advisors in terms of fees, target segments, minimum required investment, but not much has been said about the way they work. The objective of this dissertation is to try to fill some gaps, in particular regarding one of the most important steps of the service process workflow, that is, client profiling. This activity, performed through an online questionnaire, is critical because it directly affects the suitability statement, for which there are specific requirements in the regulation, as well as because it gathers information on client's characteristics used to build the product (i.e. portfolio).

The list of relevant start-ups for the sample has been made considering the database of last years' analyses as starting point, then enlarging it to include companies founded recently and/or that have received financing in the last years, applying some filters in Crunchbase. After eliminating the companies that do not fall within the scope of our analysis, either because they are incumbents or not involved in the asset management industry, information on year of launch, geography, financing, assets under management, allocation method, financial instruments used/recommended, asset classes covered and channel of the 96 start-ups were gathered. Moreover, for each dimension the distribution of the sample was analysed to give a general overview of the current landscape. Then the focus was narrowed on the core part of the work, that is, how robo-advisors profile their customers.

First of all, all the necessary data had to be collected: for this purpose, all the portfolio simulations available on start-ups websites were tried and it was kept track of the questions asked to users as well as the result of the customer profiling process (risk profile, portfolio allocation, risk and performance indicators) via screenshots. Of the 96 companies in the sample, 52 allow to build a portfolio on their website; those that require to register a bank

account or a credit card before starting were excluded. On this subset, the same analyses done for the entire sample were conducted considering the variables previously described.

All the pieces of information required to profile customers and recommend them a suitable portfolio were grouped into 5 macro categories (personal information, financial situation, risk propensity, knowledge/experience, investment related), which were furtherly broken down in categories and single questions. The same was done for output data, identifying 7 different types (choice among alternatives, portfolio allocation, return, risk, fees, comparison, details). Based on these 2 reorganizations, all the screenshots were arranged in 2 PowerPoint presentations and in parallel a spreadsheet database was built for further analyses, reaching the maximum level of detail with graphical aspects. As for questions, it was found out that on average the most asked belong to investment related, risk propensity and financial situation macro categories, while personal information and knowledge/experience questions are less relevant. With regards to output, portfolio allocation and return are showed by most start-ups (respectively 83% and 79%), while the other item types are much less present. Such analyses were refined even more considering other 3 different dimensions: firms subject to MiFID II (present in ESMA register), different geographical groups and clusters. Considering the 2 continents that are more represented in the sample, it was noticed that European and North American start-ups ask on average the same number of questions (10.82 vs 10.67), even though there are large discrepancies among macro categories and different countries: in particular European ones ask 260% more knowledge/experience questions but 125% less personal information questions than North American ones; Canadian companies ask on average 67% more questions than US ones. The statistics of those subject to MiFID II are very similar to the overall European sample. As for the outcome, European start-ups and those subject to MiFID II generally show more information than the others about the portfolio: respectively 55% and 81% more than North American ones.

Another analysis was conducted subdividing the sample in 6 clusters, using the instruments employed as a proxy of the strategy applied for the portfolio, and the number of asset classes

as a proxy of the complexity of the portfolios. Even though some differences between clusters were found, it is important to highlight that clusters are not homogenous.

It is remarkable that in any subdivision (geographical and by clusters) the standard deviations of the results are relatively high. In fact, even if there are some differences in the average number of questions asked, of the specific categories and macro categories, and of the number of information displayed, the high standard deviations of the averages of each group mean that there is no homogeneity.

Given the recent introduction of MiFID II in the European Union, it was conducted an analysis to what extent firms that must comply with that Directive are actually compliant with the suitability requirements. Based on results from some papers, it was identified a list of items that should be demanded to clients according to the Directive, which were classified in 3 areas (knowledge and experience, financial situation, investment objectives), afterwards each item was linked to a specific category/subcategory in the spreadsheet. This allowed to understand whether a certain type of information is asked or not by each start-up and, consequently, to compute the percentage of compliance. None of the 19 companies resulted 100% compliant with MiFID II from the analysis; in particular, the average is 31.58%.

Some insights on customer profiling were also retrieved through a questionnaire sent to all the 52 companies in the sample and a workshop organized by Osservatorio Fintech & Insurtech for industry players.

Lastly, it was conducted a similar analysis trying to assess questionnaires coherence with literature. The main advantage of this approach is that it takes into account all 52 start-ups, not only those subject to the European Directive. After recognizing the variables considered by literature, which are again gathered in 5 main areas (socio-demographic characteristics, experience and knowledge, financial situation, investment objectives and risk tolerance), and relating them to items of the abovementioned worksheet, it was examined to what degree companies belonging to the sample cover those items. Results are even worse than MiFID

compliance: the average coverage is only 26.5% and only 2 start-ups out of 52 perform better than 50%. Literature, indeed, is stricter than the Regulation, as it includes some additional variables that are hardly ever asked in questionnaires. It is interesting to underline that some basic concepts concerning financial markets like portfolio diversification, risk dimensions, risk-return trade-off, and investors' propensities such as overconfidence and loss aversion are almost completely neglected in customer profiling questionnaires. After this quantitative analysis, some common mistakes that can undermine validity and reliability of such instruments were analysed. Few double-barrelled questions were identified, whereby more than one issue is asked in a single questions causing ambiguity; few imprecise questions, characterized by the use of vague adjectives to describe the client's investment approach, which may make the client choose the more socially acceptable answer instead of the correct one; some questions that mix investment objectives and risk preferences, whereas literature suggests keeping them separated; quite a lot of instances of self-evaluation, whereby investors are asked to assess their financial literacy or their risk profile, which might be biased by overconfidence, optimism, previous investments' outcome or the tendency to improve self-image.

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Chapter 1

Introduction

The aim of this research is to explore and analyse the phase of profiling customers by robo-advisors. The analysis is conducted on a sample that has a worldwide geographical scope, and it focuses on the start-ups that offer the possibility to customers to build a portfolio and start investing directly online. The objective is to understand what the key information asked to customers is, in order to assess their profile, especially the risk profile, and then build a portfolio. Furthermore, the analysis has also the aim to highlight what the information shown together with the portfolio built is, and thus, with what level of detail portfolios are presented.

The second step of the research is to compare different groups of start-ups (i.e. start-ups from the same continent or clusters) to understand what the differences and similarities among the groups are, or how they differentiate with respect to the whole sample. Therefore, even if the focus of this work is worldwide, the results will be also shown at a higher level of detail, especially for what concerns North America and Europe, that are the most represented continents in the database.

Furthermore, the data is used to assess if the way in which customers are profiled is correct. More in detail, this analysis is conducted in order to assess the compliance with the Markets in Financial Instruments Directive II (2014/65/EU) of the European Union for those start-ups that are legally subject to that Directive.

More information about the topic is also collected through workshops organised by Osservatorio Fintech & Insurtech and a questionnaire designed for the specific purpose of collecting complementary information to support this work.

Chapter 2 of this work focuses on a critical literature review on the topic. Firstly, an introduction to asset management is provided. The objective is to clearly define what asset management is and to give a basic understanding of the main theories and actors part of this industry. In this way, an explanation of the main terms will be provided, in order to clarify and illustrate the industry of which robo-advisory is part.

Furthermore, after having defined the key aspects and theories of asset management, key numbers about the industry are provided, in order to assess the relevance of this industry in the financial sector. In fact, the total Asset under Management (AuM) in the world in 2016 accounted for 84.9 trillion USD (PwC, 2017). The total AuM is also growing at a fast pace: forecasts suggest it will be 111.2 trillion USD (PwC, 2017) in 2020, and 145.4 trillion USD in 2025. (PwC, 2017). The growth rate is also larger than expected: older forecasts, in fact, suggested an estimation of 101.7 trillion USD in 2020 (PwC, 2014), from a starting point of 63.9 trillion USD in 2012 (PwC, 2014). Focusing more on the European market, the total AuM reached 25.2 trillion USD and it has almost doubled since 2009. (EFAMA, 2018). Furthermore, total Asset under Management in Europe represented only the 81% of the European GDP. This percentage has been growing almost until 2017 (the only drop occurred from 2010 to 2011), reaching in 2017 the value of 147% of AuM/GDP ratio. (EFAMA, 2018). The last point of the section about asset management is dedicated to the last trends in the industry. In fact, one of the key challenges is the disruption due to the new technologies and the new preferences of customers. More in details, millennials constitute the generation that is having

an important role in shifting to automated solutions: *"This generation will increasingly turn to automated wealth management solutions. Automated asset allocation – the power behind robo advisers – is already reducing the need for human advice and increasing the use of passive funds for asset allocation. Technology is also enabling outcome-based planning. It can quickly identify important life goals and solutions to match."* (PwC, 2017).

After having talked about asset management, Chapter 2 pays specific attention to robo-advisory. A definition of what robo-advisor is will be provided; there is no standard definition of the activities involved, but almost everyone agrees that investment algorithms constitute the core element of robo-advisors: *"These algorithms use investor characteristics such as age, net income, and assessment of individual risk aversion to recommend suitable asset allocations"* (Faloon and Scherer, 2018). In fact, the definition is complex, and it is difficult to come up with a standard one, but this work investigates the possible definitions, the history of robo-advisors and their implications.

Besides, since it is the key topic of this thesis, a critical review of the literature about customer profiling will be presented, in order to narrow the focus of the literature review to the specific subject that this work explores. Thus, main concepts and theories and the problems of customer profiling and asset allocation will be presented. In conclusion of the revision of academic literature, key figures about the industry to understand the relevance of the phenomenon are shown. For instance, Statista forecasts that assets under management are expected to show a CAGR (2018-2022) of 38.2% resulting in the total amount of $1,452,637m by 2022.

In chapter 3, the scope and the objectives of the thesis are presented in detail. Moreover, the general framework and methodology are explained. First of all, it is presented the methodology of the literature review and how the research of academic papers was conducted. Secondly, it is presented how generally the data gathering and the data analyses were done, focusing on the building of the database and the data results. Moreover, the

precise details about how data was collected, analysis conducted, database built, and results found are presented in the following specific sections and chapter about each topic.

In Chapter 4 all the details about the research, the analyses and the results are illustrated. First of all, a description of how the start-ups constituting the sample were chosen and selected is provided. Secondly, the variables that were taken into account in order to gather the necessary information are explained. These variables were inserted in the database as columns and are useful for describing start-ups. Then, the sample list was completed, and the necessary data collected.

Defined the sample and the variables, a breakdown of the key data is provided. Moreover, the key variables are analysed in order to describe the sample at an aggregate level and to present the results of the data gathered.

The next step of Chapter 4 is to focus on the customer profiling. First of all, the subset of start-ups in the sample that offer the possibility to build or simulate a portfolio online is presented. Then, a breakdown of this subset is provided, following the same steps and methodology applied to the whole sample.

Once this subset is presented, this work focuses on the customer profiling. Firstly, the methodology about the collection of data regarding questions asked to profile customers and information shown about the portfolio built are explained. Secondly, it is clarified how data was rearranged in order to design specific macro categories and categories to cluster the information. This step is fundamental for the following analyses.

The first analysis done provides the results concerning the entire subset. Therefore, the first results of the research have the aim to highlight what are the areas in which most of the questions are asked on average by the whole subset, and what is the main information shown in the outcome of the portfolio. A further level of detail concerns the graphical way in which the questions and the information are displayed.

Once the entire subset is analysed, the next level of detail is to conduct the same analyses to specific groups of start-ups. First of all, since it is part of the scope of the thesis, a first analysis is about the start-ups that are subject to Markets in Financial Instruments Directive II (2014/65/EU) of the European Union. Secondly, start-ups are divided by continent, in order to provide the results of the analysis for different geographical scopes, as well as to understand what the differences and similarities among start-ups headquartered in different continents are. A third analysis is conducted dividing the subset in clusters using specific variables to subdivide the sample.

Moreover, the data is also used to assess the compliance with MiFID II of all the start-ups subject to it. Specific academic papers and studies were taken into account to understand what are the main areas of information that start-ups must ask to customers to be compliant with the Directive. Matching these areas with the data from the previous analyses, it is possible to evaluate the compliance.

Further information and data on the topic gathered during specific workshops are provided. In the end, a questionnaire designed to enrich the information available is explained and the results of the survey illustrated.

In conclusion, the data gathered is compared to the literature, in order to figure out whether there are discrepancies between the way start-ups actually profile customers and the theory.

Lastly, in Chapter 5 all the conclusions concerning this work and the analyses conducted are presented, in order to provide a final review of the results, summarize the main aspects and underline the key findings, giving an order to the analyses explained in the previous chapters.

Chapter 2

Literature Review

2.1 Asset Management

As will also be presented in the following chapters, this work focuses on start-ups in the industry of robo-advisor, more specifically on the process of customers profiling. Therefore, before the analysis, it is necessary to define the sector. Thus, the aim of this section is to give an overview of the asset management industry in general, being robo-advisor its digital evolution, that is the application of technology to asset management. The precise definition of robo-advisor within Asset Management will be given in section 2.2.

Firstly, the definition of the activity and the industry of asset management will be given; then, a general definition of main actors will be presented, following with the main theories and strategies of asset management, this, in order to better explain how this industry works and because most of the theories are also applied by robo-advisors. In conclusion, key data about the industry will be highlighted.

The first step is to define what financial assets are: *"Financial assets are intangible, non-physical assets. Often, financial assets are more liquid than tangible assets. Traditional asset classes are equities, fixed income securities, money market instruments and currencies. Alternative asset classes include real estate, commodities and private equity. Hedge funds are not an asset class, but an investment strategy defined in liquid asset classes."* (Vanini, 2018).

This definition is necessary do better understand what asset management is: *"Asset management is a systematic process of analysing, trading, lending and borrowing assets of all kinds. Since all assets belong to a person, the management of the assets results from a decision on the investment strategy - a decision made by the owner of the assets or is hit by a third party. McKinsey (2013) estimates that third-party asset managers managed a quarter of global financial assets worldwide. Main outsourcers are pension funds, sovereign wealth funds, family offices, insurance companies, and banks private households."* (Vanini, 2018).

Thus, the main point is the decision of the investment strategy, which can be delegated to third parties. The author identifies two kinds of third-parties:

"Third-party managed portfolios are either mutual funds or discretionary mandates. In a mandate, the owner of the asset delegates the investment decision to the asset manager. Funds combine assets with a certain level of risk into a collective system, where diversification is the key concept. Investors buy and sell shares in funds (mutual funds, ETFs or hedge funds). The asset management function can be organized as an independent firm (Blackrock, Amundit) or the function is part of a bank or insurer (Goldman Sachs Asset Management). There is no consistent systematic asset management process. All have the same basic function of managing assets from savers to investors. The investment method and technology are two important parts of the process. The goal of investing is to save today for the benefits of future consumption. The benefit of consumption after an investment period should be greater than the direct consumption of all resources. Investments are made through the use of securities of all kinds - that is, money, stocks, bonds, ETFs, mutual funds or derivatives. Securities are tradable financial assets. They are issued through financial intermediaries (primary market)

and can often be traded on the secondary market. They may differ in their ownership, complexity, liquidity, risk and reward profile, transaction fees, accessibility and so on." (Vanini, 2018).

Therefore, asset management is a process with which investors manage to maintain or increase their wealth for a specific goal (i.e. buy a house, a car, save for retirement). This is generally done allocating the resources in a portfolio of investments, with the result that the management of the assets implies investment decisions. Investments can be made by different financial assets and securities, such as equities, fixed income securities, money market instruments, currencies, ETFs, mutual funds or derivatives. Furthermore, the portfolio is a trade-off between risk and returns. Often, investors rely on third parties for their investments and asset management, such as mutual funds or discretionary mandates, with which the investor delegates the investment decision to an asset manager.

It is also important to highlight that in this definition asset management is not only a process, but also an industry, an industry in which asset managers operate as part of different parties and firms organised in different ways, as independent firms or functions of a bank or an insurance company. The size of this industry can be well represented by the fact that McKinsey estimates that a quarter of the world financial assets are managed by third parties and not by direct owners. *"Asset management refers to the segment of the financial industry that is involved in the management of financial assets on behalf of investors, either through the collective management of an investment fund, in which many investors may have a stake, or through the discretionary management of an individual investor's portfolio. Those investors can be households, non-financial corporations or professional investors such as financial institutions. As a substantial part of their financial assets is managed by asset managers, the importance of the sector cannot be questioned." (*Report on Asset management and Shadow banking, 2017).

Therefore, it is necessary to better define the importance and the role of asset managers and the services they offer.

"Asset managers provide investment management services and ancillary services to clients as fiduciary agents. The diversity of clients' needs results in a wide variety of firm structures and business models, ranging from investment boutiques that focus on a single product or clientele to large, complex financial institutions that offer multiple services. Many asset managers focus their investment strategies on a single asset class, such as equities or fixed income; examples include long-only equity mutual funds and municipal bond funds. Some focus on a style of investing within an asset class, such as large-capitalization growth or dividend-yielding U.S. equities. Other managers cover broad market areas, offering multiple strategies within a fund or family of funds, and provide custom "solution" investment services for clients" (Asset Management and Financial Stability, 2013).

Thus, asset managers are fiduciary agents in charge of providing customers with services that match their financial needs; the clientele and the offer is diverse, as a consequence, the actors that provide those services are diverse too. Moreover, the asset management industry is a complex industry that provides a huge range of services and thus has a broad definition.

Besides, *"Asset managers act in a fiduciary capacity as an agent on behalf of the asset owner, investing the client's assets within specified guidelines for a given investment mandate. Asset managers do not own the assets they manage. The assets are generally held by third party custodians (e.g., banks) selected by these clients. Both in-house and external asset managers live within an ecosystem that consists of multiple players and intermediaries"* (Blackrock, 2014).

Again, the importance of asset managers as fiduciary agents is remarked. In fact, the asset manager does not own the assets but manages them on behalf of the investors.

Asset managers are fundamental because the Asset Management process involves the collection and processing of a huge amount of data and information, this due to information asymmetry and market inefficiency (as explained in Gârleanu N., Pedersen L. H. (2015). *Efficiently Inefficient Markets for Assets and Asset Management.*). Furthermore, not only the

asset manager is important to collect and manage information, but also, the increase in volume and in the industry complexity, along with the technology development, makes it necessary to find new solutions.

In fact, *"In order for asset managers to responsibly invest on behalf of their clients, they need robust processes to manage and maintain the tremendous volume of data and information required to have an informed view of the client's current portfolio and risk profile. Historically, asset managers have relied on homegrown technology solutions often used in conjunction with manually maintained spreadsheets to accomplish this. As the landscape has become more complex, the effort required to load, cleanse and process the information needed to support the investment process has increased significantly."* (Blackrock, 2014).

Therefore, technology is nowadays fundamental to manage the information and it is necessary to pursue the development of new innovative solutions for the Asset Management industry. Moreover, *"Increasingly, asset managers are looking to implement automated solutions to manage this data. Their goals are to reduce data errors emanating from manual processes, to eliminate the need to reconcile data across systems, and to allow investment professionals to focus their time on making investment decisions using sound and reliable data."* (Blackrock, 2014).

2.1.1 Actors

As mentioned before, there are many actors that take part in the Asset Management industry and it is important to define one by one each of them. In this section, further details about the actors quoted before will be provided.

First of all, the asset manager was introduced. Asset managers take investment decision on behalf of their customers. Besides, asset management can be organised as an independent firm or as a part of bank or insurance company. Furthermore, asset managers manage

portfolios with mutual funds or discretionary mandates. The mandate means that all the investment decisions are delegated to the asset manager. On the other hand, mutual fund means to pool the investments in a fund, in which investors have a stake, that collect assets with different risk level exploiting the advantages of diversification. There is a strict difference between the asset management company, the custodian bank and investors. The same fund can be managed only by one asset management company, but the same company can manage more funds. Asset manager can offer different services and be specialised in some specific assets, as stated above.

Secondly, it is also important to define the type of investors that decide to exploit the services of asset managers. The main kinds of investors listed in the previous paragraph are *pension funds, sovereign wealth funds, insurance companies, private investors* and *non-profit organisations:*

- **Pension funds: "**Pension funds may be defined as forms of institutional investor, which collect, pool and invest funds contributed by sponsors and beneficiaries to provide for the future pension entitlements of beneficiaries (Davis 1995a). They thus provide means for individuals to accumulate saving over their working life so as to finance their consumption needs in retirement, either by means of a lump sum or by provision of an annuity, while also supplying funds to end-users such as corporations, other households (via securitised loans) or governments for investment or consumption. Pension funds have grown strongly in recent years in many OECD countries as well as in emerging markets, both relative to GDP and compared to banks." (Philip Davis, 2000).
- **Sovereign Wealth Funds:** "There is no consensus, in either the academic or practitioner literature, on exactly what constitutes a sovereign wealth fund. While SWFs are a heterogeneous group, most of the larger and more established SWFs evolved from funds set up by governments with revenue streams dependent on the value of one underlying commodity and who wished to diversify investments to stabilize revenues. Accordingly, most SWFs have been established in countries that

are rich in natural resources, with oil-related SWFs being the most common and largest group." (Bortolotti, Fotak, Megginson, 2014).

- **Insurance Companies:** "Insurance is the transfer of risk. It transfers the risk of financial losses as a result of specified but unpredictable events from an individual or entity to an insurer in return for a fee or premium. If a specified event occurs, the individual or entity can claim compensation or a service from the insurer. Insurance is therefore a means of reducing uncertainty. In return for buying an insurance policy for a smaller, known premium, the possibility of a larger loss is removed. By pooling premiums and insured events, the financial impact of an event that could be disastrous for one policyholder is spread among a wider group." (Insurance Europe, 2012).
- **Private Investors: "**Their biggest asset is human capital, which interacts with assets along the life cycle as follows. As a young, they only have human capital. In the course of their lives, human capital generates an income that is converted into financial capital. When retiring, most people no longer use their human capital to generate finance capital but consume accumulated finance capital. Pension funds for example are timeless. Another difference from private is their strong real estate risk due to the leverage effect of mortgage finance: the ratio of assets (real estate) to existing capital is large. Small changes in the property asset price have a significant impact on the balance sheet equity of the investor. Interest rate risk and real estate market price risk affect the asset. The latter is potentially more dangerous for the investor's default and thus for systemic risk." (Vanini, 2018). Part of this category are high net worth individual (HNWI), and mass affluent (PwC, 2017).
- **Non-profit organisations:** non-profit organisations are entities with different purposes, such as religious, charitable, scientific, or educational that do not act with the aim of making profits. They generally have tax exemptions and are also allowed to invest in financial resources and make investments as for-profit firms. Non-profit organisations receive donations that are usually enough only to cover operating expenses with no room to form financial reserves. Furthermore, when they become larger, they can use the money for prudent investments in order to fulfil long-term

goals such as capital spending or a permanent endowment. In order to grow their capital enough to be able to achieve long-term charitable investments, they can invest in stocks, bonds, funds, and any typical investment. They are also allowed to accept donations in stock or securities from donors in-kind. Thus, donors can exploit tax benefits for charitable contributions while non-profit organisations can keep the stock and exploit financial returns. Generally, there are not restrictions for small holdings in large companies, thus, in this case, non-profits are identical to any other minor shareholder of the company. (The Motley Fool, 2018).

Lastly, it can be also useful to define more specifically **exchange-traded funds (ETF).** ETFs are a peculiar kind of investment fund that is negotiated as shares in the stock exchange and has the aim to replicate a benchmark. It has the characteristics of both a fund and shares, exploiting the advantages of both, such as diversification, flexibility and transparency. (Borsa Italiana, 2010).

2.1.2 Asset Allocation

As mentioned before, one of the main activities of asset management is the asset allocation. *"Asset allocation involves dividing an investment portfolio among different asset categories, such as stocks, bonds, and cash. The process of determining which mix of assets to hold in your portfolio is a very personal one. The asset allocation that works best for you at any given point in your life will depend largely on your time horizon and your ability to tolerate risk."* (SEC).

Therefore, the main variables that affect the allocation of the customers' financial resources in order to achieve the expected returns are risk tolerance and time horizon. Furthermore, the main advantage of a proper asset allocation is diversification. *"By including asset categories with investment returns that move up and down under different market conditions within a portfolio, an investor can protect against significant losses. Historically, the returns*

of the three major asset categories have not moved up and down at the same time. Market conditions that cause one asset category to do well often cause another asset category to have average or poor returns. By investing in more than one asset category, you'll reduce the risk that you'll lose money and your portfolio's overall investment returns will have a smoother ride. If one asset category's investment return falls, you'll be in a position to counteract your losses in that asset category with better investment returns in another asset category. The practice of spreading money among different investments to reduce risk is known as diversification. By picking the right group of investments, you may be able to limit your losses and reduce the fluctuations of investment returns without sacrificing too much potential gain." (SEC).

To sum up, the main objective of asset allocation is to design a portfolio exploiting the advantage of diversification to reduce risk and achieve returns.

Furthermore, "*The general approach of an asset allocation strategy is to determine which asset classes to invest in based on your risk tolerance and return objectives. It is our opinion that any portfolio implementation decisions must separate two important concepts: asset allocation and diversification. Asset allocation in its most basic form is the decision of how to weight stocks, bonds and cash in a portfolio in a way that provides the potential for the best investment return for the amount of risk you're willing to accept. Setting these targets appropriately is a critical first step in portfolio construction. Too much in bonds or cash will ensure lower volatility than stocks, but may not produce enough returns to meet return objectives or keep ahead of inflation. Conversely, too heavy a weighting in stocks can produce higher rates of return over time, but can also be subject to large swings in value over shorter periods. 20-Year Annualized Return Avg Stock Investor Avg Bond Investor Stock Index (S&P 500) Bond Index (BC Agg) Ination (CPI) 5.0% 0.7% 9.2% 7.7% 2.8% 10% 8% 6% 4% 2% 0% GRAPH 1: Performance of the Average Investor Source: Dalbar, for the 20-year period ending 12/31/13. Please refer to page 7 for information. - 3 - Expected return and acceptable risk must be viewed simultaneously – an investor must feel comfortable with the downside risk associated with higher return potential.*" (Baird Asset Manager Research, 2014).

Therefore, what is fundamental is to assess customers' risk tolerance, their time horizon, to identify risk and returns of specific investments and their correlation, and then build a diversified portfolio that matches customers' needs to reduce risk and achieve returns.

However, asset allocation and diversification are not synonymous, and the degree of a diversification in a portfolio can vary. *"Asset allocation refers to the mix of investments inside your portfolio – how much is in stocks, bonds, cash and other asset classes. It also refers to your investments within each asset class. Although the term "asset allocation" and "diversification" are often used interchangeably, not all asset allocations provide the same level of diversification. True diversification means investing in a mix of assets that perform differently in various economic environments. If stocks fall worldwide, for example, other assets such as bonds and cash may help buffer your portfolio against losses until stock recover."* (Invesco, 2017).

Once asset allocation has been defined, it is important to highlight that there are different kinds of asset allocation and strategies. *"Asset allocation consists of choosing the spread of different asset classes within the portfolio. There two separate steps in the asset allocation process. One first defines the long-term allocation, based on estimates of risk and return for each asset class. This is known as "strategic allocation". Then, one can subsequently carry out dynamic adjustments based on short-term anticipations. This is known as "tactical allocation"."* (Amenc, Martellini, 2002) Therefore, the most important are: *Strategic* and *Tactical Asset Allocation:*

- **Strategic Asset Allocation:** "Strategic allocation is the first stage in the investment process. It involves choosing an initial portfolio allocation consistent with the investor's objectives and constraints. This is equivalent to defining the benchmark, or reference, portfolio. Optimal asset allocation, which is based on long-term estimates of risk and return for each asset class, can be based on a quantitative approach, with the help of different methods that we now describe." (Amenc, Martellini, 2002).

- **Tactical Asset Allocation: "**Tactical Asset Allocation (TAA) broadly refers to active strategies that seek to enhance portfolio performance by opportunistically shifting the asset mix in a portfolio in response to the changing patterns of return and risk There is now a consensus in empirical finance that expected asset returns, and also variances and covariances, are, to some extent, predictable.[…] TAA can be regarded as a 3-step process: • Step 1: forecast asset returns by asset classes • Step 2: build portfolios based on forecasts (i.e. turn signals into bets) • Step 3: conduct out-of-sample performance tests.**"** (Amenc, Martellini, 2002).

These two are not the only possible strategies, among the others, the main are:

- **Constant-Weighting Asset Allocation:** the portfolio is constantly rebalanced, i.e. if one asset loses value, more of that asset is purchased. If the asset gains value, it would be sold. This can be done applying different rules, there is not a common one, but, generally, the portfolio is rebalanced to the original mix if one of the asset classes' value shift of more than 5%. (6 asset allocation strategies that work, 2018).
- **Dynamic Asset Allocation:** assets that rise in value are purchased while assets that decrease in value are sold, thus, this strategy is the contrary of the previous one. The mix of assets is continuously rebalanced according to markets' rises and falls and economy's growth or drop. The aim is to sell before the decrease in value or to buy before its rise. (6 asset allocation strategies that work, 2018).
- **Insured Asset Allocation:** the main point of this strategy is to define a base portfolio value. Thus, the portfolio would not be allowed to fall below this value. When the portfolio's value is above, analytical research, forecasts, judgments and experience are used to decide what to buy and sell. However, if the portfolio drops close to the defined base value, risk-free assets are bought to fix the value. (6 asset allocation strategies that work, 2018).
- **Integrated Asset Allocation:** integrated asset allocation is a mix of all the above-mentioned strategies. Moreover, it considers economic expectations and the investor's risk tolerance. Furthermore, contrary to other strategies, it not only

accounts for expectations, but also changes in capital and risk tolerance. (6 asset allocation strategies that work, 2018).

2.1.3 Asset Management Styles

There are two main styles in which a fund can be managed: 'Active' or 'Passive'. This choice differentiates completely the kind of managed fund. Indeed, "*Passive investment vehicles track markets by holding portfolios that mirror representative indices. Such vehicles are attractive as they provide close to market returns at low cost and in efficient markets the scope for outperformance from active management is limited. Active investment approaches aim to identify opportunities to outperform a market or index and are typically more costly than passive approaches. The appeal of active investing is thought to be linked to the belief that investors will attain a higher risk-adjusted return.*" (Sheetal Radia, CFA).

Therefore, 'Passive' and 'Active' management style choice implies a set of advantages or disadvantages. While 'Passive' is cheaper, market inefficiency gives the possibility to asset manager to find opportunities to outperform the market and achieve higher returns, but this kind of fund is generally costlier.

2.1.3.1 Active Asset Management

"Actively managed funds are run by professional fund managers and / or investment research teams. These individuals make all of the investment decisions on behalf of the investor. For example: which companies to invest in, when to buy or sell these companies, which geographical sectors and asset types are performing better than others. The manager will seek to outperform an Index - like the FTSE 100 - by achieving a higher return, limiting losses, taking a lower risk or a combination of the three. Active managers believe that the market

can be beaten and whilst they appreciate that they cannot realistically expect to beat it all of the time, they do believe there are certain irregularities in the market that can be exploited in order to achieve potentially higher returns. There is no guarantee that outperformance of the relevant Index will be achieved though as the economy, market trends, political events, and company-specific factors can all affect an active manager's decisions." (Eden-Heyes, Blackstone Sington).

Active asset management has different PROs (Eden-Heyes, Blackstone Sington):

- **Expert Analysis:** investment decisions are made by asset managers after a scientific analysis. Decisions are informed and based on their experience, judgements, on specific analysis about the companies and looking at market trends.
- **Defensive Measures:** portfolio allocation can be changed if the asset manager sees the possibility of a market downturn, thus, the position of the fund can be reassessed based on those projections.
- **The opportunity for higher-than-index returns:** able asset managers rely on their skills, knowledge and abilities to make superior investment decisions and strategically timing trades, to bring a higher value to the portfolio, in order to beat the performance of the index.

Moreover, the main CONs are (Eden-Heyes, Blackstone Sington):

- **Higher fees and operating expenses:** since the aim is to gain an overperformance and experts are needed, the fee charged is higher than passively managed funds.
- **Mistakes May Happen:** there is the possibility that asset manager makes the wrong decision impacting the returns.
- **Performance could be affected by style issues:** the investing style of the asset manager may not be in favour of the market at a given time, dropping possible returns.

Furthermore, there are different techniques to actively manage a fund. As far as stocks are concerned, the most common stock-picking strategies are top-down and bottom-up (Vanguard, 2017):

- **Top-down:** the asset managers study market trends and predict if a geographical area or an industry will grow or not. After this broad analysis, a research on specific companies is conducted to find the most valuable.
- **Bottom-up:** first of all, an analysis on individual companies is done. The aim is to find strong performance and value not reflected by the current share price. The rationale is that those firms will deliver profit to investors unrelated to the geographical area or the sector in which they operate.

With reference to bonds, generally, an active will buy short-term bonds to hedge against price fall if it forecasts that interest rates will rise. On the other hand, if interest-rates are expected to drop, the manager will buy longer-term bonds to gain higher returns in future. (Vanguard, 2017).

2.1.3.2 Passive Asset Management

A passive managed fund entails the creation of a portfolio that tracks the returns of a market index or a specific benchmark. The aim is to achieve the most similar possible returns. The asset managers select some stocks and securities and build the portfolio using the same weights of the market. This means that, passive asset management does not try to achieve higher returns than the market exploiting the managers' skills, instead, the objective is to replicate the market performances. As a consequence, fees are lower. Moreover, a passive managed fund does not have a management team; passive managed funds can be exchange-traded funds (ETF) or a unit investment trust. (Lioudis, 2017).

The main PROs of passive asset management are (Eden-Heyes, Blackstone Sington):

- **Low operating expenses:** fees are lower than actively managed funds, since there is not the need of continuous deep market analysis.
- **No action required / simplicity:** there is not the need to make investment decisions by the manager or the investor. Thus, the main point is that the investors know what they are investing in: a replication of an index.
- **Performance is close to that of the index:** generally, passively managed funds marginally underperform their benchmark due to fees, that are, however, low, but the outcome is much more predictable than actively managed funds.

The main CONs of passive asset management are (Eden-Heyes, Blackstone Sington):

- **Lack of control:** since it is a replication of an index, generally asset managers do not have means to apply defensive measures, i.e. if they think stock price is going to drop soon.
- **Concentration risk:** even if the market is composed by a huge number of companies, there are few that are very large. Therefore, often, indices are heavily impacted by a small number of stocks or sectors.
- **Performance is dictated by the index:** since the returns of the fund are following the markets' returns, investors have to be aware that those are the returns they are going to have and that is the best that the fund can produce.

There are two main approaches for a passive asset management, *Replication* and *Sampling* (Vanguard, 2017):

- **Replication – straightforward matching:** this is often the case for equity index funds and not for bond index funds. The portfolio will fully replicate the index, owning same stock and securities with exactly the same proportions, achieving the same performances of the index.

- **Sampling – useful when the index is very large or complex:** the asset manager selects specific stocks and securities from the target index, replicating the same risk level and characteristics. Moreover, to create the sample, complex mathematics is needed.

2.1.4 Asset Management Theories

In this section, the theories to describe the market and asset management, and the ones applied by asset managers, will be analysed further in details, in order to give a definition of the most important and most used. Therefore, this section will provide further knowledge to deeper understand asset management. In fact, in order to assess the optimal portfolio allocation, asset managers generally have different ideas and opinions, applying different theories. The theories explained are *Modern Portfolio Theory, Efficient Market Hypothesis, Capital Asset Pricing Model (CAPM), Fama – French Three Factors Model, Black – Litterman Model.* These theories are important to be defined because they are still the basis of Asset Allocation in Asset Management, and theories such as CAPM and Black – Litterman are also the most used by some robo-advisors (Gerstein, 2016).

2.1.4.1 Modern Portfolio Theory

"Set of concepts aimed at building a most efficient collection (portfolio) of different types of assets, based on the observation that although investors want high returns they dislike high risk (likelihood of the deviation of an actual return from the anticipated return). It suggests that the risk of a particular investment comprising a portfolio should be assessed on the basis of how its value varies in comparison with the market value of the entire portfolio, and not in isolation. And that a diversified portfolio of investments is efficient if it yields highest possible return for a given level of risk or incurs the lowest level of risk for a given amount of return." (Modern Portfolio Theory, MPT, Business Dictionary). The theory was developed by Harry

Markowitz and published in 1952, even if there is a long literature discussion its applicability, *"Harry Markowitz himself, have argued over the years that the methodology should be used with moderation."* (de Jong, 2017).

In fact, the problem of portfolio optimisation should have a wider setting. Moreover, it must be taken into account as a part of the problem the possibility that prices do not follow the rule that risks are predefined by statistical law. Thus, the Modern Portfolio Theory works in periods with low entropy and predictable risks, but less in more turbulent times (de Jong, 2017).

Another factor that changes the paradigm is that the financial world is nowadays more complex, and a wider portion of portfolios is allocated abroad. Norland and Wilford (2002) argue that the original model of Harry Markowitz was relatively simple, showing that mean-variance optimization can be used to find the optimal level of return per unit of risk. Moreover, at the time, barriers to invest abroad were very high and exchange rates fixed by the Bretton-Wood agreement. They explain that now the situation is different, thus, it is not possible to optimise the portfolio as Markowitz argues:

"Now, many portfolio managers allocate a portion of their assets abroad and, like Markowitz's hypothetical domestic-only investors, many of them also seek to earn an optimal amount of return per unit of risk. Unfortunately, when investing internationally, one can no longer rely upon expected total returns and variance–covariance as inputs for an optimizer. Because different currencies pay different rates of interest and because exchange rates fluctuate, one must use expectations and variance–covariance measures based upon excess, not total, return as the inputs for the mean–variance optimization. Still, many investment managers rely on total returns." (Norland and Wilford, 2002).

2.1.4.2 Efficient Market Hypothesis

The first theory, already quoted before, is the **Efficient Market Hypothesis (EMH)**. The Efficient Market Hypothesis states that current stock prices completely reflect all the information available about the firm's value (Clarke, Jandik, Mandelker, 1999). Therefore, it is impossible to gain excess profit with respect to the market, thanks to the available information. *"It deals with one of the most fundamental and exciting issues in finance – why prices change in security markets and how those changes take place. It has very important implications for investors as well as for financial managers. The first time the term "efficient market" was in a 1965 paper by E.F. Fama who said that in an efficient market, on the average, competition will cause the full effects of new information on intrinsic values to be reflected "instantaneously" in actual prices"* (Clarke, Jandik, Mandelker, 1999).

There are three main assumptions on which this hypothesis relies (bin Tarik, Naseer, 2015):

1. Rationality of investors: investors are rational, and they use the maximum expected utility to value securities.
2. The trade of investors, if they are not rational, is random, with no effect on prices.
3. "Rational arbitragers are assumed to eliminate any influence irrational investors have on market/security prices." (bin Tarik, Naseer, 2015).

Other fundamental assumptions are (University of Windsor):

1. "A large number of competing profit-maximizing participants analyze and value securities, each independently from the others" (University of Windsor).
2. Any new information about any security becomes available to the market "in a random fashion" (University of Windsor).
3. All these investors in the market keep the prices of securities updated and adjusted according to the new information.

Moreover, in the light of the Efficient Market Hypothesis, few decades ago it was widely accepted and believed that when new information are available, these are spread quickly and thus prices of securities accordingly adjusted. In fact, the belief was that markets of securities were extremely efficient. Therefore, any technical analysis or fundamental analysis is useless to select undervalued stocks, thus, it was not considered possible to achieve excess returns. However, from the beginning of the 21st century, the hypothesis lost consensus, financial economists and statisticians now believe that prices are less predictable and must be forecasted in a different way. Phycological and behavioural aspects must be considered and analysis on the past prices and fundamental valuation metrics have to be conducted (Malkiel, 2003). Yet, the level of efficiency of the market is still debated, in fact, the author continues his saying *"I conclude that our stock markets are far more efficient and far less predictable than some recent academic papers would have us believe. Moreover, the evidence is overwhelming that whatever anomalous behaviour of stock prices may exist, it does not create a portfolio trading opportunity that enables investors to earn extraordinary risk adjusted returns."* (Malkiel, 2003).

Furthermore, it is also possible to distinguish different versions of Efficient Markets Hypothesis. This is related to the meaning given to 'available information'; in fact, there are different kinds of possible information, and literature is full of examples of empirical studies that try to find evidences of the validity of the theories. For example, Clarke, Jandik and Mandelker, in 1999, identify three main versions:

- **Weak Form Efficiency:** current prices are due only to the information part of the history of prices. Being this information know by everyone, they cannot be used to profit more than the market. However, analysts try to achieve higher returns using stock prices series and trading volume data. *"The empirical evidence for this form of market efficiency, and therefore against the value of technical analysis, is pretty strong and quite consistent."* (Clarke, Jandik, Mandelker, 1999).
- **Semi-strong Form Efficiency:** information available to everybody does not include only past prices, but also companies' financial statements, earnings and dividends

announced, mergers planned, financial situation of competitors, macroeconomics forecasts and so on. Therefore, the assumption is still that is not possible to gain excess profits with this information, but macroeconomist experts are needed to process this kind of information. *"financial researchers have found empirical evidence that is overwhelming consistent with the semi-strong form of the EMH."* (Clarke, Jandik, Mandelker, 1999).

- **Strong Form Efficiency:** current price reflects all the existing information, public and private. Therefore, according to this theory, it is not possible to gain higher returns even having non-public information. Thus, companies' managers (insiders) or research departments should not be able to profit by the information from inside (deals not yet announced or new discoveries). *"Empirical research in finance has found evidence that is inconsistent with the strong form of the EMH."* (Clarke, Jandik, Mandelker, 1999).

2.1.4.3 Capital Asset Pricing Model

Capital Asset Pricing Model (CAPM) is one of the most employed theories for the estimation of the required rate of return of a security. (Elbannan, 2014). The CAPM defines the relationship between systematic risk and expected return for an asset, especially stocks. It is widely used in finance to price securities. (Capital Asset Pricing Model – CAPM).

The CAPM equation according to Sharpe and Lintner assumptions of risk-free borrowing and lending are expressed as follows:

$$E(R_i) = R_f + \beta[E(R_M) - R_f]$$

Where market Beta:

$$\beta_{iM} = COV(R_i,R_M)/\sigma^2(R_M)$$

$E(R_i)$= Expected return of investment

R_f = Risk-free rate

β_i = Beta of the investment

$E(R_m)$= Expected return of market

$[E(R_{m)} - R_f]$ = Market risk premium

Even if it is very common, it has some critical issues: *"Moreover, using the CAPM in estimating the cost of equity capital for specific industries is imprecise due to uncertainty about the true expected risk premiums and imprecise estimates of industry betas (Fama & French, 1997). In spite of the empirical evidence which suggests weakness of the CAPM, and the problems concerning the model assumptions, the CAPM remains a useful tool for estimating the cost of capital"* (Elbannan, 2014).

2.1.4.4 Fama – French Three Factors Model

The Fama – French Three factors Model is a widely used tool to understand portfolio performance, measure the impact of active management, portfolio construction and to estimate future returns. This model is now the most accepted one to explain stock prices in the aggregate and investor returns, replacing CAPM. The Fama – French Three factors Model considers that investors worry about three different risk factors and not only one. Moreover, in reality, there are many risks that investor consider. The premium size was computed as the difference in returns between the largest and smallest stocks in the CRSP database. Therefore, the formula is now the sum of: the risk-free return, the market premium (Beta), size premium, value premium, impact of management (Alpha), random error. (Armstrong III, 2013).

2.1.4.5 Black – Litterman Model

This model was developed by Fischer Black and Robert Litterman. It is a sophisticated method that has the aim to solve the problem of unintuitive, highly-concentrated portfolios, input-sensitivity, and estimation error maximization. (Idzorek, 2005). What is fundamental in this model is the use of the investor's view: *"The BlackLitterman model provides a quantitative framework for specifying the investor's views, and a clear way to combine those investor's views with an intuitive prior to arrive at a new combined distribution."* (Walters, 2014).

Moreover, it becomes important to define what is meant with 'view': "*a view is a general statement about the expected return for any portfolio. These views are combined with the market equilibrium expected returns.*" (He, Litterman, 1999). However, the investor could also not have views, and thus expected returns are the ones of equilibrium, or, investors might want to build the optimal portfolio based on their views: *"In the case when the investor does not have any views about the markets, the expected returns from the BlackLitterman model match the equilibrium, and the unconstrained optimal portfolio is the market equilibrium (capitalization weights) portfolio. In the case when the investor has one or more views about the market, the BlackLitterman approach combines the information from the equilibrium and tilts the optimal portfolio away from the market portfolio in the direction of the investor 's views."* (He, Litterman, 1999).

2.1.5 Asset Management Industry

The asset management industry is one of the most relevant in financial services. In fact, the total Asset under Management (AuM) in the world in 2016 accounted for 84.9 trillion USD (PwC, 2017). The total AuM is also growing at a fast pace: forecasts suggest it will be 111.2 trillion USD (PwC, 2017) in 2020, and 145.4 trillion USD in 2025. (PwC, 2017). The growth rate is also larger than expected: older forecasts, in fact, suggested an estimation of 101.7 trillion USD in 2020 (PwC, 2014), from a starting point of 63.9 trillion USD in 2012 (PwC, 2014).

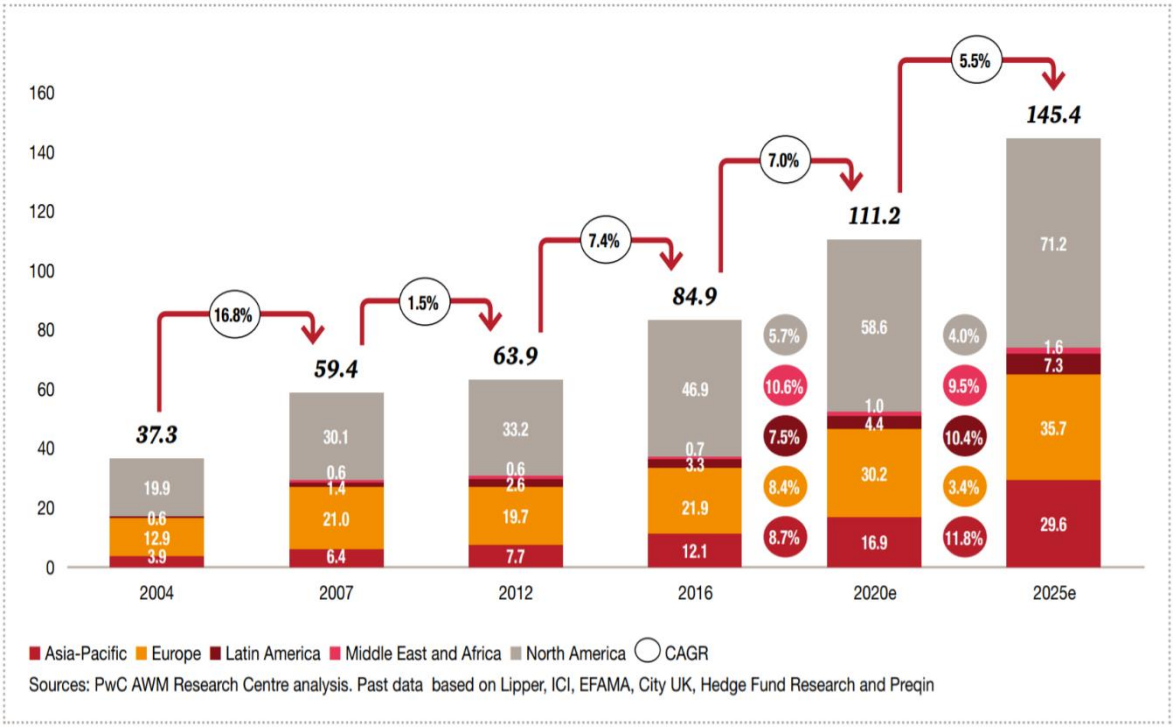


Figure 2.1 Global AuM by region in USD Base scenario

As figure 2.1 shows, the CAGR between 2016 and 2018 of the total AuM will be 7.0%, and from 2020 to 2025 5.5%. North America represents now and will represent in the future the largest share of AuM in the world, but the growth will be slower in developed markets and faster in developing markets. (PwC, 2017). If fact, the figure highlights a forecasted CAGR of 5.7% and 8.4% for North America and Europe in 2016-2020, slowing to 4.0% and 3.4% in 2020-2025 respectively, that will be the slowest paces, if compared to Middle East and Africa (9.5% in 2020-2025), Latin America (10.4% in 2020-2025) and Asia-Pacific (11.8% in 2020-2025).

In total, the CAGR of the global AuM is forecasted to be 6.2% in the period 2016-2025, as figure 2.2 shows.

Clients	2004	2007	2012	2016	2020e	2025e	CAGR 2016-2025e
Pension funds	21.3	29.4	33.9	38.3	53.1	64.6	6.0%
Insurance companies	17.7	21.2	24.1	29.4	38.4	44.7	4.8%
Sovereign wealth funds (SWF)	1.9	3.3	5.2	7.4	10.0	13.6	7.0%
HNWI	37.9	50.1	52.4	72.3	93.4	119.9	5.8%
Mass affluent	42.1	55.8	59.5	67.2	84.4	102.2	4.8%
Total client assets	**120.9**	**159.7**	**175.1**	**214.6**	**279.3**	**345.0**	**5.4%**
Global AuM	37.3	59.4	63.9	84.9	111.2	**145.4**	6.2%
Penetration rate	**30.9%**	**37.2%**	**36.5%**	**39.6%**	**39.8%**	**42.1%**	**0.7%**

Sources: PwC AWM Research Centre analysis. Past data based on Lipper, ICI, Preqin, Hedge Fund Research, EFAMA, City UK, Insurance Europe, Financial Stability Board, Credit Suisse, Towers Watson, OECD and World Bank.

Note: Foundations and Endowments assets were not included as their total global assets represent less than 1% of all client assets.

Figure 2.2 Total client assets in USD trillion

The table shows how AuM changed and will change over time and the total assets per customers by type of customer. Moreover, the penetration rate is forecasted to be almost the same in the period 2016-2020, with a faster growth in the period 2020-2025, with a CAGR in 2016-2025 of 0.7%. In the same period, the CAGR of the total client assets is predicted to be 5.4%. The largest portion of total assets will still be the high net worth individuals (HNWI), that are predicted to have also a higher CAGR than mass affluent. Sovereign wealth funds (SWF), represent the smallest portion of assets, but are forecasted to have the highest CAGR, 7.0%.

Focusing more on the European market, the total AuM reached 25.2 trillion USD and it has almost doubled since 2009. (EFAMA, 2018). Furthermore, total Asset under Management in Europe represented only the 81% of the European GDP. This percentage has been growing almost until 2017 (the only drop occurred from 2010 to 2011), reaching in 2017 the value of 147% of AuM/GDP ratio. (EFAMA, 2018).

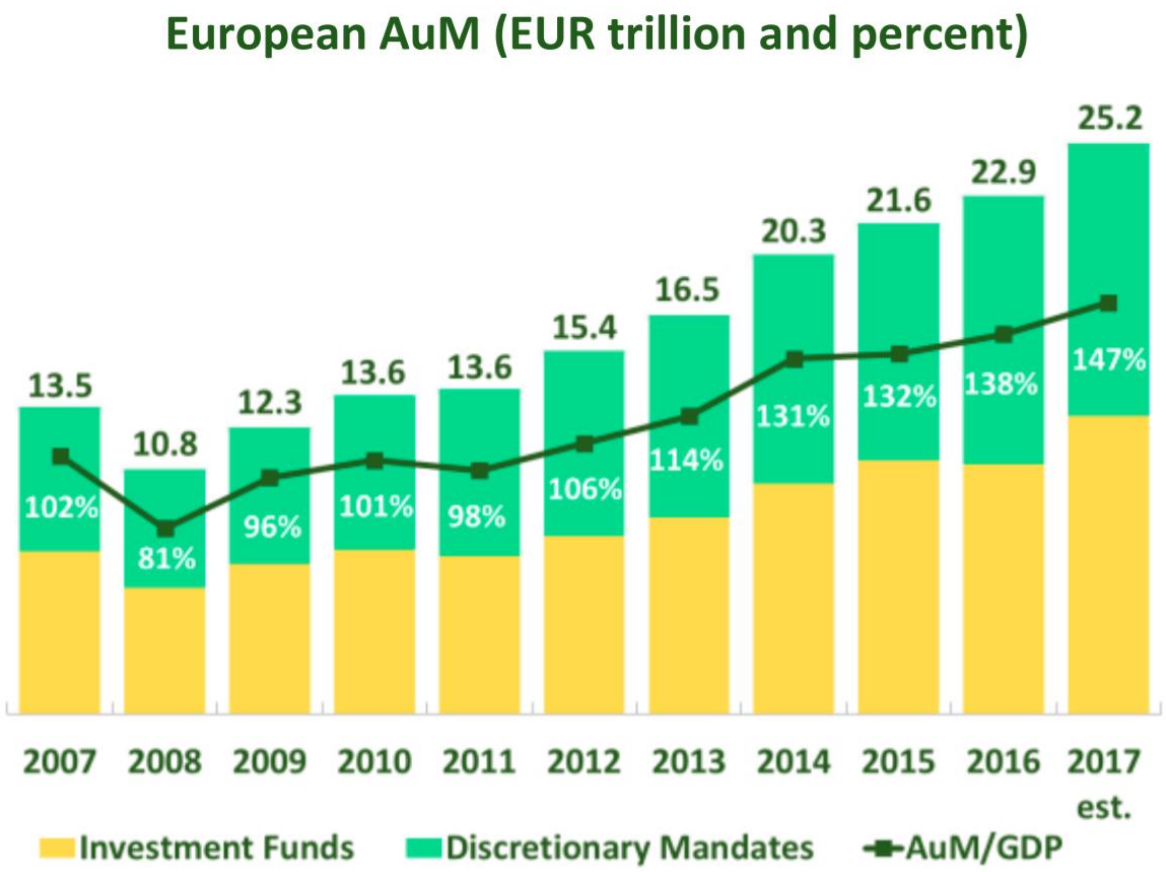


Figure 2.3 European AuM

Source: European Fund and Asset Management Association

The figure highlights this trend of growth in the past 10 years. The only drop in total value of AuM occurred in 2007 due to the financial crisis, from 13.5 trillion EUR to 10.8 trillion EUR (EFAMA, 2018).

As the figure shows, investment funds and discretionary mandated split almost in two half the total AuM in Europe, that were, respectively, 51.9% and 48.1% at the end of 2016 (EFAMA, 2018).

Moreover, the United Kingdom accounts for the largest share of total AuM in Europe, followed by France and Germany. These three markets together represent the 62% of total Asset under Management in Europe (EFAMA, 2018).

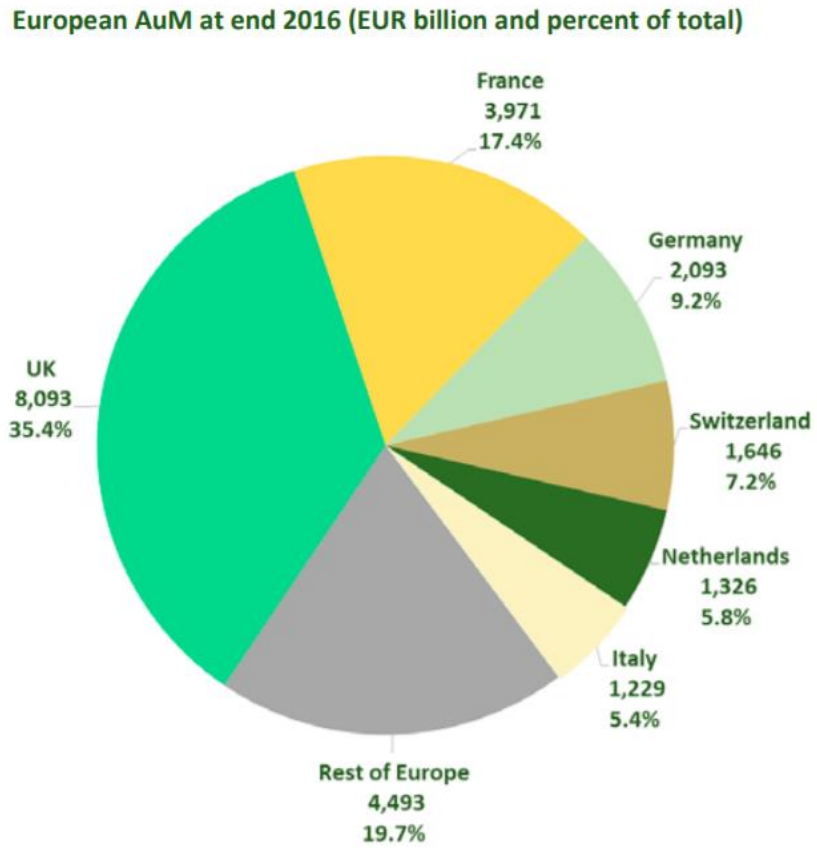


Figure 2.4 European AuM by country

Source: European Fund and Asset Management Association

The figure shows that Italy accounts only for the 5.4% of the total European AuM, less than the Netherlands and Switzerland, almost the half of Germany and less than a third of France.

Moreover, at the end of 2016, 29% of the clients' AuM belonged to retail customers, while institutional investors accounted for the 71% of European total AuM. This 71% is composed by pension funds (28%), insurance companies (25%), banks (2%) and other institutional investors (16%) (EFAMA, 2018).

Going deeper in details in the Asset Allocation, at the end of 2016 the 41% of investments were in bonds, the 31% in equity, the 7% in cash/money market instruments, the 21% in other. (EFAMA, 2018).

Figure 2.5 shows that the main difference in asset allocation between investment funds and discretionary mandates is mainly in the portion of bond and equity.

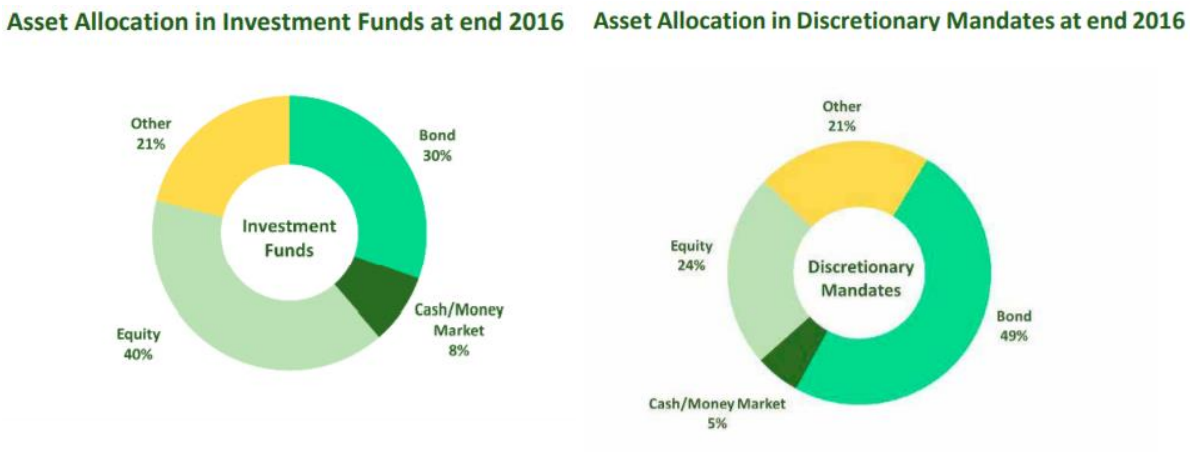


Figure 2.5 Investment funds vs Discretionary mandates

Source: European Fund and Asset Management Association

Even if the industry is growing at a relative high rate and accounts for a very large portion of total assets, there are some threats and challenges that is facing.

2.1.6 Challenges in the Asset Management Industry

The most important and disruptive trend is the digital disruption, that is bringing structural changes in business models, and, in this context, robo-advisor is a great example (Pal, Tikam, Vij, 2016). Online robo-advisors are growing also due to the characteristics of millennials as customers, in fact, they want to have more control on their investments and trust more online reviews and peer recommendation; moreover, they are also less tolerant to standardised and old fees structures and financial models (Pal, Tikam, Vij, 2016).

Moreover, keeping talking about millennials, *"This generation will increasingly turn to automated wealth management solutions. Automated asset allocation – the power behind*

robo advisers – is already reducing the need for human advice and increasing the use of passive funds for asset allocation. Technology is also enabling outcome-based planning. It can quickly identify important life goals and solutions to match." (PwC, 2017). Even though the automated process is gaining importance, customer relationship managers will still be fundamental, especially for life's big financial planning. Different customers that are approaching asset management have different capabilities to pay different fees; thus, this will bring to a greater segmentation, and asset managers will have to choose which segments they want to market. (PwC, 2017). The robo-advisors industry will be better defined, explained and analysed in the next chapters.

Another relevant challenge in this industry is represented by regulations, that are changing and that will bring to an increase in costs due to time and resources spent for compliance. (Pal, Tikam, Vij, 2016). Regulations will be also taken into account in the analysis part of this work, especially regarding the Markets in Financial Instruments Directive II (MiFID II).

Other than the two issues presented above, is important also the rising of environmental, social and governance (ESG) factors. In fact, many investors, much more in European Union and the UK rather than the US, believe that socially responsible investments have a positive benefit on returns. (van Duuren, Plantinga, Scholtens, 2015).

Moreover, it has to be considered that the change in customers and different preferences of millennials, added to the low fees of passive Asset Management and the development of new technologies (that, as said before, are changing the business models and favouring newcomers such as robo-advisors) are supporting a high growth of passive Asset Management if compared to active Asset Management. Indeed, the AuM passively managed grew by 25% from 2016 to 2017, and actively managed AuM represent now only one third of the total, compared to the 57% of 2003. (BCG, 2018). Much of this growth comes from the high performance of the equities market, that is predominant for passive funds. These results confirmed the shift to passive strategies, either in retail segments (thanks to transparency

and fees) either in the institutional segment. However, being fees low, this provided limited revenue to asset managers. (BCG, 2018).

Analysing further in detail the clients, younger generations are definitely part of the disruption. In fact, they have different preferences when it comes to digital channels compared to older clients. An EY's survey of 2016 suggests that customers care the most about three factors: engagement, trust and performance. Moreover, according to the survey, key aspects are the digital channel capabilities and if the asset manager is able to understand customers' financial goals. In fact, 59% of respondents answered that they would prefer the digital channel to receive advice in the following two to three years. Furthermore, 61% of millennials (18 to 34 years old) are likely to consider robo-advisor as an Asset Management solution, compared to the 51% of clients aged between 35 and 50 and 24% between 51 and 71 years old. What is also surprising, is that HNWI are more likely to try robo-advice, 70% of clients against the 37% of mass affluent. (EY, 2017).

2.2 Robo-Advisors

There is no unique definition of robo-advisory. In broad terms, a robo-advisor (RA) can be defined as *"an automated investment platform that uses quantitative algorithms to manage investors' portfolios and is accessible to clients online. Therefore, the term RA covers a wide range of (semi-)automatic investment platforms and services"* (Beketov et al., 2018). Others, instead, provide a narrower definition, specifying the activities performed by robo-advisors. For instance, in its *"Report on Digital Investment Advice"* (2016), FINRA (Financial Industry Regulatory Authority) stated that *"digital investment advice tools […] support one or more of the following core activities in managing an investor's portfolio: customer profiling, asset allocation, portfolio selection, trade execution, portfolio rebalancing, tax-loss harvesting and portfolio analysis"* and robo-advisors refer to *"client-facing tools that incorporate the first six activities – customer profiling through tax-loss harvesting".* Although there is no standard definition of the activities involved, almost everyone agrees that investment algorithms constitute the core element of robo-advisors: *"These algorithms use investor characteristics such as age, net income, and assessment of individual risk aversion to recommend suitable asset allocations"* (Faloon and Scherer, 2018). Their other fundamental feature concerns the way through which the service is delivered: *"client interaction and delivery of portfolio advice are web-based and without human interaction"* (Faloon and Scherer, 2018). Actually, this is not completely true: human presence is the distinguishing feature of hybrid (robo) advisors.

2.2.1 Brief history and reasons for current success

The genesis of robo-advisors might be traced back to the 2008 Global Financial Crisis (GFC) and the consequent rise of passive investing. At that time *"investors preferred low-risk portfolios, given their recent unpleasant experience from the global financial crisis. In addition, the low interest rate environment in the post-crisis period and the lack of positive returns from active asset management led to investors shifting towards passive investment*

management" (Phoon and Koh, 2018). In turn, *"this created demand for relatively more automated and cheaper approaches to portfolio rebalancing and management"* (Phoon and Koh, 2018).

Besides passive style momentum, there are at least other 2 reasons for the current success of robo-advisors: a new generation of clients and advantages over traditional financial advisors.

With regards to the first point, *"in recent years, the wealth management industry encountered a new generation of clients who are receptive to digital technologies […] older generations are also becoming increasingly technologically receptive"* (Beketov et al., 2018). According to BI Intelligence research (2017), 49% of HNWI worldwide would consider letting a robo-advisor manage at least some portion of their wealth.

As for the second point, the main advantages of robo-advisors over conventional players can be condensed in: increased accessibility through online platform, lower fees or the absence of a minimum required amount of capital (or very small); lower costs thanks to high automation, use of algorithms and absence of human component (hybrid advisors are an exception); enhanced customer experience via internet and mobile app-based services (EBA report on the prudential risks and opportunities arising for institutions from fintech, 2018).

2.2.2 Service process workflow

The typical workflow of a robo-advisor includes five main steps: asset universe selection, investor profile identification, asset allocation/portfolio optimization, monitoring and rebalancing, performance review and reporting (Beketov et al., 2018). In this section each step of the process will be described, focusing on the second (i.e. customer profiling), which is an important topic in later analysis.

Table 2 Summary of the main building blocks of Robo Advisors

Asset universe selection	Investor profile identification	Asset allocation/portfolio optimization	Monitoring and rebalancing	Performance review and reporting
All systems use ETFs with minor exceptions including: Mutual/ Actively Managed Funds, Sustainable Funds, ETCs, and Index Funds. Different selection criteria include: expense ratio, total costs, liquidity, replication method, and correlation among the ETFs	Online questionnaires focused on identifying clients' risk tolerance as well as investment objectives and horizon. Typically, the questions are compiled to understand the objective risk tolerance through information on age, income, savings, previous investment experience, and investment goals	Most of the systems apply the Modern Portfolio Theory approach, supplemented and modified by various methods (e.g., Black–Litterman, VaR and CVaR optimization[a]). Notable exceptions include Risk Parity, Full-Scale Optimization and Constant Proportion Portfolio Insurance. A few systems apply constant portfolio weights	Most systems use event/ threshold-based rebalancing based on the daily rebalancing check. The triggers are defined as portfolio structure (i.e., weights), returns (drift), and VaR Some systems use calendar-driven rebalancing. Some also use optimized dividend and cash-flow (re)investment for the rebalancing	Half of the systems provide control and monitoring possibilities through the website only. The half also provide a smartphone app. Some systems send the monthly statements and quarterly reports automatically by e-mail

Figure 2.6 Summary of the main building block of Robo-Advisory

Source: Beketov et al., 2018

2.2.2.1 Asset universe selection

The aim of the first step is twofold: *"(i) creating a representative set of instruments covering different asset classes and types and (ii) selecting low-cost and risk-efficient instruments"* (Beketov et al., 2018).

As for the asset classes, all robo-advisors cover stocks (domestic, international and emerging markets ones, of small and medium enterprises as well as blue chips) and bonds (frequently named fixed income, corporate and government ones, investment grade as well as non-investment grade depending on target level of risk). Few robo-advisors, oversimplifying the portfolio construction, cover *only* stocks and bonds. A good part covers real estate (especially

in the form of REITs, Real Estate Investment Trusts), cash and money market instruments, some also commodities and natural resources (usually gold), few alternative asset classes. However, *"the extent to which they divide asset classes into smaller sub asset classes varies greatly"* (Lam, 2016). Even though one might think that the large the number of asset classes the better due to higher diversification, which in turn reduces idiosyncratic risk, criticism has been moved: *"the error maximization property of mean-variance optimization becomes more pronounced as the number of asset classes increases. With more asset classes in the analysis, the likelihood that some asset class has either a large positive error in the estimation of its expected return or a large negative error in the estimation of its variance increases"* (Lam, 2016). A reasonable number of asset classes is discussed in *Pioneering Portfolio Management* by David Swensen (2009): *"the number should be small enough so that portfolio commitments make a difference, yet large enough so that portfolio commitments do not make too much of a difference. […] Most portfolios work well with around a half a dozen asset classes"*.

Almost all robo-advisors invest in ETFs that passively track market benchmarks to represent each asset class, having adopted a passive indexing strategy. In particular, they *"generally select ETFs that minimize costs, provide ample market liquidity, and minimize tracking error"* (Lam, 2016). The corresponding reasons behind this choice are:

1. lower the costs for investors
2. reduce bid-ask spreads and allow for withdrawals at any time
3. although tracking error can be either positive or negative, the goal of passive indexing is to match the market return, hence robo-advisors try to minimize this error

Minor exceptions include robo-advisors that invest in Index Funds, mutual funds, directly in securities such as stocks, or that in general adopt also active management strategies.

This activity is performed a priori: the potential investor does not see it as the customer journey process stars with the following step (onboarding and profiling). This is probably the

least automated step across robo-advisors: many indeed have a team of experts that define investment strategies (and sometimes even construct predefined portfolios).

2.2.2.2 Investor profile identification

There is a rich literature on designing questionnaires for customer profiling in general for asset management and, in particular, on the factors that are correlated with risk tolerance. In this section will be presented some relevant literature for the generic content that should be included in such questionnaires, then the focus will be moved on the assessment of risk tolerance (which is probably the most important and critical factor) as well as other investors' propensities, and lastly a recent study on robo-advisors will be presented.

Questionnaires for customer profiling

Linciano and Soccorso (2012) recall some principles that one should follow to design a good questionnaire:

- For each item, *"it is also necessary to identify the relevant questions, finding the right balance between reliability (positively correlated with the number of questions) and the need for brevity. On this point, quantitative techniques are of some help, such as factor analysis or Cronbach's alpha"*
- Wording questions is a very important aspect as it can affect the reliability of the questionnaire. Questions must be clear, comprehensible and must limit the errors in perception which might be driven by behavioural biases and cognitive distortions
- Risk tolerance must be assessed separately from measuring the other variables (e.g. investment horizon and objectives); if one puts them together individuals will focus on the latter rather than the former

The authors also summarize the items that should be covered according to existing literature; some of them will be explained leaving risk tolerance to a separate section:

Items	Variables	
socio-demographic characteristics	gender	
	age	
	marital status	
	current and expected household composition	
experience and knowledge	profession	
	education	
	previous investment experience	
	outcome of previous investment choices (positive/ negative)	
	knowledge of financial products	
	knowledge of how financial markets work	risk-return trade-off
		risk dimensions (credit/market/exchange rate)
		portfolio diversification principle
		perception of probability
	overconfidence and optimism	
financial situation	investments and real property; assets, including liquid assets	
	source and extent of regular income	
	regular financial commitments	
	other financial commitments (expected changes in regular revenues and expenses)	
investment objectives	holding period	
	time preferences (discount rate/degree of impatience)	
	liquidity needs	
	purpose of the investment	
	amount (in relation to wealth/income)	
risk tolerance	risk attitude (objective risk)	
	emotional capacity to assume risk (subjective risk)	
	loss aversion	

Figure 2.7 Variables
Source: Linciano and Soccorso, 2012

Level of education and profession are put in the experience and knowledge cluster because the authors made a comparison with MiFID requirements; however, they should be considered socio-demographic characteristics. *"Economic literature argues that many other characteristics affect investment choices, both in terms of their impact on risk attitude as well as the constraints on risk capacity"* (Linciano and Soccorso, 2012): age, gender, current and expected household composition, planned retirement age.

"Questions designed to assess knowledge of specific financial instruments […] can lead to unreliable answers if investors overestimate their financial knowledge or are reticent about admitting their ignorance. The financial literacy of Italian investors is quite low, on average. Therefore, it would be better to assess the client's knowledge and understanding of fundamental notions, such as the relationship between risk and return, and the principle of risk diversification" (Linciano and Soccorso, 2012). As for experience, also the outcomes of past investments may matter: *"as shown in behavioural finance studies, more experience combined with past positive results can lead to overconfidence and optimism and, therefore, a greater willingness to take risk, regardless of the client's risk capacity. Therefore also assessing overconfidence and optimism (or pessimism) may be important in defining a clearer picture of the customer's perception of his/her experience"* (Linciano and Soccorso, 2012).

Income and wealth have a relevant impact on risk tolerance and are fundamental to evaluate the client's financial capacity, so they should be measured precisely. As for income, *"it might be worth obtaining the income of the entire household rather than just the individual's. Indeed, several empirical studies show that the level and distribution of total income among family members also affect spending and investment choices of the individuals"* (Linciano and Soccorso, 2012). Other items that should be considered are the household's significant expenses (e.g. mortgage, rent, number of children), factors that could affect the regularity of income and factors affecting the background risk (e.g. professional status, area where the client lives).

Lastly, *"the holding period depends on many different factors including the expected return objective, the investor's degree of impatience […] and the foreseeable needs for liquidity"* (Linciano and Soccorso, 2012).

Risk tolerance and other investors' propensities

As the ESMA explained (2017*), "Classical finance theory considers the risk of an investment as an objective measure, which can be easily quantifies and summarized by single parameter […]. Conversely, behavioural finance theories focus on the risk perception of the single investor (perception which clearly differs from one person to another) that depends both on specific psychological characteristics and the emotional sphere in a way that could make the standard risk measurement […] less effective. To avoid this risk, questions in the questionnaire should be drafted to prevent any perceptive or cognitive distortion from impairing the answer provided by investors and affecting their validity and their reliability"*. Risk questionnaires have been deeply analysed by Pan and Statman (2012) in the light of behavioural finance; according to them *"typical questionnaires are deficient for five reasons"*:

1. Each investor has a multitude of risk tolerances. Specifically, investors consider their portfolios as a collection of mental accounts, each devoted to a goal (e.g. retirement income, college education), and they are likely to have a different risk tolerance for diverse goals
2. Assessment of investors' risk tolerance is essential in guidance toward portfolio asset allocation, which is one of the most important tasks of financial advisors. Yet existing questionnaires offer no clear linkage between risk tolerance scores derived from questionnaires and portfolio asset allocations
3. Investors' risk tolerance varies by circumstances and associated emotions: vividly high returns on asset classes induce exuberance, so questions asked after periods of high stock returns are likely to elicit answers overestimating risk tolerance; conversely, vividly low returns on asset classes induce fear, thus questions posed following periods of low stock returns are likely to elicit answers overestimating risk tolerance
4. The risk tolerance assessed in foresight is probably different from that assessed in hindsight
5. Not only risk tolerance but also investor propensities matter to advisors

Then the authors propose some questions that inquire about not only risk tolerance but also individual propensities, in particular: overconfidence, propensity for maximization, regret, trust.

Risk tolerance

> Suppose that you are the only income earner in the family, and you have a good job guaranteed to give you your current family income every year for life. Now you are given an opportunity to take a new and equally good job. The new job has a fifty-fifty chance to increase by 50 percent your standard of living every year during your lifetime. However, the new job also has a fifty-fifty chance to reduce by X-percent your standard of living every year during your lifetime. Circle the maximum X-percent reduction in standard of living you are willing to accept.

Figure 2.8 Risk tolerance question
Source: Pan and Statman, 2012

This type of question is good for some reasons:

- It lets investors choose the maximum downside risk they are willing to accept; indeed, the language spoken by investors is more coherent with the concept of downside risk.
- There is a one-to-one relationship to a level of risk tolerance (measured by the coefficient of risk aversion), which in turn determines the optimal asset allocation on the efficient frontier.
- It addresses the difference between risk tolerance and risk perception: the absolute value of the income is not specified, otherwise wealthy people and poor people would give different answers despite having the same risk tolerance (but different risk perception)

The same questions could be posed talking about portfolios:

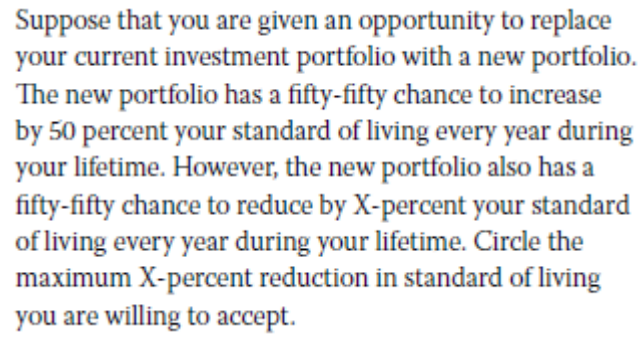

Suppose that you are given an opportunity to replace your current investment portfolio with a new portfolio. The new portfolio has a fifty-fifty chance to increase by 50 percent your standard of living every year during your lifetime. However, the new portfolio also has a fifty-fifty chance to reduce by X-percent your standard of living every year during your lifetime. Circle the maximum X-percent reduction in standard of living you are willing to accept.

Figure 2.9 Risk tolerance question
Source: Pan and Statman, 2012

"The distinction is important because incomes from a job likely reside in a mental account distinct from the mental accounts that contain incomes from an investment portfolio" (Pan and Statman, 2012). Evidence shows that risk tolerance towards portfolios declines almost monotonically with age, while risk tolerance towards jobs and age have a U-shaped relation. Moreover, the first is always lower than the second, except for people older than 55 years. Thus, it is probably better to consider this variant of the question.

Overconfidence

It is important to consider overconfidence because: *"Investors' overconfidence might be correlated with their risk tolerance. Overconfident investors might perceive risk as lower than less-overconfident investors, biasing upward the measure of their risk tolerance. Advisors need to adjust downward their assessment of the risk tolerance of overconfident investors and perhaps tamp down their overconfidence as well. Even if overconfidence is unrelated to risk tolerance, it still matters […]. Investors who are overconfident in their stock-picking skills*

are likely to resist advice to buy diversified portfolios and hold them rather than trade" (Pan and Statman, 2012). A possible question could be:

> Some people believe that they can pick stocks that would earn higher-than-average returns. Other people believe that they are unable to do so. Please indicate your belief by circling the number on a scale ranging from "Strongly believe I cannot pick higher-than-average stocks" to "Strongly believe I can pick higher-than-average stocks." Scores range from 1 to 10 where high numbers indicate a belief that one is able to pick higher-than-average stocks.

Figure 2.10 Overconfidence
Source: Pan and Statman, 2012

Propensity for maximization

"Propensity for maximization matters to financial advisors for two reasons. First, investors with high propensity for maximization are likely to be demanding investors, not easily satisfied. Second, propensity for maximization also might be related to risk tolerance. Investors with high propensity for maximization might set high standards of investment returns, motivating them to tolerate more risk in exchange for a chance to reach these high returns" (Pan and Statman, 2012). One might ask people for their level of agreement with the statement: "I always want to have the best. Second best is not good enough for me." Scores range from 1 to 10, where high scores indicate high propensity for maximization.

Regret

Even if it is unrelated to risk tolerance, propensity for regret matters to advisors because all financial choices open the door to regret. To assess it, one may ask people for their level of agreement with the statement: "Whenever I make a choice, I try to get information about how the other alternatives turned out and feel bad if another alternative has done better

than the alternative I have chosen." Scores range from 1 to 10, where high scores indicate high propensity for regret.

Trust

"Advisors care about trust not only because it might affect risk tolerance but also because trusting investors are easier to guide than less trusting ones" (Pan and Statman, 2012). To assess it, one may ask people for their level of agreement with the statement: "Generally speaking, would you agree that most people can be trusted, or that you always have to be careful in dealing with people other than your family?" Scores range from 1 to 10, where high scores indicate high levels of trust.

How robo-advisors profile their customers

Customer profiling is probably the most important step in the workflow from an investor protection standpoint, as robo-advisors gather information through online questionnaires to provide a suitable service to the client. Faloon and Scherer (2018) have identified a set of questions commonly used by robo-advisors:

1. Do you invest for retirement or to generate general savings?
2. What is your age?
3. What is your net income after taxes?
4. What is your savings rate?
5. What is the value of your current (liquid) investments?
6. When deciding how to invest your money, do you worry more about maximizing gains, minimizing losses, or both equally?
7. If your investment portfolio lost *x*% in a given month, would you liquidate your portfolio, just sell some investments, do nothing, or increase investments?

Figure 2.11 Customer Profile
Source: Faloon and Scherer, 2018

The authors group the questions in three blocks, namely investment objectives (1), ability to take risks (2-5), willingness to take risks (6 and 7), and declare that *"Portfolio proposals based on such limited information […] neither meet economic suitability criteria nor represent advice that is in the best interest of the client"* (Faloon and Scherer, 2018). The reason is twofold: there is a lack of individualization and a problem with the calculation of risk aversion. Since it is an unobservable variable, you have to rely either on investor characteristics highly correlated with risk aversion or derive risk preferences from observable experimental or investment decisions (Faloon and Scherer, 2018). Most robo-advisors ask questions similar to 6 and 7 (assumed to be related to risk-taking behaviour) and transform the answers into a numerical value for risk aversion; however, there are large doubts regarding the validity of this approach. Very few robo-advisors, instead, use sophisticated questionnaires developed with psychologists. Still there are at least two problems with this method: validity (it is not sure whether the test score measures what it claims to measure) and usability (it is difficult to translate the test score into a utility function or a risk parameter) (Faloon and Scherer, 2018). A better solution is to use experience sampling, whereby investors observe via

simulations what could occur to a certain portfolio over time and how final wealth can change in good and unfavourable scenarios.

2.2.2.3 Asset allocation/portfolio optimization

From questionnaires to portfolios

According to Faloon and Scherer (2018), information gathered through questionnaires can be used in 2 main ways by robo-advisors.

Firstly, *"questions […] are used in a scoring model that maps scores on a given efficient frontier. Scores and their weightings are invented rather than derived from an academically cross-validated decision-making model"*. Provided that the robo-advisor poses questions to identify both the investor's objective capacity to take risks (objective risk tolerance) and subjective willingness to take risk (subjective risk tolerance), the weights associated to the two components are fundamental to determine the overall level of risk the individual should take. Some robo-advisors equally weight the two scores, but this approach contrasts with that recommended by the CFA institute: *"the prudent approach is to reach a conclusion about risk tolerance consistent with the lower of the two factors (ability and willingness)"* (Bryne and Smudde). Thus, a more conservative approach is that of Wealthfront, which assigns a higher weight to the component that indicated lower risk tolerance.

"The second method is in line with decision theoretic models on portfolio choice. These models typically include household assets and liabilities" (Faloon and Scherer, 2018).

Assets	Liabilities
$\theta = \frac{Financial\ assets}{Total\ assets}$	$\frac{1}{f} = \frac{Retirement\ liabilities}{Total\ assets}$
$1 - \theta = \frac{Shadow\ assets}{Total\ assets}$	$1 - \frac{1}{f} = \frac{Household\ equity}{Total\ assets}$

Figure 2.12 Assets and Liabilities

Avoiding technicalities, on the left find of the balance sheet there are financial assets (retrieved from the questionnaire) and shadow assets (human capital, the present value of lifetime savings, calculated from investor's age, net income after taxes and savings). The right side consists of the retirement liabilities (discounted pension gap computed using the same information needed for human capital with the additional assumption of a replacement rate) and residual net wealth (household equity). All items have been rescaled to yield a balance sheet length of 1, thus they represent percentages rather than absolute values.

In any case, *"the portfolio advice provided by our generic robo-advisor is suitable for investors who are average in every aspect of their economic lives apart from age, net income, and current investments"* (Faloon and Scherer, 2018).

Asset allocation methods

Asset allocation methods used by robo-advisors have been thoroughly analysed by Beketov et al. (2018), who found information on 73 systems. They found out that *"the most frequently applied/mentioned framework is Modern Portfolio Theory followed by Sample Portfolios and Constant Portfolio Weights. […] only the first can truly be called a quantitative methodological*

framework, whereas the other two are general definitions provided on the companies' web pages, which may include various methods unknown to us".

An interesting analysis conducted by the authors regards the relationship between the asset allocation method used by a robo-advisor and its AuM. Unsurprisingly, being the most adopted framework, MPT has the highest AuM volume. Yet, *"relatively advanced methods such as Full-Scale Optimization and the Black-Litterman model attract high overall AuM volumes despite having relatively low occurrences. In contrast, the simple and generally defined methods such as Sample Portfolios and Constant Portfolio Weights are used more often but attract relatively low AuMs"* (Beketov et al., 2018).

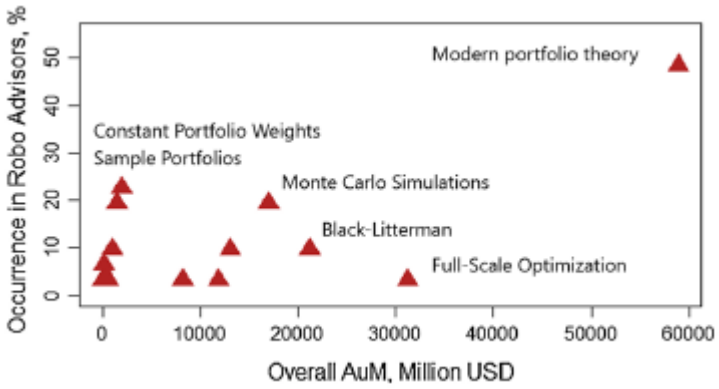


Figure 2.13 Overall AuM
Source: Beketov et al., 2018

For the sake of completeness, it is better to specify that while the Black-Litterman model is used as an additional component within the MPT, Full-Scale Optimization is a methodological framework independent of MPT.

Therefore, it is possible to identify two interesting trends. *"First, most of current RAs use Modern Portfolio Theory, and importantly, they tend to improve and augment this framework rather than applying and developing entirely new approaches. Second, the companies using relatively sophisticated methods attract higher AuM volumes despite the fact that these*

methods are applied less often than the simpler and more generally defined methods" (Beketov et al., 2018).

2.2.2.4 Monitoring and rebalancing

Most robo-advisors employ event/threshold-based rebalancing, with monitoring typically conducted daily, to maintain the target portfolio. This means that *"once asset class weights have drifted away from the target allocation by a certain amount, an algorithm automatically conducts the trades necessary to bring the asset allocation back to target"* (Lam, 2016). Other triggers are portfolio returns and VaR (Beketov et al., 2018).

Some robo-advisors, instead, use calendar-based rebalancing with predefined rebalancing dates (e.g. once per month). This approach obviously leads to worse results as investors may lose a lot of money in between two consecutive rebalancing dates; the lower the frequency, the higher the probability that the portfolio could experience a loss.

Portfolio rebalancing is not necessarily automatic: it may also be triggered by a change in the client's personal circumstances (e.g. risk tolerance or investment goals). In this case, the investor *"can usually indicate these changes through the robo advisor's online platform, and target allocations are adjusted accordingly"* (Lam, 2016). Some robo-advisors impose restrictions on the number of times the client is allowed to modify its profile over a certain time period.

2.2.2.5 Performance review and reporting

This last step includes monitoring options available through web pages and smartphone apps, periodic reports usually sent automatically via e-mail as well as future profit and risk projections.

2.2.3 Channel

In a report on *Digital Wealth Management* (2018), PwC identified 3 robo-advisory solutions, which are different in terms of automation level and target segment:

- B2B: automatized wealth management solutions offered to traditional players who need to implement new digital services for their customers. The automatized solution does not target directly the final client but the intermediary, who in turn will employ it to optimize and support the consultancy activity
- B2C: robo-advisory services that directly target the retail client and are able to manage their portfolio in a completely autonomous manner, with no intermediary intervention. This solution represents the frontier for totally automated financial advice, with no human component
- B2B2C: hybrid solutions that entail both an automatized service supporting the intermediary and an interface that allows the client to access autonomously their portfolio, reviewing its performance and customizing the periodic reports on the managed capital

In section 4.2.8 the distribution of the sample considering this dimension will be analysed.

2.2.4 Benefits and risks

In 2015, the European Banking Authority (EBA), the European Securities and Markets Authority (ESMA) and the European Insurance and Occupational Pensions Authority (EIOPA), collectively known as the three European Supervisory Authorities (ESAs), published a discussion paper on automation in financial advice, identifying potential benefits and risks associated to this recent trend. In this section the attention will be put especially on those related to consumers, assuming the perspective of robo-advisors (other examples of automation are overlooked).

2.2.4.1 Benefits

- **More affordable advice**, as the costs of providing advice through automated solutions is lower. With robo-advisory solutions, indeed, companies partially avoid paying financial advisors and benefit from scale economies. The system is highly scalable; once its development cost has been met, the marginal cost of each new transaction should be relatively low.
- **A wider range of consumers has access to advice**; there are 2 main reasons: consumers that do not normally contact a human advisor (e.g. because they feel they are not wealthy enough) might feel more confident using robo-advisors and some categories of clients with no experience in consulting a human advisor might feel that robo-advisors are more accessible.
- **Consumers have access to a wider range of service providers**, from other jurisdictions too; since robo-advisors are available online, they should facilitate cross-border transactions. However, this is only a potential benefit that has not materialized yet: in the final version of the paper (2016), indeed, the Joint Committee of the ESAs admitted that cross-border provision of automated advice is not easy, due to national differences. This is confirmed also by the research conducted to do this analysis: most robo-advisors operate at a national level.
- **Consumers obtain financial advice in a faster, easier and non-consuming way**; robo-advisors are usually available 24 hours a day, 7 days per week, and it takes only a few moments to get the advice, after answering to an online questionnaire.
- **Consumers receive more consistent advice**; being based on algorithms, robo-advisors should reduce some elements of behavioural biases, human error or poor judgement. Again, this is true in theory but not in practice: as previously highlighted, currently algorithms are not very complex and the level of personalization is not that high. Moreover, advice consistency also depends on the quality and completeness of the information inputted.
- **Consumers receive advice based on the most up-to-date market information**; automated tools should be able to quickly reassess the recommendation against

current data, providing real-time, personalized feedback. Based on what emerged during the research, this is generally not true, as the vast majority of robo-advisors rebalances the portfolio not on an ongoing basis but on either a threshold or time basis.

- **Consumers find it easier to keep a record of the advisory process**, as robo-advisors keep track of all the stages of the advisory process.

2.2.4.2 Risks

- **Lack of information and reduced opportunity to seek clarifications**; it may be more difficult for consumers to understand key information about advice provided to them by robo-advisors (e.g. terms and conditions) and usually they cannot ask staff help. Furthermore, it has been noticed that important information that should improve customers' understanding (e.g warnings, disclaimers, contractual terms) is written in a small font size and/or difficult to find, thus users may ignore this "legal small print".
- **Unsuitable advice due to problems with inputted information**: the consumer may not fully understand what kind of input is requested, may not be knowledgeable enough to input the requested data or the tool may rely on subjective questions that give rise to misconceptions. Given the reduced ability to seek clarifications and ask questions, this risk is greater with robo-advisors. Besides, clients might not be aware that advice provided by the tool is consistent to their present situation only.
- **It may be difficult to assess who is liable**, in case of an issue, especially when the advice process is fragmented and its steps are performed by different financial institutions.
- **Unsuitable decisions made by consumers due to limitations or assumptions** within the tool. As observed from the analysis and highlighted by literature findings, the output (i.e. investment portfolio) is limited: robo-advisors are usually designed to fit a customer into a range of pre-determined options. Therefore, the advice provided by the tool may not be completely adequate to the customer's personal situation.

- **Operational risks** such as errors in the algorithms and hacking, which are likely to affect many users simultaneously.
- **Herding risk:** a significant volume of consumers may end up transacting in the same way in relation to the same financial products. This procyclicality, in turn, could increase volatility in the market and lead to losses. However, this risk would materialize only if robo-advisors became widespread and if they were based on similar (or the same) underlying algorithms, so it in unlikely to occur.

With further advances in the underlying technology, some benefits could be enhanced (more consistent advice, most up-do-date information) and some risks could be reduced (fewer problems with inputs, less limitations), resulting in an overall improvement of the advice quality.

2.2.5 Regulation

Generally speaking, no specific regulation has addressed the issue of robo-advisory yet. This is not due to the fact that regulatory authorities are underestimating the phenomenon of robo-advisors, either in magnitude or in diffusion; on the contrary, they have acknowledged the recent trends of automation and digitalization in investment advice, are monitoring the evolution of the situation and will eventually decide whether or not to handle the matter in a special way. Regulation, indeed, usually works on an ex-post basis, as it cannot foresee the emergence of certain events, especially if they are characterized by a high level of technological innovation. Nonetheless, many already existing legislations apply to robo-advisors too, since they may be recognized as financial advisors. The next sections will be devoted to explaining if and how regulatory authorities are dealing with the problem, focusing on the geographical areas that are more representative of the sample.

2.2.5.1 EU

As said in Chapter 2.2.4, in 2015 the three ESAs published a discussion paper on automation in financial advice, focusing on the potential benefits and risks associated to this phenomenon. After assessing the numerous responses received from a wide variety of stakeholders, in 2016 the final version of the report was published. The ESAs noticed that several EU laws and regulations already applied to automated advice and stated that no cross-sectoral regulatory or supervisory actions were needed. Given the potential for growth of this innovation, the ESAs said they would have continued to monitor the evolution of the market. After the monitoring exercise, in 2018 the Joint Committee published the results of this activity, essentially confirming what had been previously declared. In particular, many National Competent Authorities (NCAs) noted that supervisory work had been carried out at a national level, but no new domestic regulation was issued in relation to automated advice.

Concentrating on robo-advisors, the pertinent regulatory framework is the Markets in Financial Instruments Directive (MiFID), which *"specifies the information that should be provided to clients, […] the services offered, the financial instrument(s), the risks involved, as well as the overarching obligation that all information provided to clients and potential clients should be fair, clear and not misleading"* (Report on Automation of Financial Advice, 2016). MiFID II even strengthens these and other requirements, especially in relation to information about the scope of advice and S&A (suitability and appropriateness). The most relevant principles for robo-advisors might be those regarding the way through which they serve clients:

- **Act in the best interest of the client**, providing advice on an independent basis (assessing a sufficient range of financial instruments, no inducements)
- **Better inform investors**, with adapted and accurate information
- **Improve profiling**, assessing client's knowledge and experience, financial situation (including the ability to bear losses), investment objective and risk tolerance before providing advice or portfolio management services

- **Provide clients with a suitability statement** (specifying how the advice meets client's preferences, objectives and characteristics) and periodic assessment of suitability

Although no specific regulation on robo-advisory has been issued, in 2017 ESMA drafted some guidelines on certain aspects of the MiFID II suitability requirements, taking into account also the technological evolution of the advisory markets (i.e. robo-advice). According to ESMA, *"the use of automated tools for the provision of investment advice and portfolio management services might raise some specific issues related to the protection of investors",* in particular about the second and third points of the overmentioned principles.

As for informing investors, in order to cover potential gaps in clients' understanding of the services provided, robo-advisors, besides other required information, should provide clients with:

- A clear explanation of the exact degree and extent of human involvement and if and how the client can ask for human interaction
- An explanation that the answers provided by the client will directly affect the determination of suitability of investment decisions
- A description of the information sources used to provide advice or portfolio management service
- An explanation of how and when the client's profile will be updated

As far as disclosures are concerned, in order to design them in an effective way, robo-advisors may emphasise the relevant information (e.g. through pop-up boxes) and accompany it by interactive text (e.g. tooltips) or additional details (e.g. F.A.Q. section).

With regards to customer profiling, ESMA believes that in the case of robo-advisors, more than in traditional interaction models, the suitability statement strongly depends on the quality of the answers provided by the client which, in turn, also depends on the quality and objectivity of the questions. Therefore, robo-advisors should:

- design their questionnaires so that they are able to gather the necessary information about their client for assessing suitability (knowledge and experience, financial situation, investment objectives and needs)
- ensure that the questions are sufficiently clear
- explain if some level of human interaction is available while responding to online questionnaires
- be able to spot inconsistent client answers.

Lastly, measures aimed at dealing with the risk that clients may overestimate their knowledge and experience are particularly important for robo-advisors, since the risk of overestimation might be higher when they provide information via an automated system.

Summarizing, authorities have observed that the use of robo-advisory solutions is likely to raise additional concerns for consumers protection, more specifically in relation to providing information and customer profiling (essential to the suitability assessment), and are continuing to monitor the situation as well as designing specific guidelines for addressing those problems.

2.2.5.2 US

The reference regulation for robo-advisors is the Investment Advisers Act of 1940 (IAA), according to which *"Investment adviser means any person who, for compensation, engages in the business of advising others, either directly or through publications or writings, as to the value of securities or as to the advisability of investing in, purchasing, or selling securities"*. Apart from some exceptions, since they provide investment advice for compensation, robo-advisors are generally required to register as investment advisers. Indeed, in the *Investor Bulletin: Robo-advisers* (2017), the SEC stated that *"although the services that they provide are automated, robo-advisers in the U.S. must comply with the securities laws applicable to SEC or state-registered investment advisers".* The main question is whether they satisfy the

fiduciary standard elements prescribed by the Act, which can be condensed in three main components: *"provide personalized investment advice, disclose conflicts of interest, and seek the best execution of transactions"* (Lightbourne, 2017).

In 2015, the SEC's Office of Investor Education and Advocacy (OIEA) and the FINRA issued an alert cautioning investors to be wary of robo-advisors, as they may rely on assumptions that could be incorrect or do not apply to the client's individual situation, questions might be misleading, ambiguous or designed to fit the client into predetermined options, may not assess all investor's circumstances and thus suggest unsuitable investments. In February 2017, the Division of Investment Management of the SEC (Securities and Exchange Commission) published a Guidance Update intended to provide suggestions to robo-advisors as they seek to meet their obligations under the IAA, arriving at conclusions very similar to those of ESMA presented in the previous section. The fact that it identifies practices that robo-advisors should consider and highlights some flaws in their methods could indicate that they are not fully compliant with existing rules. The U.S. Department of Labor (DOL)'s expansion of fiduciary duty to all financial professionals providing services to retirement plans could further complicate the situation, because many robo-advisors also provide retirement plans such as 401(k) and IRAs. Nonetheless, *"the DOL has stated that this new rule does not apply to robo-advisors"* (Strzelczyk, 2018) and, in any case, the U.S. 5th Circuit Court of Appeals officially vacated the rule, effectively killing it (Investopedia, 2018). Thus, there is still no industry consensus and there are opposite positions on this topic.

Among critics there is Melanie L. Fein (former senior counsel to the Federal Reserve Board of Governors) who, in line with SEC and FINRA alert, believes that *"the resulting advice may be based on incorrect assumptions, incomplete information, or circumstances not relevant to the user"* and that *"clients are essentially left on their own to determine whether the robo advisor's investment strategies are appropriate for their needs"* (Fein, 2015), concluding that they do not provide personal investment advice. Supporters, instead, may say that *"Curiously, the SEC has never explicitly stated what constitutes personalized investment advice"* and that *"just like a robo-adviser, a human adviser relies on information provided by*

the client. So long as a robo-adviser or a human adviser asks the right questions […] humans and machines can both meet this fiduciary requirement" (Lightbourne, 2017). Fein continues saying that *"Robo-advisers are affected with a number of conflicts of interest […] use affiliated brokers, custodians, clearing firms or other firms from which they receive compensation"* (Fein, 2015), criticizing that they disguise these conflicts in small prints. However, conflicts of interest are not prohibited if disclosed and accepted with the customer agreement. As for the best execution principle, which requires an adviser to identify the brokerage service with the lowest total cost to the client, Fein observes that *"robo-advisors typically use an affiliated broker-dealer or a broker of their choice, which may not always obtain a favorable price for the user"* (Fein, 2015).

All things considered, criticism on robo-advisors not meeting the fiduciary standard seems to be grounded on objective facts, as their questionnaires to profile customers are too simplistic and they tend to avoid responsibilities in disclaimers and small prints. Probably, *"The bull market returns and the low service costs being charged may be the reason that no private actions have been brought against these firms"* (Strzelczyk, 2018).

2.2.6 Industry data

According to a research published by Morningstar (2018), *"robo-advisors […] have failed to disrupt investment services incumbents and are still largely unprofitable. Many have sold themselves to established firms after realizing they can't count on investors giving them money. Robo-advisor costs also present a challenge to profitability"*. Some incumbents, indeed, have reacted quickly, adopting robo-advisory technological solutions and overtaking start-ups in terms of AuM, as the following figure shows:

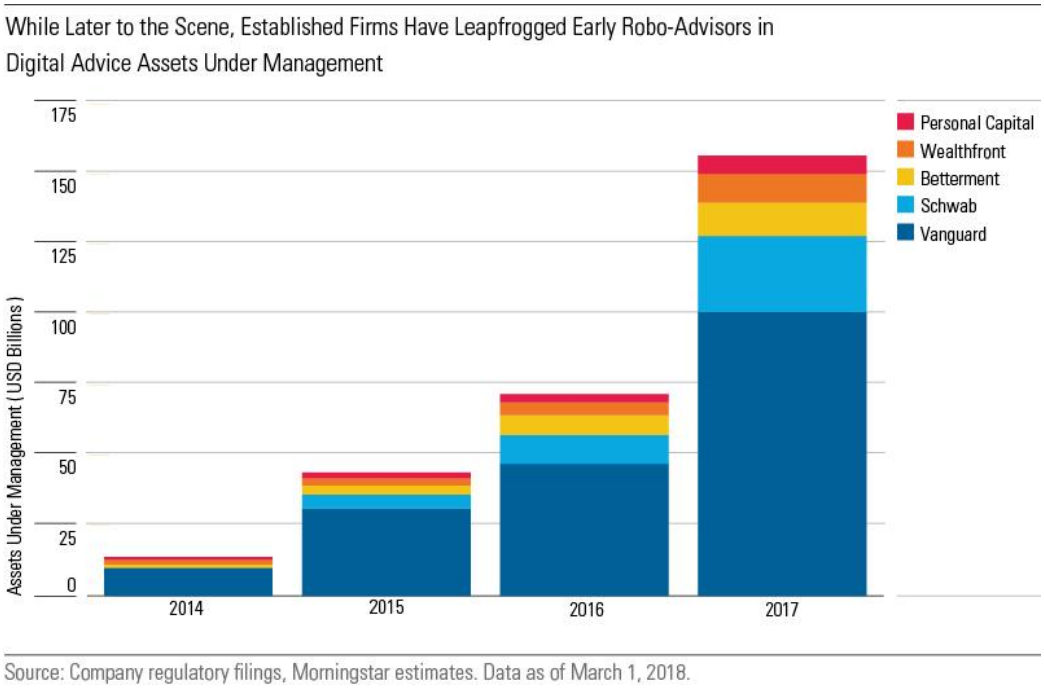


Figure 2.14 Digital Advice AuM

There are three main problems with the original robo-advisor model: *"high client-acquisition costs, ongoing costs of servicing clients, and low revenue yield on client assets"* (Morningstar, 2018). For instance, the research indicates that the break-even point for robo-advisors that charge 50 basis points could be between $15bn and $25bn AuM, which is 38%-63% lower than the break-even point of robo-advisors that charge 25 basis points.

As for the size of the industry, estimates of the AuM that will be managed by robo-advisors in the future are extremely various. Burnmark (2017), for example, forecasts over $1 trillion AuM by 2022:

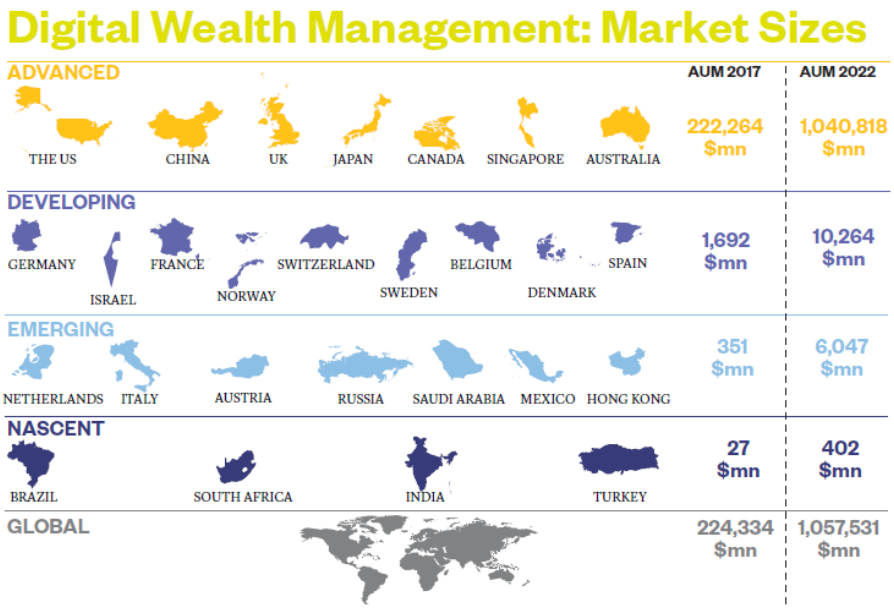


Figure 2.15 Digital Wealth Management: Market Size
Source: Burnmark, 2017

Statista[1] data is even more optimistic: assets under management are expected to show a CAGR (2018-2022) of 38.2% resulting in the total amount of $1,452,637m by 2022. The next figure shows more in detail current AuM and expected 2022 AuM for the major geographical areas (South America, Africa and Oceania are not relevant):

[1] www.statista.com

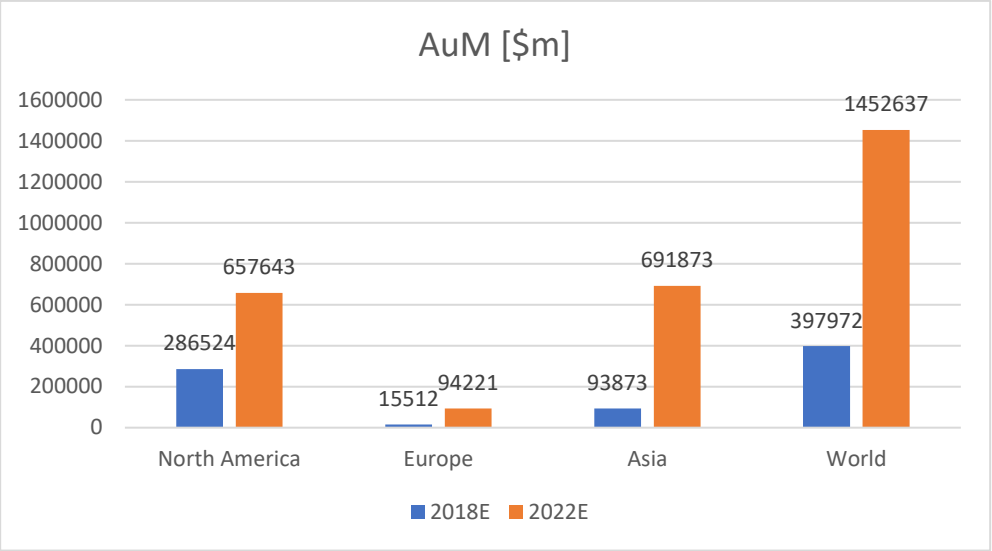


Figure 2.16 AuM Estimations

What about Italy? Democratization in the asset management industry has not come yet; the main reason is the low degree of financial literacy, which positions this country in the last places of international rankings. Mauro Panebianco, PwC partner in Italy, declared that while in the United States (and generally in the Anglo-Saxon world) there is a widespread financial culture, in Italy there is not and that's why robo-advisory has not yet become popular (ilsole24ore, 2018). The following histogram shows AuM managed by robo-advisors in Italy in 2018 and 2022:

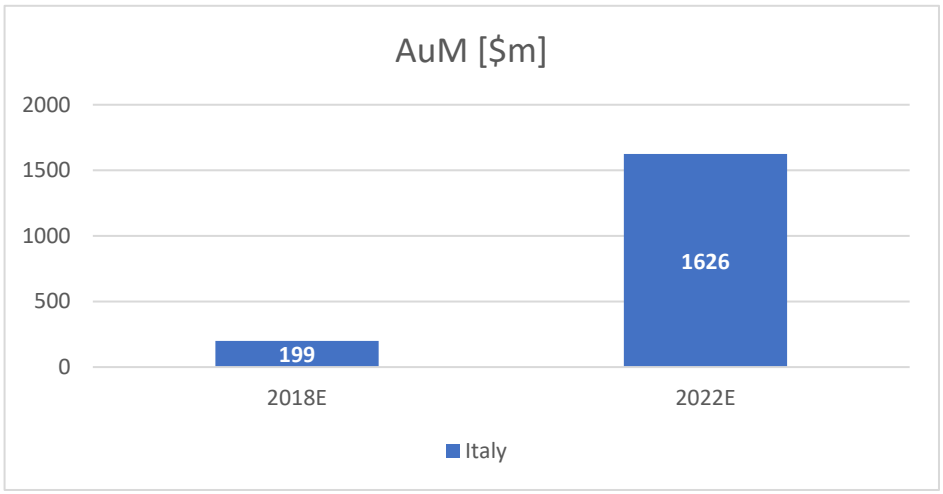


Figure 2.17 AuM

2.2.7 Future scenarios

An important question is whether or not robo-advisors will replace traditional asset managers in the following years. Undoubtedly the asset management industry will undergo a democratization: a number of disruptors are already emerging to provide low-cost alternatives to a larger customer base. A possible outcome is that, thanks to technological advancements and innovation, they *"will in the longer term commoditize the simpler and technical aspects of wealth management"* (Phoon and Koh, 2018). However, in this scenario traditional players will not be driven out of the market, as customers may have needs of different complexity*: "investors with simpler needs will increasingly choose robo-advisors because the latter are cheaper, accessible and client-centric. […] more sophisticated investors as well as high-net-worth clients may stay with asset managers, private bankers, and other traditional wealth managers for some time yet"* (Phoon and Koh, 2018). Therefore, these cheaper and faster online tools and automated services that initially targeted underserved customers may steal market share in the mass affluent market from traditional asset managers, who will be forced either to develop their own automated solutions, accepting lower margins, or to focus on providing more customized and value-added services to high-end clients, especially HNWI and UHNWI, or both.

Another scenario is more disruptive: robo-advisors might commoditize even high-value services, such as wealth transfer management and estate/tax strategies, eroding the value delivered by traditional players across all segments and pushing them to offer more customized services to a broader customer base. To do so, they will probably have to adopt or further develop automated functionalities, freeing some capacity for human advisors, who in turn will be able to provide more bespoke solutions to several customer segments.

Up to now, the first scenario seems the more realistic one. Indeed, *"most robo-advisors are focused on helping individual clients manage relatively passive portfolios. Few robo-advisors assist clients in addressing their estate and retirement planning […]. Tax planning remains very rudimentary and focused on tax-loss harvesting"* (Phoon and Koh, 2018). Moreover,

some incumbents have already reacted to this phenomenon that could potentially disrupt the asset management industry adopting their own digitalized solutions, either built in-house (e.g. Vanguard Personal Advisor, Schwab Intelligent Portfolios) or via acquisition (BlackRock and FutureAdvisor).

However, further advancements in technology could make the second scenario become true. Using more sophisticated algorithms together with artificial intelligence, machine learning and other data analytics techniques, would allow robo-advisors to tailor portfolios to individuals with even complex financial circumstances and to improve investment advice (Phoon and Koh, 2018). This is confirmed also by the FBS (Financial Stability Board): *"Robo-advice could use innovations such as machine learning and artificial intelligence to improve decision-making"* (*Financial stability implications from FinTech: supervisory and regulatory issues that merit authorities' attention*, 2017).

Chapter 3

Scope of the Thesis and Methodology

3.1 Scope of the thesis

As said since the beginning of this thesis, the focus of the work is robo-advisors. Therefore, after a definition of asset management, the main theories and a breakdown of the industry, the focus was narrowed to robo-advisors. It was defined what they are, how they work, the major trends and some key data were given. However, what this thesis focuses on is the customer profiling, and a more specific explanation of the scope and objectives has to be defined.

In the literature review, the disruption of robo-advisors and the trends in the asset management industry, such as the changes in customers (i.e. millennials) and new technologies, that favoured the flourish of robo-advisors, were explained. In fact, there are many papers and studies that focus on the key elements of this phenomenon.

The main point of this work is to analyse a less studied part of this new business: the customer profiling. This research has the aim to define how customers are profiled by start-ups operating in the market, especially start-ups that offer the possibility to build or simulate a portfolio directly online. Thus, once the sample of the main start-ups operating in the asset management industry is defined, the analysis focuses on a subset of robo-advisors. Moreover, the geographical scope of the thesis is worldwide. The first part of the research is the data gathering, all the questions done by start-ups and the information showed once the portfolio is built were registered. Then, they were divided in macro categories and categories to put together the similar ones. The objective of this part of the research is thus to analyse what kinds of questions are asked to customers to profile them and what types of information are showed. The second part of the research is to conduct the same analyses on subsets, such as start-ups headquartered in the same continent and clusters of start-ups divided by specific variables. The main objective is to understand the key information gathered by start-ups to profile their customers and to find differences among specific groups.

Furthermore, after these analyses, the second objective is to understand if the way in which start-ups profile their customers is the correct one, from specific points of view, such as regulations. In particular, the following step and objective of the analyses is to define if start-ups subject to it are compliant with MiFID II. For this purpose, the results of the research were compared to regulatory requirements for those start-ups that are subject to MiFID II in order to understand if the guidelines of the Directive were followed.

Moreover, more information about the customer profiling (how it should be and how it is) was gathered in the workshops of Osservatorio Fintech & Insurtech and, especially, with the design of a specific questionnaire to be directly submitted by the start-ups in the database.

In conclusion, the results of this research are compared to the literature.

3.2 Methodology

In this section, a description of the general framework of the work and the methodology will be given. The methodology and the details of each part of the research will be provided while the single analyses and researches that are part of the work will be explained and discussed.

3.2.1 Literature review

The aim of the literature review was to explain and define the industry. In fact, with the idea of analysing the customer profiling of start-ups, it was necessary to define the general environment of which this specific subject is part. Therefore, a screening of the academic literature was done, looking for academic papers focused on the asset management industry in general and robo-advisory specifically. Once the most relevant papers on the topics were collected, it was possible to define a structure of the literature that was useful to review for this work.

First of all, it seemed necessary give a definition of the general industry. Thus, academic papers and book were used as sources to provide a definition of what asset management is, who are the main actors, what is asset allocation and what are the main theories and models of asset management. This was important to define the taxonomy and the theory behind the general industry to which robo-advisors belong to. Moreover, to understand the relevance and the trends of the industry, key data were gathered from previous researches, and the main aspects that are also the key to understand why robo-advisors developed were provided.

Secondly, it was important to review the academic literature in order to define the taxonomy and the industry of robo-advisory. Since this work focuses on a specific topic of robo-advisory, it was important to define what robo-advisors are, why and how they developed, what is the history behind and the most important aspects of this business. Moreover, the focus

narrowed to customer profiling in order to understand the studies that were conducted before of this topic, that is the main scope of this work, and, therefore, to present the topic on which the research is conducted. In conclusion, key data on the sector were provided, to emphasize its relevance and size.

3.2.2 Variables and sample

As said before, the scope of the thesis is worldwide. Using online databases and websites, and starting from the database of last years' analyses, it was possible to gather a list of relevant start-ups for the sample. Moreover, the key variables to describe, especially, the geographical origin, the size, and the asset allocation strategy and assets used were defined. These variables are considered in order to have a general description of the start-ups and, in particular, to gather all the information that, after also the literature review, was related to the way in which the start-ups decide to design the phase of customer profiling.

Once defined the variables, all the data was gathered, using start-ups websites and other online sources such as CrunchBase. In this way, a database of the start-ups and the related information was built.

3.2.3 Database and analyses

Once the database of start-ups was defined, the next step was to gather the information related to customer profiling. Therefore, all the information related to questions asked to profile customers and what is displayed when the portfolio is built, was collected. The main source was the start-ups' websites. In fact, all the portfolio simulations were done in order to register the process of profiling and to analyse the portfolios built.

Then, all this information was registered in the database of the start-ups, and further analyses conducted. It was possible to define macro categories and categories of questions and information, in order to find similarities and differences between start-ups and groups of start-ups.

Another important issue for which the database was useful is regulations. In fact, defined the area in which questions are asked by start-ups, it was possible to define if these areas comply with MiFID II for the robo-advisors subject to it. The starting point to understand what areas are the ones that have to be asked, was to analyse previous studies about the MiFID II compliance. Moreover, the last analysis aims to compare the way in which start-ups profile customers and theory found in the academic literature.

Chapter 4

Data collection, Database and analyses

4.1 Start-ups sample composition

In this section, the sample of the analysis is presented and explained, with further details on the information gathered and how the sample was selected, providing more information and explaining all the variables considered.

4.1.1 Start-ups selection

The original version of the database was the result of last years' analyses conducted on companies offering financial services, in particular those belonging to the asset management industry. The sample has been enlarged in order to take into account recently-founded ventures as well as firms that may have experienced a significant growth of funding, applying

in Crunchbase[2] (a powerful online platform for finding business information) the following filters:

- Companies founded in the last 5 years (more specifically after 1/1/2013)
- Companies that are currently operating or have been acquired or have made an IPO, leaving out those that have closed down
- Companies that have been financed in the last 2 years (after 1/1/2016)
- Companies that fall within the scope of analysis, using the tags “wealth management” and “asset management”

The third constraint ensures that only the most interesting start-ups are considered and relies on the hypothesis that those that have not received any financing are less useful to be analysed. After a thorough examination of each company, a few (coming from both the original database and the newly-added ones) have been eliminated because either they are not involved in digital wealth management, or they are incumbents, or they have been acquired by already established companies and completely absorbed. Here, the degree of autonomy has been the main driver of decision: while spin-offs of traditional players have not been excluded, as they operate independently from the parent company, other firms, after being acquired, no longer exists as separate entities. In addition, a start-up, Fiveraday, despite being eligible according to the above-mentioned conditions, has not been included as it is currently unable to process new applications. The only exception to the above-mentioned procedure is Euclidea, an investment management company born recently, which has been manually inserted in the sample as it is an interesting Italian example of robo-advisory.

[2] www.crunchbase.com

4.1.2 Variables used to describe start-ups

Regarding start-ups, information about the following variables were gathered:

- **Year of Launch:** in a financial sector that is continuously changing and has seen the introduction of many innovations in the last years, being the first mover has proved to be a successful strategy in several cases. The 2 biggest start-ups that have exceeded $10bn, namely Betterment and Wealthfront, were founded in 2008; the third biggest company, Personal Capital, was born in 2009.
- **AuM:** assets under management is the market value of assets that an investment firm or financial institution manages on behalf of investors. It is important for at least 2 reasons: it gives an idea of the size of the company as well as its reputation and it is related to the computation of the break-even point. In case of multiple sources of data, the AuM value and the corresponding date have been recorded. Moreover, many American start-ups file Form ADV to register with the SEC and/or the states; Form ADV (Uniform Application for Investment Adviser Registration) is a reporting form that contains information about an investment adviser and its business operations, among which its AuM. If available, this has been considered as the most reliable source of AuM data.
- **Headquarters:** country in which the organization is headquartered. Start-ups belonging to the asset management industry, especially robo-advisors, usually operate at national level only.
- **Continent:** continent of the firm's headquarters.
- **Financing:** it is very important for start-ups to collect funds from both financial and strategic investors in order to scale up as well as to take advantage of their expertise and networks. The funding amount and the number of (different) investors may also reveal how much a start-up is appealing in terms of business model and prospects for success. For each financing round the amount, date and exchange rate between the currency in which it was denominated and US dollar have been saved, so as to compute the total amount raised across all funding rounds.

- **Allocation method:** theories and approaches used by start-ups to build portfolios and select securities. Not many start-ups specify the actual method employed; the following ones have been identified:
  - **MPT:** Modern Portfolio Theory
  - **MDR:** Minimum Downside Risk
  - **BL:** Black-Litterman
  - **FF:** Fama-French
  - **Other:** all other methods developed internally by companies that can be a combination of the previous ones and/or result of some adjustments

  Some start-ups may take some elements from different approaches; in that case all the methods mentioned on their websites were listed.
- **Instruments:** financial instruments actually bought, recommended or made available by start-ups for portfolio construction that usually cover multiple asset classes. They were divided for this research in 5 types:
  1. **ETF:** Exchange Traded Fund (see Chapter 2.1.1 for the definition)
  2. **Index funds:** they are funds that match or track the components of a market index and are managed passively
  3. **Funds:** all other types of funds (e.g. mutual funds) that are usually characterized by an active management style
  4. **Fund of funds:** investment strategy whereby a fund invests in other types of funds instead of investing directly in bonds, stocks and other securities
  5. **Individual securities:** very few start-ups invest directly in securities such as stocks and bonds
- **Asset classes:** clusters of securities with similar characteristics. Their variety and weights determine the overall risk-return profile of the portfolio; the following asset classes have been considered:
  - **Equity:** stocks representing an ownership interest in a company; investors purchase them to sell them later at a higher price and make profits (or, to a lesser extent, to get dividends)

- **Fixed income:** type of investment whose return is fixed or predictable and paid at a regular frequency (e.g. corporate and government bonds)
- **Emerging markets:** investments in shares/bonds of emerging markets' companies and/or in bonds issued by emerging markets' governments; they are characterized by higher volatility (and higher potential returns) than those of developed economies
- **Real estate:** investments in residential (i.e. lands, houses…) and commercial (i.e. office buildings, warehouses…) real estate, which result in profits (or losses) through value appreciation (or depreciation) of the real estate or revenues from rents/leases
- **Liquidity:** cash and money market instruments characterized by high liquidity and low risk-return
- **Commodities:** precious metals (e.g. gold), natural resources (e.g. oil) and other goods
- **Others:** all other alternative investments different from traditional asset classes such as private equity, cryptocurrencies, mortgages, peer lending…

- **Channel:** a company can operate in 3 different ways:
  1. **B2C:** the service is provided directly to the final client; the most typical example is that of robo-advisors that target individual investors offering them automated investment solutions with a low/medium degree of personalization.
  2. **B2B:** the service aims at supporting other financial institutions; for instance, some start-ups sell algorithms for the customer profiling process or for the optimization of portfolios (e.g. tax-loss harvesting).
  3. **B2B2C:** the service is for the final client but intermediated by financial institutions; in other words, it supports a financial intermediary with an interface directed to the final client.

The channels are not mutually exclusive: for example, a few start-ups offer both B2B solutions, selling proprietary algorithms to market operators, and B2C ones, being

robo-advisors too. However, during the research a few problems emerged with respect to the abovementioned classification. While it is relatively easy to understand when a company operates on a B2C basis (private area on the website, no reference to any other intermediary), it might be quite challenging to disentangle the difference B2B/B2B2C. Some start-ups are certainly B2B, as they declare that they (only) sell algorithms to other financial intermediaries such as banks or advisors (e.g. 55ip sells algorithms for portfolio design and tax-loss harvesting); others are probably B2B2C, because they help advisors with client onboarding and portfolio building but clients can autonomously access their account and see their portfolio (e.g. BlueOpes). In the middle there is a number of situations whereby firms describe their offering to third-parties in an ambiguous way or it is not clear whether an interface with the retail client exists. Moreover, it is not possible to spot cases in which the start-up offers a robo-advisory solution to an intermediary and the final client accesses to a private area on the intermediary's website (which would be B2B2C). Therefore, to avoid making mistakes, the label B2B2C will not be used; start-ups will be described either as B2C or B2B, with the latter tag including also the B2B2C scenario.

Crunchbase has been used as primary source of basic information about companies (i.e. about year of launch, geography, financing rounds and founders); in case of unavailability of data, start-ups' websites and LinkedIn profiles have been employed.

4.2 Sample breakdown

In this section, a breakdown and a first analysis of the sample are presented in order to give a further understanding of the composition of the sample. The geographical distribution, year of launch, financing and AuM will be the main variable taken into account. Following the methodology described in the previous section to select the start-ups, the final sample is composed by 96 start-ups.

4.2.1 Geography

First, it could be interesting to analyse the sample from a geographical perspective, as regulation and populations' characteristics strongly vary across different countries. The most represented continent is Europe, with 45 start-ups out of 96, followed by North America (31), Asia (14) Oceania (4) and South America (2). The fact that Europe and North America together account for 79% of the entire sample is not surprising as the fintech phenomenon has developed a lot in these 2 regions; Asia accounts for only 15% because Asian companies are more difficult to analyse, due to the language.

At country level, in Europe only UK and Germany are significantly represented: with respectively 14 and 12 start-ups they account for more than half of the European sample. France (4), Italy (3), Switzerland (3) and Spain (3) are very outdistanced, while other 6 countries (belonging in particular to central and northern Europe) are present with only one occurrence. Focusing on North America, US constitute almost three quarters of the sample, confirming that they are on the edge of the digital innovations introduced in the asset & wealth management industry. As for Asia, only Indonesia (4) and Singapore (4) are present with more than one company; as said before, Asian figures are biased because, due to the language and impossibility to translate the website, in some cases it was not possible to properly understand what the start-ups do and consequently they have not been included in

the sample. With regards to Oceania and South America, in both cases just one country is represented, respectively Australia and Brazil.

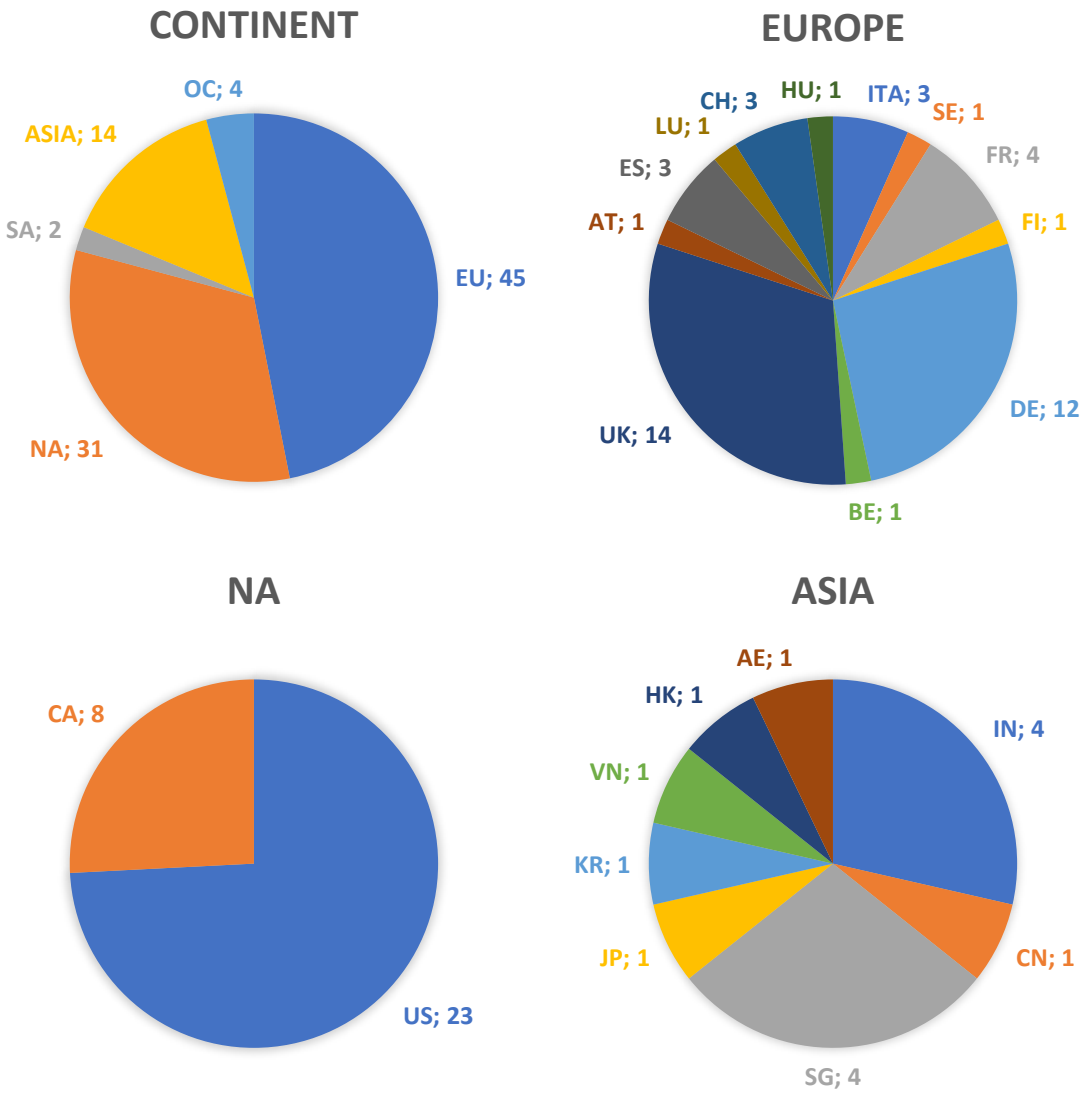


Figure 4.1 Geographical distribution of the sample

4.2.2 Year of launch

Going deeper in the analysis, the following histogram shows the number of start-ups founded in each year:

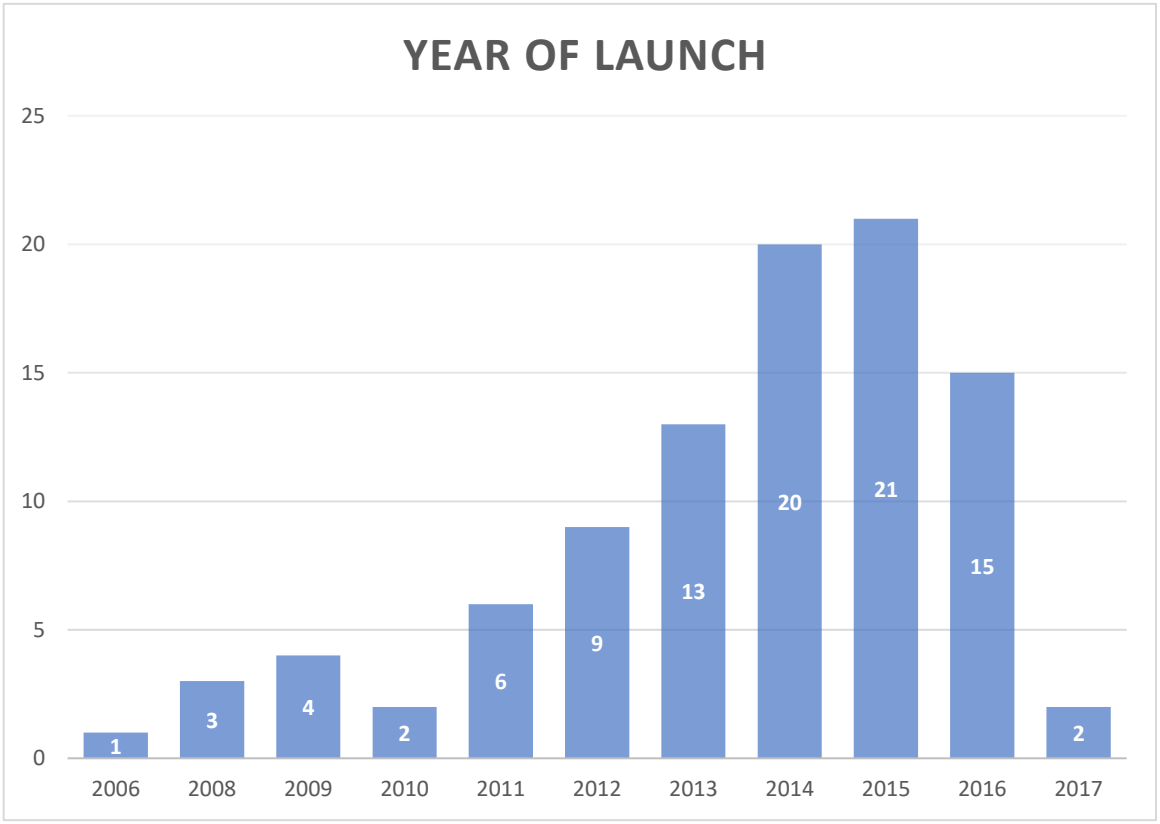
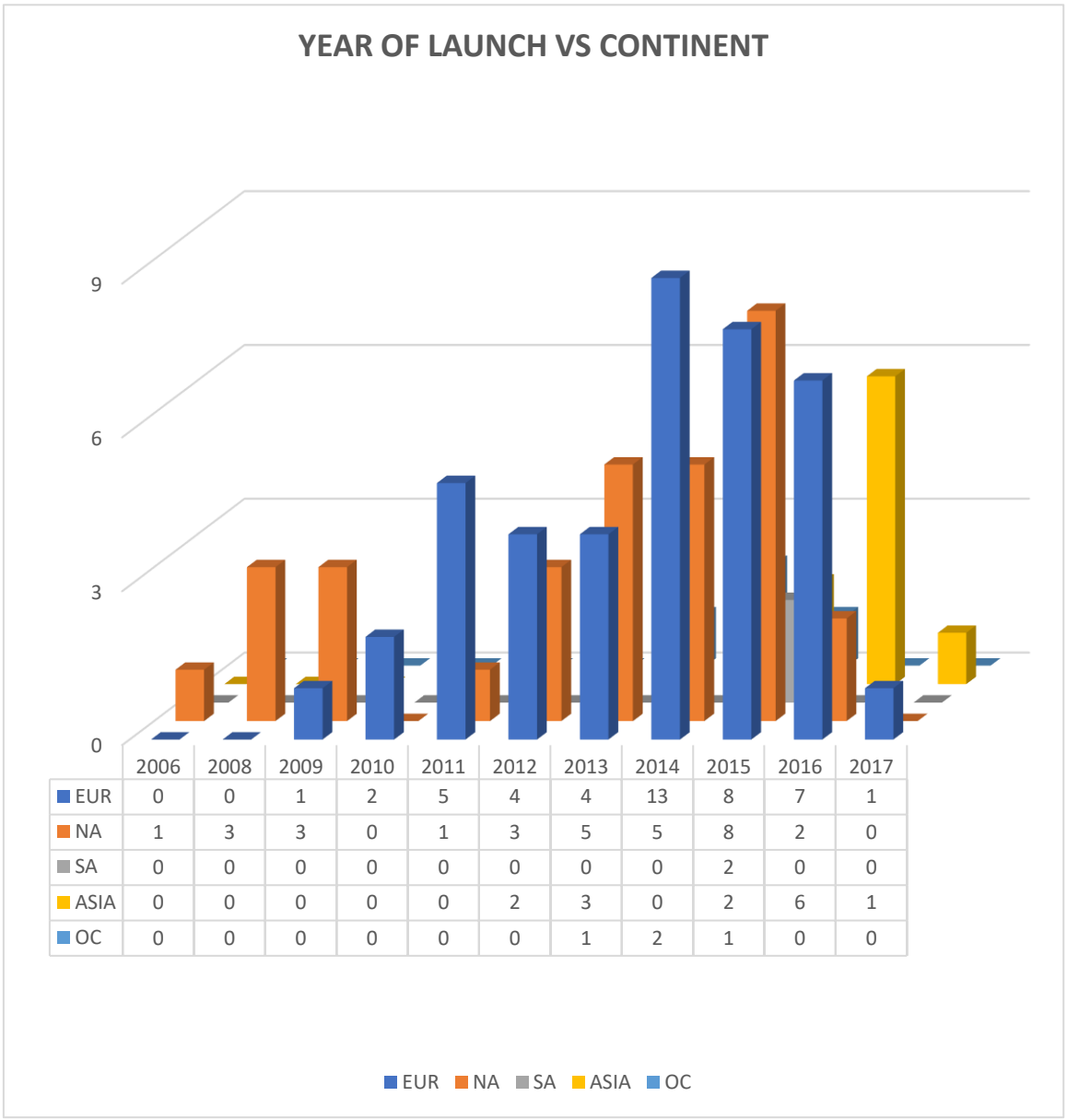


Figure 4.2 Year of Launch

As far as asset management is concerned, the fintech phenomenon has experienced an almost continuous growth over the years, as customers become more and more conscious about the potential advantages of newcomers (e.g. lower fees). Data on the last year is not significant because many start-ups might not have received any financing yet or the source used (i.e. Crunchbase) may have not collected yet some information about the most recently-founded companies.



	2006	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
EUR	0	0	1	2	5	4	4	13	8	7	1
NA	1	3	3	0	1	3	5	5	8	2	0
SA	0	0	0	0	0	0	0	0	2	0	0
ASIA	0	0	0	0	0	2	3	0	2	6	1
OC	0	0	0	0	0	0	1	2	1	0	0

Figure 4.3 Year of Launch vs Continent

From this graph, instead, it is possible to observe that the fintech wave started in North America and then spread all over the world, probably with Europe as first follower, while the other continents lag behind.

4.2.3 Financing

It was possible to find information of 60 companies: 21 based in Europe (of which 5 in UK), 24 in North America (of which 18 in US and 6 in Canada), 1 in South America, 12 in Asia and 2 in Oceania.

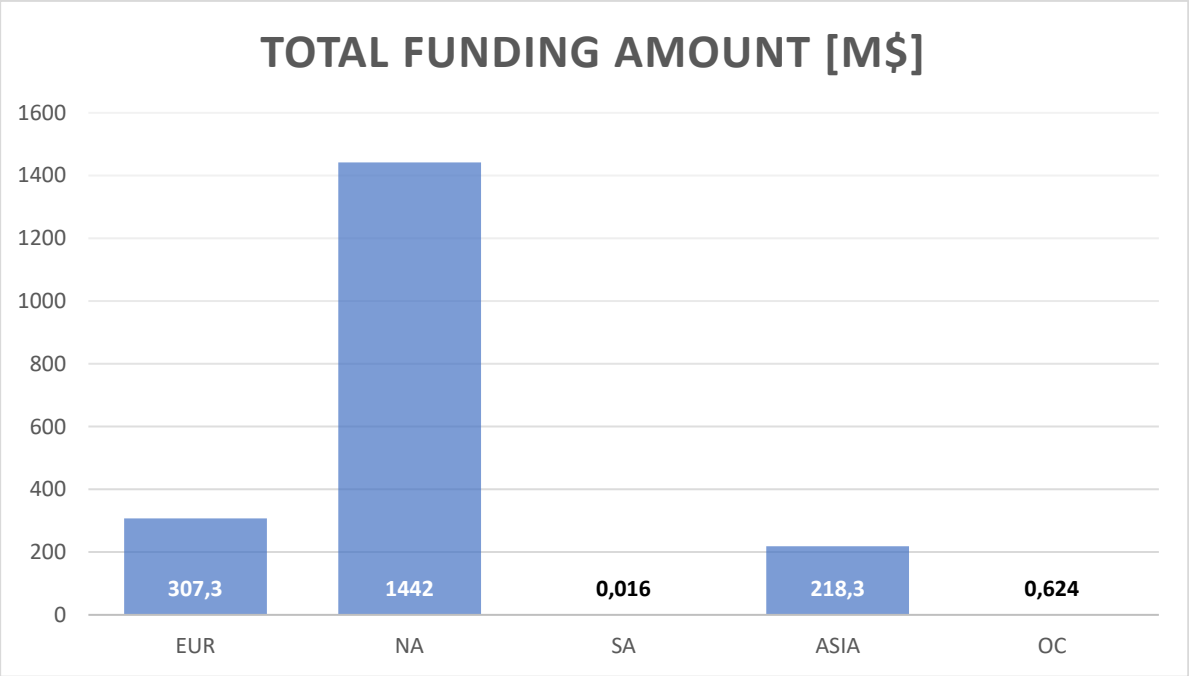


Figure 4.4 Total Funding Amount

Despite the number of start-ups is similar, North American ones have collected 4.7 times more funds, meaning that the American market is much more developed and appealing to investors. South America and Oceanian data are not relevant as it was possible to analyse only very few start-ups: respectively Vérios ($ 1.58m) for SA, Clover ($ 2m) and Stockspot ($ 4.24) for OC. More in detail, for the other 3 areas:

- In Europe the average is $ 14.6m, if the UK is excluded the average becomes $ 10.55m, UK average is instead $ 27.7m. In UK, indeed, there are 3 start-ups that have raised more than $ 20m; Nutmeg has collected the most with $ 89.7m. Not far behind there is Moneyfarm, an Italian start-up that has collected $ 83m.

- In North America the average is $ 60m; Betterment, headquartered in US, has collected the most with $ 275m. It is interesting to notice that the first 3 start-ups in terms of funds raised (namely Betterment, Wealthfront and Personal Capital) are all based in US and, despite representing 1/8 of the sample, they account for almost half of the total funding amount in NA.
- In Asia the average is $ 18.2m, higher than Europe; Dayli Financial Group has collected the most with almost $ 97m, accounting for more than 44% of Asian total funding amount.

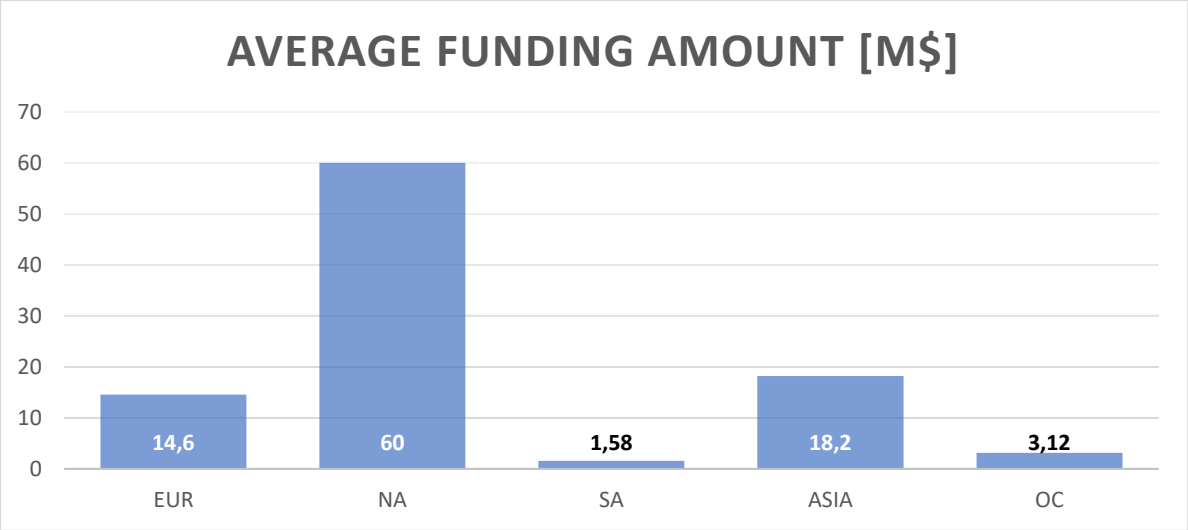


Figure 4.5 Average Funding Amount

4.2.4 AuM

As said before, for some start-ups multiple sources of AuM data were found. The figure actually used to make further analyses is the AuM coming from Form ADV (only for some US companies), the most recent AuM data for all the others. There are only 3 exceptions to this rule of thumb:

1. Aspiration: since this US company declared in the Form ADV to have AuM much lower than that found from other sources and to have only 2 investment management companies as clients, it was decided to use the most recent AuM data available.

2. Wealthsimple: this Canadian start-up filed an ADV form, probably because it operates also in US, declaring an AuM amount much lower than that retrieved from other sources, therefore it was decided to use the most recent AuM data available.
3. Ginmon: 2 very different AuM amounts were found, one referring to March 2017, the other to July 2017. Since the article in which the first source was found cited the second one claiming that it contained wrong information, the latest AuM data was not used.

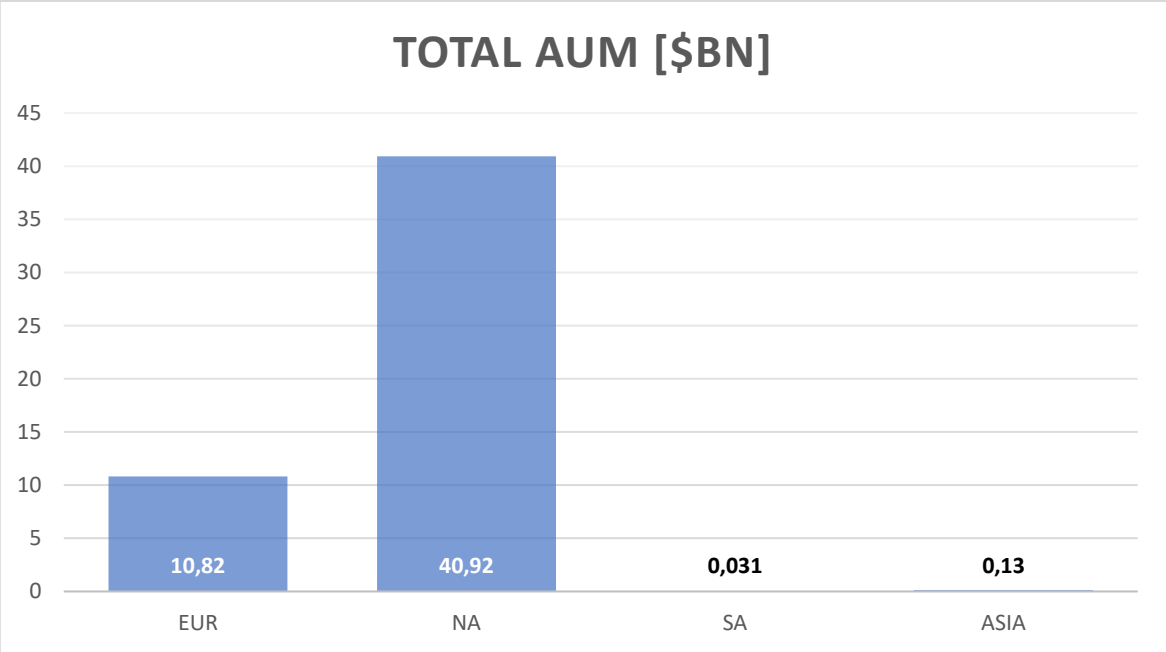


Figure 4.6 Total AuM

Data was found on 48 start-ups, of which 19 headquartered in Europe, 25 in North America, 3 in Asia, 1 in South America and no one in Oceania, for a total of almost $ 52bn and an average of $ 1.08bn.

Again, South America, Asia and Oceania figures are not relevant due to very low occurrences; more in detail, for the 2 most important areas:

- In Europe the total AuM is $ 10.8bn and the average is around $ 570m, while in UK the total is $ 6.7bn and the average is $ 1.68bn. The biggest company in terms of AuM is True Potential Investor with $ 5.3bn, which is based in UK.
- In North America the total AuM is $ 40.9bn and the average is $ 1.6bn. Similar to the total financing amount, the 3 biggest start-ups in terms of AuM (namely Betterment, Wealthfront and Personal Capital) are all based in US and, despite representing less than 12% of the sample, they account for more than 75% of total AuM.

Furthermore, it can be observed that American companies are on average almost 3 times larger than European ones in terms of AuM, probably because American households are more willing to invest money than European ones.

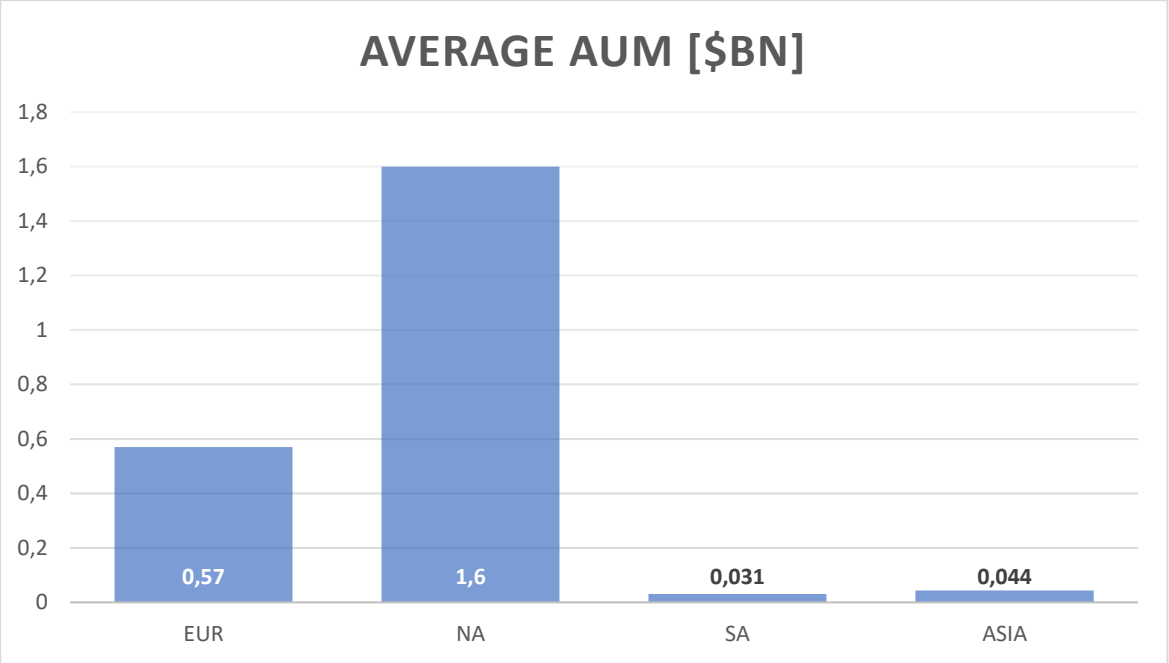


Figure 4.7 Average AuM

4.2.5 Instruments

Of the 96 companies in the sample, it was possible find data on the instruments purchased, suggested or made available of 71 start-ups. In the other cases either information was not found or there are no "instruments" because firms are B2B robo-advisors (i.e. they sell algorithms to other financial institutions or advisors). The graph shows how many start-ups use each instrument.

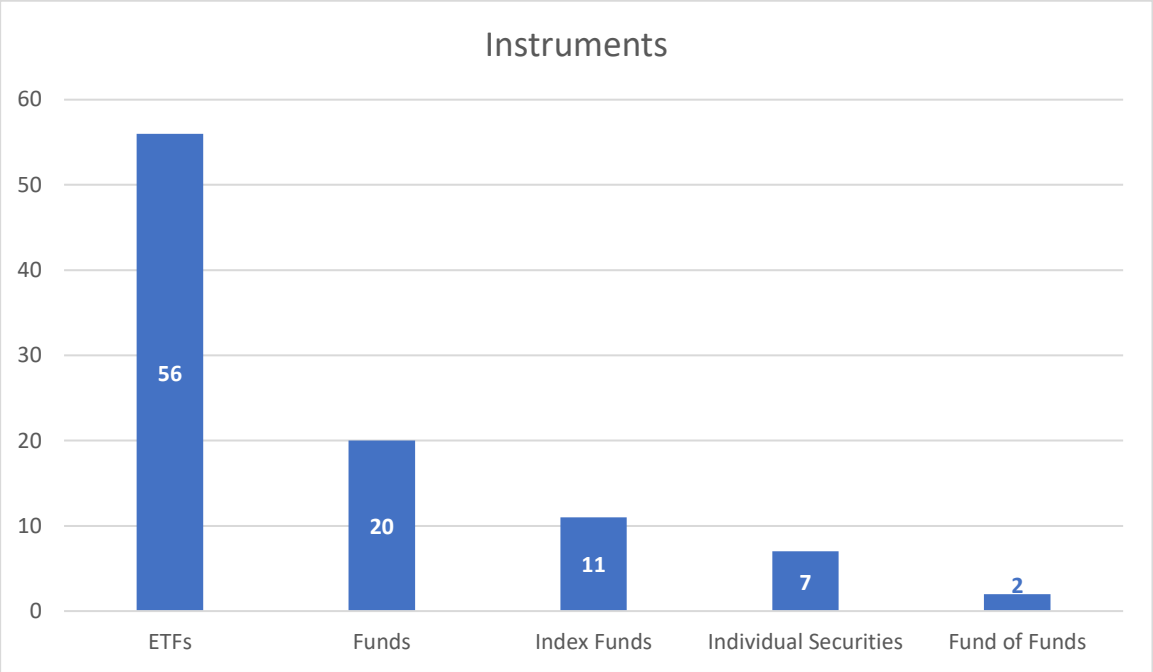


Figure 4.8 Instruments

Almost 79% of start-ups offer or recommend ETFs: the success of this financial instrument is related to the rise of passive management as well as to benefits such as low costs, usually ample liquidity, accessibility, transparency and high diversification. 15% of companies use index funds: they are not listed like ETFs and usually carry slightly higher costs, yet they track a market index and thus are passively managed. Other types of funds, in particular mutual funds, appear in 28% of cases and should be actively managed. More than half of these companies (13 out of 20) also offer ETFs or index funds, probably because they want to

complement passive strategies with active ones. Funds of funds are not relevant, as only 2 start-ups use them: one is US-based and offers only 2 investment products (both funds of funds), the other is Indonesian and lets the user invest in Asian funds (mutual funds, index funds and one fund of funds). Lastly, only 7 start-ups use individual securities in clients' portfolios; sometimes this is an additional option included in the premium service, in one case the company is a DIY platform and lets investors pick individual stocks besides ETFs.

4.2.6 Asset Classes

As far as Asset Classes are concerned, it was possible to find information for 73 start-ups. The very majority invests in Equity (72 start-ups, 98.63% of the sample), Fixed Income (73, 100%), and Emerging Markets (69, 94.52%). Stocks and bonds, indeed, are among the most important and traditional asset classes and even alone allow for a good diversification, given the fact that they offer many different risk-return profiles. Only one start-up, CoPower, lets the client invest exclusively in fixed income: it is the particular case of "green bonds", namely bonds used to raise funds for environmentally-friendly projects and initiatives. 44 start-ups invest also in Real Estate (60.27%), 43 in Liquidity (58.90%), 36 in Commodities (49.32%) and 10 in Others (13.70%).

Furthermore, 72 start-ups invest in more than one Asset Class, and 70 in more than 2. This number is much lower for start-ups that invest in more than 3 classes (55 start-ups) and 4 (42 start-ups). Only 26 start-ups use more than 5 classes, of which 5 start-ups invest at least in 6 classes. Some start-ups enable the customer to access certain asset classes only with the premium service: offering several asset classes increases diversification benefits but is likely to carry higher costs also for companies.

4.2.7 Allocation Method

It was possible to find the data about the Allocation Method for 22 start-ups. Of these 22, 8 start-ups employ more than a method, 1 start-up uses 3 methods. Moreover, 20 start-ups employ the MPT, 2 the MDR, 4 the BL, 4 FF and 1 Other. Therefore, Modern Portfolio Theory is the most common among the sample, employed by a number of start-ups 5 times larger than the ones that use Black-Litterman or Fama-French. Furthermore, 20 represents the 90.91% of the sample.

4.2.8 Channels

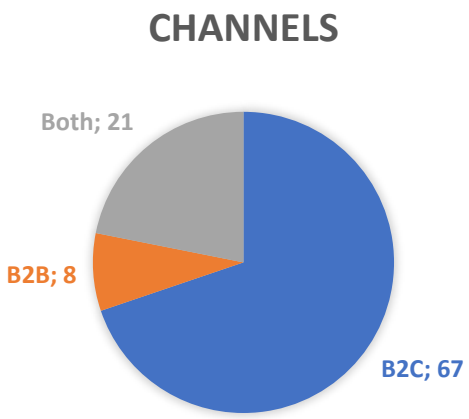


Figure 4.9 Channels

Figure 4.9 shows the channels used by start-ups. Moreover:

- Around 70% of start-ups (67 out of 96) are B2C only; the majority is represented by robo-advisors that, besides portfolio construction, also take care of the trade execution. Some players simply recommend portfolios based on client's characteristics but are not in charge of the execution phase; few provide a more

holistic financial planning to retail customers. 5 start-ups are focused exclusively on pensions: they consolidate and optimize clients' pension accounts. 2 companies offer micro-investing accounts: they automatically invest users' spare change. 3 start-ups are platforms for DIY (Do It Yourself) investors but may also suggest portfolios or give the possibility to talk with an advisor. Lastly, there is a firm offering solely green bonds, that is, fixed-return debt instruments aimed at raising funds for environmentally-friendly projects or initiatives.

- Slightly more than 8% of the sample (8 out of 96) consists of B2B companies; they all sell complete robo-advisory solutions or some building blocks (specific algorithms) to financial intermediaries.

22% of start-ups (21 out of 96) have both components; almost all are B2C robo-advisors that also sell automated investment solutions to third-parties. There are 2 major exceptions: one is focused on pensions but also provides services to financial advisors that manage 401(k) plans for their clients, the other is a micro-investing app (analyses clients' spending habits and automatically invests small amounts) that also sells its solution to other businesses.

4.3 Customer Profiling

After the definition of the start-up sample, an analysis of the process of the online portfolio building was conducted. The objective is to examine the questions that are asked to clients in the phase of profiling and portfolio building. In fact, some of the start-ups allow clients to start investing directly online, or, at least, to assess the risk profile of the customer and simulate a portfolio. The customer has to answer few questions; thus, a risk profile is created, and a portfolio can be built. Moreover, questions vary from start-up to start-up, there are huge differences in the types of the ones asked, the number, and the way they are proposed. Thus, an analysis of this flow of questions is useful to understand how customers are profiled and what kinds of information are used to build the portfolio and, especially, to assess the risk profile.

4.3.1 Sample Composition

Among the 96 start-ups in our sample, the portfolio simulation of 52 of them has been conducted. These 52 start-ups are the ones that allow to do a simulation and build a portfolio on their website. Furthermore, were excluded from the analysis all the ones that required to register a bank account or a credit card before starting. On the contrary, the ones that required only to create an account using an e-mail address were considered.

4.3.1.1 Geography

Of these 52 start-ups, 5 are headquartered in Asia, 3 in Oceania (all of them from Australia), 27 from Europe (all from the European Union, including the United Kingdom), 15 in North America, 2 in South America.

Furthermore, going more in details, it is possible to divide the start-ups based on the specific country in which they have they headquarter:

- the 5 Asian start-ups are 1 based in the United Arab Emirates, 1 in Singapore, 3 in Indonesia;
- the 27 from the EU (the all European start-ups are from EU countries) are split in this way: 3 headquartered in Italy, 2 in France, 9 in Germany, 1 in Belgium, 1 in Finland, 3 in Spain, 1 in Luxembourg, 1 in Hungary, 6 in the United Kingdom;
- the 15 based in North America are 8 headquartered in the United Stated and 7 in Canada;
- both the start-ups based in South America have they headquarters in Brazil.

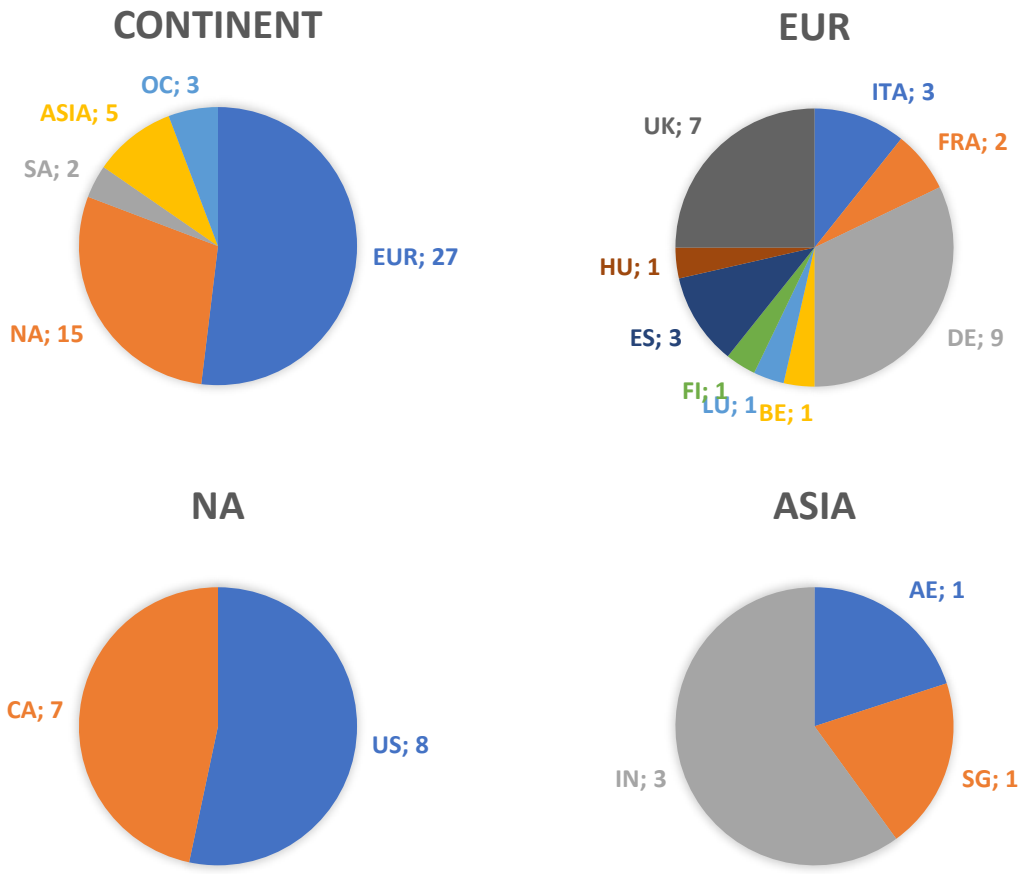


Figure 4.10 Geographical distribution

As shown in figure 4.10 the largest part of the sample is composed by start-ups based in Europe (European Union, including the United Kindgom) or in North America (in total 81% of the sample). Moreover, Europe alone represents the 52% of the 52 start-ups analysed, where Germany and the United Kingdom account for the 33% and the 22% of the European sample, respectively.

Furthermore, Germany (9) is the most represented country in the sample, more than the United States (8), Canada (7) and the United Kingdom (6). These 4 countries are the only ones that account for more than 3 start-ups. As far as Asia and South America are concerned, Indonesia and Brazil are the most represented countries of these continents, respectively, with Brazil as the only South American country.

4.3.1.2 Year of launch

To go further in details in the analysis of the sample, the next histogram represents the distribution of the founding date of each start-up.

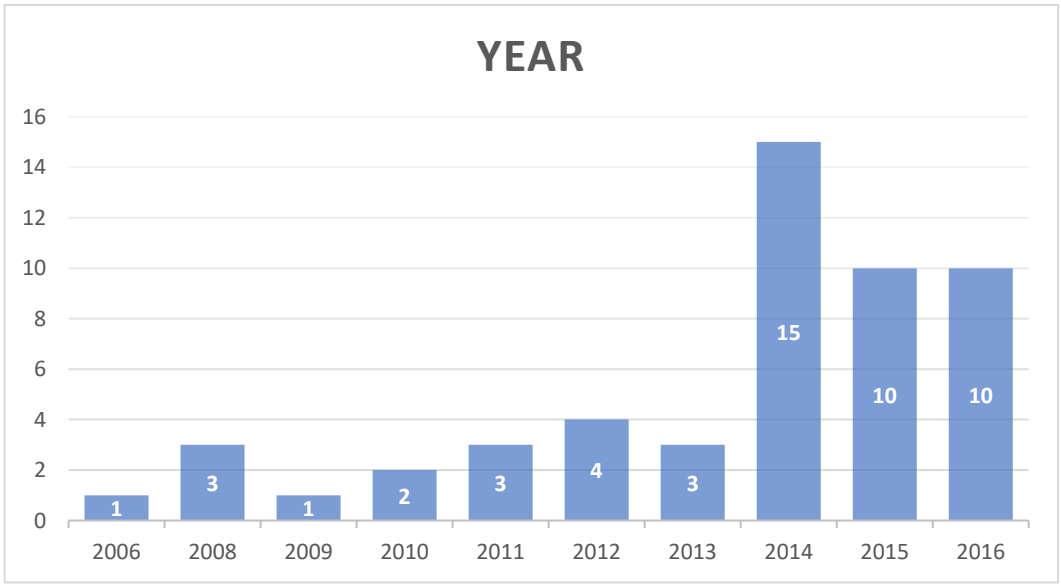
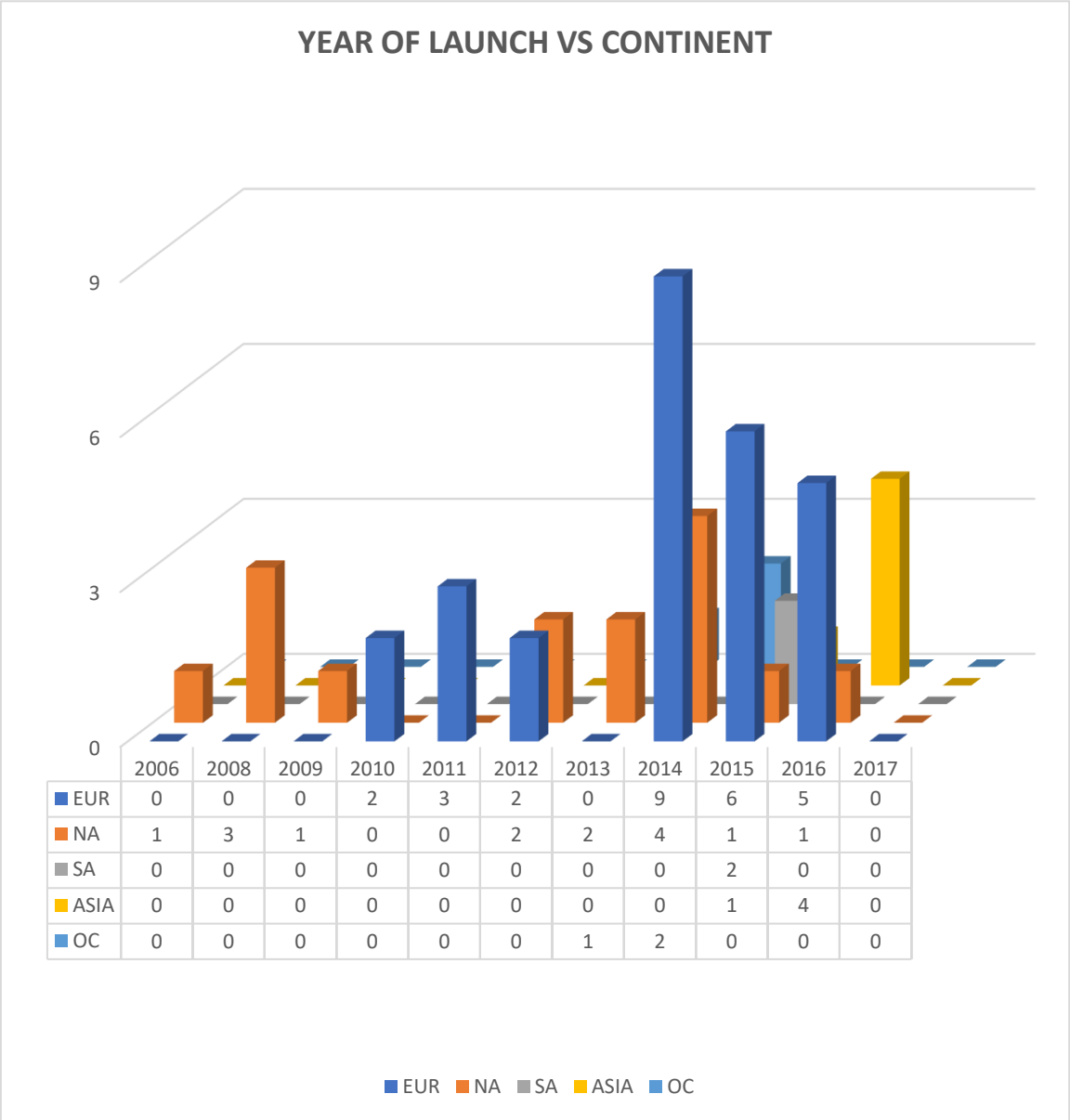


Figure 4.11 Year of Launch

Figure 4.11 shows that most of the start-ups in the sample are recent. In fact, only 17 of the 52 start-ups were founded before 2014 and only 5 before 2010, all the 5 founded in the US. Moreover, the oldest European start-ups in the sample are AdviseOnly (Italy) and Nutmeg (United Kingdom), both founded in 2010.

As far as South America, Asia and Oceania are concerned, only Stockspot (Australia) was founded before 2014, in fact, it was established in 2013.



	2006	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
EUR	0	0	0	2	3	2	0	9	6	5	0
NA	1	3	1	0	0	2	2	4	1	1	0
SA	0	0	0	0	0	0	0	0	2	0	0
ASIA	0	0	0	0	0	0	0	0	1	4	0
OC	0	0	0	0	0	0	1	2	0	0	0

Figure 4.12 Year of Launch vs Continent

4.3.1.3 Financing

Considering the capital collected, it was possible to find the information of 32 start-ups: 4 headquartered in Asia, 2 in Australia, 1 in South America, 13 in the European Union (including the United Kingdom), 12 in North America. The detailed results of each round of fund raising were analysed. Each round was converted in US dollars using the exchange rate of the date of the round. After that, the values in US dollars were summed in order to compute the total amount of funding.

Each of the 32 start-ups has collected at least $ 0.1m; however, only few of them managed to collect much more, in fact:

- 28 of them collected more than $ 0.5m;
- 25 more than $ 1m;
- 15 more than $ 5m;
- 8 more than $ 10m;
- 6 more than $ 50m;
- 4 more than $ 100m;
- 2 more than $ 200m;
- 1 collected $ 275m.

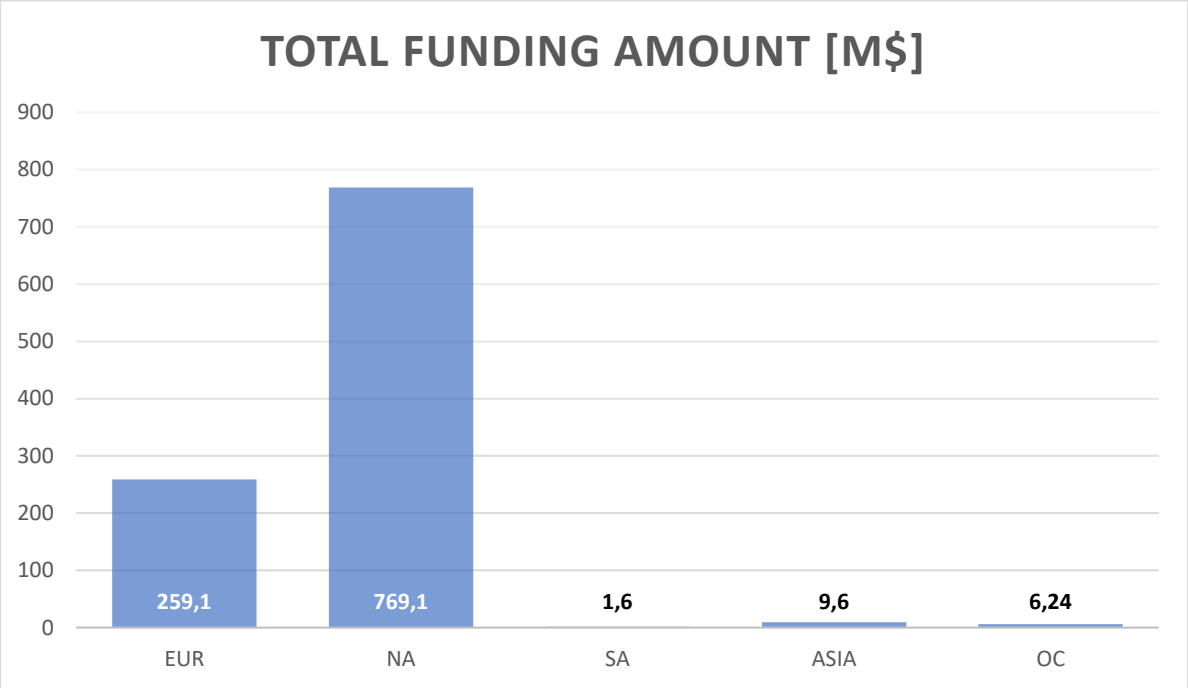


Figure 4.13 Total Funding Amount

Furthermore, the average capital raised is $ 32.3m, the median is $ 4.5m.

Going deeper in details in details, it was possible to consider the capital raised based on the headquarter:

- in Asia the total is $ 9.6m, the average is $ 2.4m and the median $ 0.72m. The Singaporean StashAway collected the most, with $ 8.04m;
- in Oceania the total is $ 6.24m, the average and the median are $ 3.12m, Stockspot collected the most, with $ 4.2m;
- in South America there were data available only for Vérios, that collected $ 1.6m;
- in Europe the total is $ 259.1m, the average is $ 19.9m and the median $ 3.8m. Nutmeg collected the most, with $ 89.83m;
- in North America, the total is $ 769.08m, the average is $ 64.09m and the median is $ 7.2m. Betterment, established in the US in 2008, collected the most: $ 275.0m.

Figure 4.14 highlights the average funding amount. As the graph shows, South America, Asia and Oceania are way lower than the other geographical areas. This is also biased by the small size of these three samples. In fact, Europe and North America have much more occurrences. Moreover, it is easy to notice that the average funds collected by Northern Americans start-ups is more than three times the one of Europe.

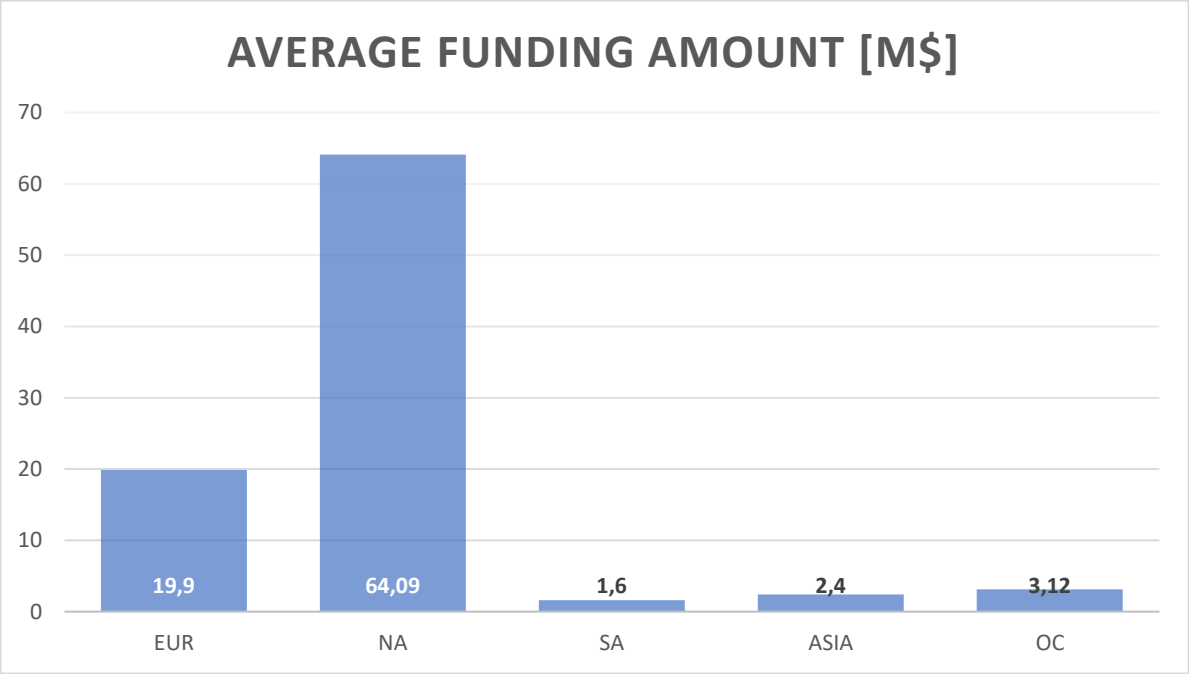


Figure 4.14 Average Funding Amount

4.3.1.4 AuM

Data was found on 27 of the 52 start-ups in the sample, of which 16 headquartered in Europe, 9 in North America, 1 in Asia, 1 in South America and no one in Oceania, for a total of almost $ 36bn and an average of $ 1.38bn.

As said before, for some start-ups multiple sources of AuM data were found. The figure actually used to make further analyses is the AuM coming from Form ADV (only for some US companies), the most recent AuM data for all the others. There are only 2 exceptions to this rule of thumb:

1. Ginmon: 2 very different AuM amounts were found, one referring to March 2017, the other to July 2017. Since the first source was found in an article that cited the second one claiming that it contained wrong information, the latest AuM data was not used.
2. Wealthsimple: this Canadian start-up filed an ADV form, probably because it operates also in US, declaring an AuM amount much lower than that retrieved from other sources, therefore it was decided to use the most r

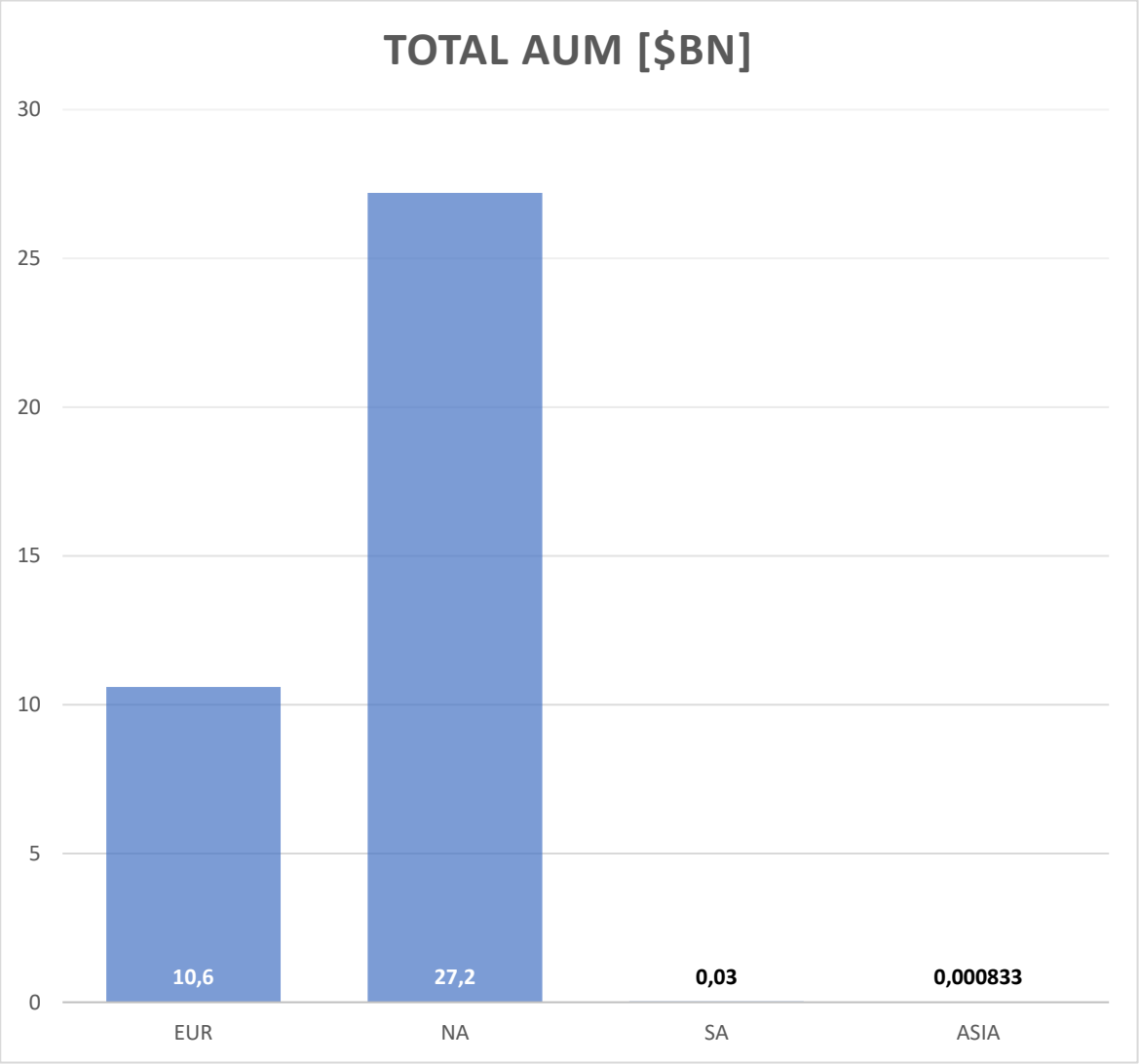


Figure 4.15 Total AuM

Again, South America, Asia and Oceania figures are not relevant due to very low occurrences; more in detail, for the 2 most important areas:

- In Europe the total AuM is $ 10.6bn and the average is around $ 663m, the median is around $ 83m. The biggest company in terms of AuM is True Potential Investor with $ 5.3bn, which is based in UK.
- In North America the total AuM is $ 27.2bn and the average is $ 3.0bn, the median around $ 211m. Similar to the total financing amount, the 2 biggest start-ups in terms of AuM (namely Betterment, Wealthfront) account for the 89.4% of the North American total AuM.

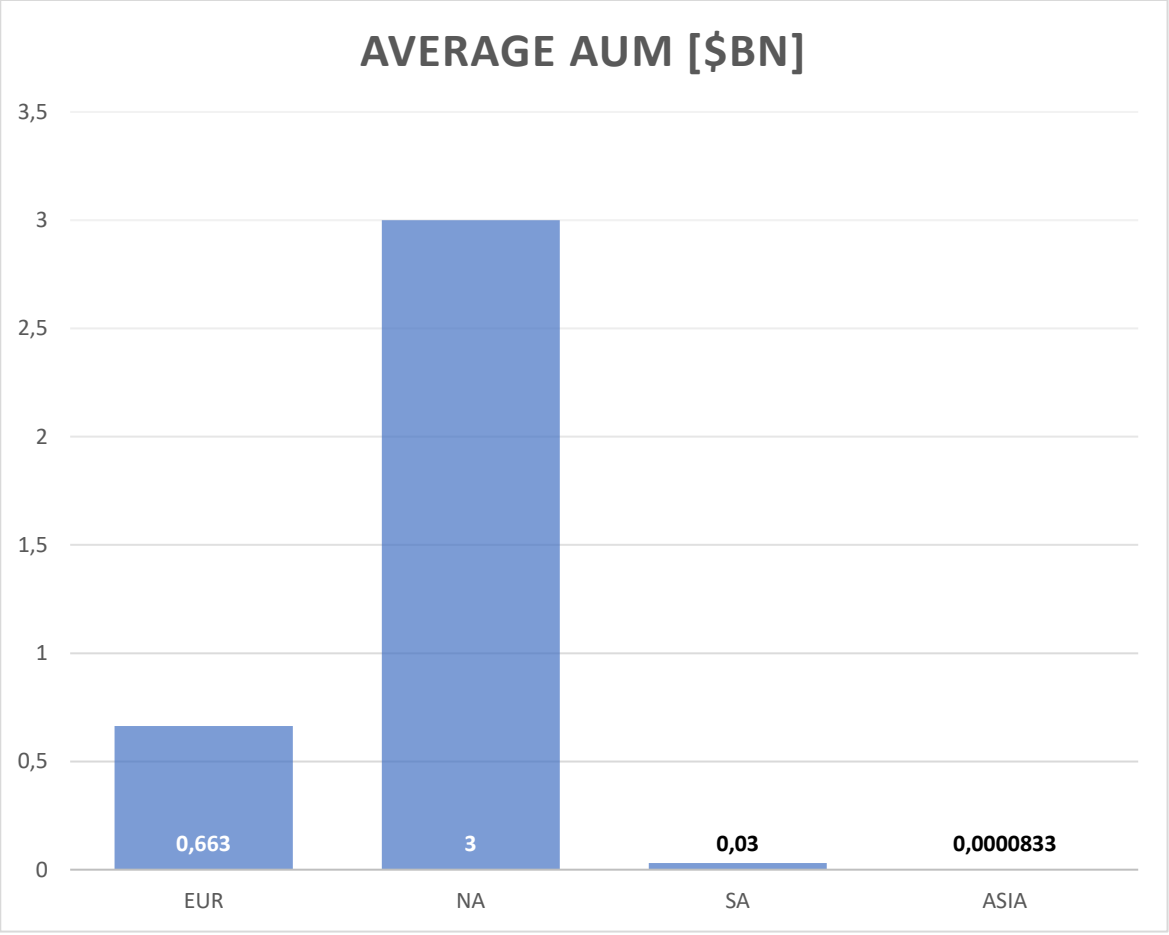


Figure 4.16 Average AuM

4.3.1.5 Instruments

It was possible to find information about the instrument purchased for 49 of the 52 start-ups. 40 of them employ the ETF (76.92%, in line with the whole sample), 13 employ Funds, 8 Index Funds, 3 Individual Securities and only 1 Fund of Funds. 15 start-ups employ more than an instrument and 2 start-ups use 3 instruments.

4.3.1.6 Asset Classes

Information was found for 51 of the 52 start-ups. The Asset Classes with the largest number of start-ups that invest in them are Equity (51 start-ups, 100% of the sample), Fixed Income (51, 100%) and Emerging Markets (50 start-ups, 98.04%). Moreover, 29 start-ups invest also in Real Estate (56.86%), 28 in Liquidity (54.90%) and 27 in Commodities (52.94%). Others account only for 8. Of these 51 start-ups, they all use more than 1 class, while 49 more than 2 and 38 more than 3. Moreover, 29 start-ups use more than 4 classes, 19 more than 5 and 3 more than 6.

4.3.1.7 Allocation Method

It was possible to find information about the Allocation Method for 19 start-ups among the 52 the allow to build a portfolio online. Of this 19, the very majority employ the MPT (17 start-ups), 2 the MDR, 4 the BL, 4 the FF, and 1 others.

4.3.1.8 Channel

All these 52 start-ups are either exclusively B2C or B2C plus other channels. This is not surprising, since the possibility to build a portfolio online is a B2C service. In particular, 37 start-ups are B2C only, while 15 have both B2C and B2B components.

4.3.2 Portfolio simulation analysis

To conduct the analysis of the online simulation, one by one, a portfolio simulation for each start-up was done (updated to July 2018). With most of the start-ups it is possible to follow different paths based on the answers to some specific questions and, especially, based on the plan or objective selected. Therefore, it is necessary to define a criterion in order to have a standardized methodology in the way in which the questions are answered. Moreover, the questions were answered in order to follow the longest possible path (i.e. if it is asked if you have children, 'yes' is answered, so it is possible to see the following question about children; otherwise, if 'no' was answered the following question would be missed).

Furthermore, most of the start-ups offer the possibility to choose between different plans or objectives. Based on the one selected, the path and possible questions can be different. Therefore, for the analysis, were always chosen the most generic and standard plan or objectives possible. In fact, most of the start-ups have, among all, a generic plan of investment which is not linked to any specific objective (i.e. some plans are linked to retirement or savings for children education). It is called, for example, 'individual non-taxable general investing', 'other', 'custom', 'increase capital', 'increase savings', 'long-term investment'. However, some of them have only one plan or have a specific target (i.e. retirement), thus, in that case, the only possibility available was chosen. That is, for example, the case of fincash.com.

While all the simulations were performed, a screenshot of each question and information displayed was taken, in order to have the possibility to analyse and check them afterwards. In this way, it was possible to analyse all the questions and information provided and to create a specific database.

The analysis was divided in two different parts:

- **Questions:** the questions asked to the client to assess its risk profile and build a portfolio. In this part of the analysis all the possible questions were collected, then divided in macro categories and categories;
- **Outcome:** the results of the risk assessment and the portfolio built. In fact, the information displayed about the risk profile and the portfolio varies from start-up to start-up. Many start-ups show risk and performance indicators, providing details of the allocation of the portfolio in specific asset classes. All the possible information was collected, analysed and divided in categories.

4.3.2.1 Questions

In total, 295 different questions were found. It was possible to identify similarities among them; thus, they were divided in 5 macro categories. Moreover, each macro category was subdivided in categories and in single questions that are composed by different variations of the same request. Differences between these variations can be either graphic (i.e. selection from a box or the possibility to write the answer) or in the way the question is asked.

The 5 macro categories were divided in categories, and they are:

1. **Personal information**: any personal information related to customers themselves that is not a financial information nor related to the risk profile. Part of this macro category are the following categories:

a. **Age**: the age of the investor;
b. **Gender**: the investor gender;
c. **Residence/citizenship**: the client's residence/citizenship;
d. **Family situation:** any question related to the family of the client, as well as its composition;
e. **Education**: customers' education;
f. **Retirement**: any questions regarding the expectations of the client about their retirement, especially the age when they wish to retire or the plans they might of for their retirement.

2. **Financial situation**: any information related to the financial situation of the customer. The categories included in this macro category are:
    a. **Assets**: this category refers to the total level of assets held by the client, their composition and the customers' total net worth;
    b. **Patrimonial situation**: any question regarding the client's patrimony and non-liquid assets owned;
    c. **Debts**: the debts that the customer has;
    d. **Income situation**: the income situation of the client;
    e. **Investments and financial situation**: questions related to the value of liquid assets and investments owned by customers;
    f. **Current investments**: specific investments held by clients or their spouse, including, for example, group work benefits.
3. **Risk propensity**: all the questions asked with the aim to assess the risk profile of the customer and its risk tolerance. This macro category is composed by the following categories:
    a. **Risk-return relationship**: qualitative and quantitative questions that offer different alternatives of risks and returns among which it is possible to choose. The aim is to assess the relationship between risk and returns that the client expects to have;

   b. **Feeling with losses**: questions that try to assess how comfortable the customer is with losses and the impact that losses would make on customer's life;
   c. **Qualitative profile**: a qualitative profile of the customer is assessed, with questions that try to identify the client's behaviour as investor, their expectations. Moreover, are included in this category any kind of qualitative question related to the relationship of the client with risk and how they see it or behave as risk takers;
   d. **Scenario analysis**: different scenarios of investments or real-life possibilities are proposed.

4. **Knowledge/experience**: this macro category has the aim to evaluate the customer knowledge or experience about finance and financial instruments and services. This macro category is composed only by two categories:
   a. **Studies and financial knowledge**: information about their financial studies are asked to clients, as well as own assessment of knowledge about generic financial instruments and services. There are also questions that address specific financial issues in order to evaluate customers' knowledge of the financial sector;
   b. **Previous experience**: questions regarding previous experience of the customers in the financial world as investors, such as the frequency of investing or specific instruments and services used, as well as losses suffered in the past.
5. **Investment related:** this macro category is related to the specifics of the investment to be made, thus, in includes any question that clearly affects the investment and that is clearly linked to the characteristics of the investments. The categories in which is divided are:
   a. **Investment**: the size of the investment to be done;
   b. **Target**: the monetary objective of the customer;
   c. **Plans**: what type of plan the investor wants to choose. In fact, many start-ups allow to choose among different plans. A plan is when the choice has a direct

implication on the type of investment and, sometimes, for tax purposes, as for example, a retirement plan;

d. **Objectives**: the main reason why the customer is investing. It is not related to level of risk to take or the desired return, but to the final goal of the investment (i.e. save for children education or to buy a house);
e. **Investment Choices**: specific choices that the customer can make about the investment allocation;
f. **Strategy**: questions about the kind of strategy that the customer wants to follow for the investment;
g. **Periodic investment**: the possibility for the customer to increase the amount invested on a periodic basis;
h. **Time horizon/duration**: for how long the client intends to hold the investment;
i. **Liquidity**: questions about the level of liquidity of the investment or the possibility to withdraw;
j. **Details**: additional details related to the investment that are not included in the previous categories.

4.3.2.2 Outcome

The same methodology was used for the outcome. All the information shown by the start-ups after the simulation was collected. In total, 56 different kinds of information or different ways to show the same information were found. These 56 types of information were divided in different categories.

The categories of the outcome's information are:

1. **Choice among alternatives**: the possibility to choose among different alternatives or plans. In fact, after the simulation, in some cases there is the possibilities to choose

among different portfolios with different performances and risks and with a different asset allocation;

2. **Portfolio allocation**: the functions that allow to influence the portfolio allocations based on the customers' preferences;
3. **Return**: all the indicators and future and past performances that shows the returns and results of the investment;
4. **Risk**: all the indicators about the portfolio and about past or future performances that highlight the level of risk taken by the portfolio;
5. **Fees**: all the possible fees displayed and highlighted related to the investment and the services provided by the start-up for the portfolio;
6. **Comparison**: comparisons of different indicators, of risk, returns and fees, between the portfolio shown and other entities;
7. **Details**: further details about the investment such as social implications of the allocation or liquidity indices.

4.3.3 Screenshots and presentation

Completed the reorganization of the screenshots in macro categories and categories, the screenshots were collected in a PowerPoint presentation. This process was done in order to store the data and easily analyse it with the further aim of building a spreadsheet database to go deeper in the data analysis. Each category has been divided in subcategories and groups that ask the same questions, or, for the outcome part, show the same information, in different ways.

Since most of the questions seem to be very similar or too different, it was really difficult to define the boundaries of the categories and to identify in which category the screenshots had to be put. In fact, in some cases some questions were ambiguous, and it was difficult to define what the aim was. In this case, to have the best subdivision, the most important thing was to understand what the purpose of the question was. For example, there were many different

questions that ask what the objective of the customer is. However, some of them are related to the reason why the client is investing, as it can be to buy a house or to save for children education. The others are referred to the risk propensity, especially to the return and possible losses relationship (i.e. the question is what the objective of the investor is, the possible answers are to maximise returns or minimize losses). Thus, these different kinds of objectives were put in different categories.

This process was done both for the questions and the outcome parts:

- **Questions**: for the questions part each category was divided in groups of screenshots in which the same question is asked in different ways;
- **Outcome**: in this part, each category has been divided by screenshots that show the same information or the same function to modify the portfolio built.

4.3.3.1 Questions

In this section, all the groups of questions identified are presented.

Personal information

1. **Age**:
    a. *Date of birth:* the client's birthday;
    b. *Precise age:* the precise age of the customer;
    c. *Age classes:* the selection among classes of the age of customers;
2. **Gender**: no further subdivisions;
3. **Residence/citizenship**: no further subdivisions;
4. **Family situation:**
    a. *Marital status:* if the customer is married or not;

   b. *Children:* how many children the client has;
   c. *Investor characteristics:* this question is related to personal characteristics of the client, especially about the description of the household;
5. **Education**: no further subdivisions;
6. **Retirement**:
   a. *Current situation and expectations*: regarding the current situation of customers (if they are retired or not) and when they are planning to retire.

Financial situation

1. **Assets**:
   a. *Total assets:* the total value of the assets owned by the customer;
   b. *Net worth:* the total net worth of the client;
   c. *Composition of assets:* how the client's wealth is distributed among different assets (liquid, savings, non-liquid);
2. **Patrimonial situation**:
   a. *Own your house:* if investors own their house;
   b. *Non-financial assets:* level of the non-financial assets owned;
3. **Debts**:
   a. *Existing debts:* the value of the customer's debts;
   b. *Debts as a % of income:* the value of customer's debt in percentage of their income;
   c. *Type of debts:* the kind of client's debt;
   d. *Mortgage monthly payment:* the amount of the monthly payment of the mortgage;
4. **Income situation**:
   a. *Gross income*: the client's gross income;
   b. *Net income*: the client's net income;

c. *Income and expenses*: the income of the customer and their periodic expenses;
d. *Other components' income*: the income of the other components of the client's family;
e. *Source of income*: the source of the customer's income;
f. *Stability of income*: how customers expects their income to be stable in the future;
g. *Periodical expenses*: the periodical expenses that the customer has;
h. *Periodical expenses as % of income*: the periodical expenses of the customer as percentage of their income;

5. **Investments and financial situation**:
    a. *Periodical savings:* the amount that the customer is capable to save periodically;
    b. *Periodical savings as % on income:* the percentage of their income that clients are able to save periodically;
    c. *Future expectations on savings:* the expectations that investors have on their savings;
    d. *Months of savings quickly accessible:* the amount of savings that the client is able to quickly have access to, measured in months;
    e. *Financial-liquid assets*: the value of financial and liquid assets owned by the investor;
    f. *Sustainability:* how customers' finances are sustainable without the need of the investment the client will make in this portfolio;
6. **Current investments**:
    a. *Workplace benefits:* if the customer has specific pension or group benefits at work;
    b. *Individual:* the kind of specific investments that the investor has holds individually;
    c. *Spouse:* the investments held by the customer's spouse.

Risk propensity

1. **Risk-return relationship**:
    a. *Qualitative alternatives:* the possibility to choose among different risk-return qualitative profiles, it is further divided in:
        i. *Scenarios:* scenarios that offer the possibility to choose between qualitative alternatives that have different risks/possible losses and returns;
        ii. *Risk/Return:* different alternatives of qualitative assessment of the risk and return desired;
        iii. *Loss/Return:* qualitative alternatives in order to assess the possible loss and return;
    b. *Quantitative alternatives:* different quantitative possibilities are presented in order to assess a risk-return profile;
    c. *Personal preferences and confidence:* they assess how what is the confidence of the customer with risk and return;
2. **Feeling with losses**:
    a. *What would you do if… (scenarios):* different scenarios to assess what the client would do if losses occurred;
    b. *How do you behave in a financial case:* how to the client reacts in different possible cases that occur investing;
    c. *Maximum loss and strategy:* what is the maximum loss needed before customers reaction and how they would act;
    d. *Loss and reaction:* the emotional view or reaction that the customer has after losses;
    e. *Impact of losses:* the impact that a loss in this portfolio would have on the customer's finances;
    f. *Quantitative definition:* the possibility for the investor to decide the level of a specific risk indicator of the portfolio;
3. **Qualitative profile**:

a. *Qualitative risk propensity:* a qualitative definition of the specific risk propensity of the customer;
b. *Type of investor:* what type of investor the client is, meaning what are their objectives and strategy. It is spit in three:
    i. *Generic;*
    ii. *Liquidity:* how customers keep liquid their investments;
    iii. *Partner:* what type of investor is the customer's spouse;
c. *Safety of the investment:* what is the customer preference for safe investments;
d. *What do you link the word risk with:* what kind of association the customer does with the word risk;
e. *Description of the risk propensity:* how the customer can be described as a risk taker. There are two type of this question:
    i. *Direct:* how customers describe themselves;
    ii. *Indirect:* how the customer would be described by others;
f. *Risk taker:* if the client generally takes some kind of risks (i.e. if they play lottery);
g. *Future expectations:* future financial expectation of the investor (i.e. expected inflation rate in the long term);

4. **Scenario analysis**:
    a. *Choice of the risky alternative vs safe:* the possibility to choose between a risky alternative or a safe one;
    b. *Choice of the risky alternative:* choice between different risky alternatives;

Knowledge/experience

1. **Studies and financial knowledge**:

   a. *Knowledge of financial instruments/services:* customers have to rate their knowledge on specific financial instruments and services;
   b. *Means of information:* how the customer keeps informed on the financial markets;
   c. *Specific tests:* questions about specific financial topic to understand how deep the client's knowledge is.

2. **Previous experience**:
   a. *Generic:* generic questions about the previous experience of customers in the financial field;
   b. *Financial instruments:* evaluate the clients' experience in specific financial instruments;
   c. *Financial services:* questions that rate the investors' experience in different financial services;
   d. *Duration/frequency:* how frequently and for how long had the client invested in financial instruments or used financial services;
   e. *Losses:* if the customer experienced losses and/or what was the amount of those losses.

Investment related

1. **Investment**:
   a. *Amount:* the size of the investment that the customer wants to do since the beginning;
   b. *Amount as % of savings:* the amount to be invested inserted as a percentage of clients' savings.
2. **Target**:
   a. *Amount:* the amounts that the client wants to have at the end of the investment period;

   b. *Return:* the desired return.

3. **Plans**: no further subdivisions;
4. **Objectives**: no further subdivisions;
5. **Investment Choices**:
   a. *Allocation:* specific decisions that the investor can make on the asset allocation of the portfolio.
6. **Strategy**:
   a. *Generic:* generic questions about the strategy to be followed for the investment;
   b. *Social responsible:* the strategy to be followed related to the social responsibility of the issuers of the assets to invest in.
7. **Periodic investment**: no further subdivisions;
8. **Time horizon/duration**:
   a. *Precise:* the precise duration of the investment desired by the investor;
   b. *Quantitative classes:* possibility to select the desired time horizon among classes of years (i.e. 0-10, 5-10, 10-15, 15+);
   c. *Qualitative:* a qualitative description of the expected time horizon of the investment.
9. **Liquidity**:
   a. *Minimum liquidity:* the possibility to specify the desired liquidity of the portfolio;
   b. *Withdrawal frequency:* with what frequency will the customer need to withdraw from this account;
   c. *Withdrawal before maturity:* if the customer will need to withdrawal before the agreed time horizon/duration;
   d. *Amount to withdraw:* the amount that the investor expects to withdraw from this account.
10. **Details**: no further subdivisions;

4.3.3.2 Outcome

In this section are explained all the groups of outcomes.

1. **Choice among alternatives**:
    a. *Alternatives per plan:* different alternatives for the same kind of plan are proposed;
    b. *Alternative plans:* different plans are shown.
2. **Portfolio allocation**:
    a. *Asset class:* the specific allocation of the investment in specific asset classes is presented;
    b. *Geography:* geographical allocation of the investment;
    c. *ETF/specific funds:* it is possible to see the specific allocation of the portfolio in specific ETFs or funds;
    d. *Historical dynamic allocation:* a graph shows how the allocation of the portfolio was changed in the past for similar portfolios.
3. **Return**:
    a. *1-month return:* the expected return in a month;
    b. *Historical return:* the returns that a similar portfolio would have performed in the last months/years;
    c. *% return:* the forecasted return of the portfolio in percentage;
    d. *Final value:* the expected value of the portfolio at the end of the agreed duration/time horizon;
    e. *Portfolio value over time:* the total value that the portfolio is expected to have in the future over time;
    f. *Historical Sharpe and Sortino ratios:* the historical value of the Sharpe and Sortino ratios of similar portfolios.
4. **Risk**:
    a. *Expected loss:* the maximum expected loss of the portfolio;
    b. *Recovery time value:* the time needed to recover from the expected loss;

c. *Volatility:* the volatility of the portfolio;
d. *Risk-return (qualitative):* qualitative representation of the risk correspondent to specific returns;
e. *VaR/CVaR:* the VaR and/or the CVaR of the portfolio;
f. *Max drawdown:* the expected max drawdown of the portfolio;
g. *Diversification index:* an index of the level of diversification of the portfolio;
h. *Shortfall probability:* the expected shortfall probability of the portfolio;
i. *Risk from 1 to x:* the risk level of the portfolio rated with a quantitative indicator (i.e. from 1 to 5);
j. *Qualitative risk profile:* the level of risk expressed with a qualitative indicator (i.e. with colours or from 'Low' to 'High');
k. *Historical data, downside volatility, max drawdown, volatility:* risk indicators that a similar portfolio would have had in the previous months/years.

5. **Fees**:
    a. *Administrative fees:* the percentage administrative fees on the portfolio;
    b. *Custody fees:* the percentage custody fees on the portfolio;
    c. *Entry fees:* the percentage entry fees on the portfolio;
    d. *Portfolio fees:* the percentage portfolio fees on the portfolio;
    e. *Management fees:* the percentage management fees on the portfolio;
    f. *Fund fees:* the percentage fund fees on the portfolio;
    g. *Trading fees:* the percentage trading fees on the portfolio;
    h. *Total fees:* the total fees on the portfolio.
6. **Comparison**:
    a. *Fees:* comparisons between fees of different entities;
    b. *Performance during crisis:* performances that the portfolio would have had in during specific crisis periods;
    c. *Expected return:* comparison between this portfolio and the market;
    d. *VaR:* comparison between the VaR of the portfolio and the average VaR of specific asset classes.
7. **Details**:

a. *Social impact:* social impact of the portfolio in different indicators (i.e. CO2 emissions or trees spread);
b. *Necessary investment:* the investment that is necessary to make in order to reach a goal;
c. *Suggested time horizon:* suggested time horizon to reach the goals of the portfolio;
d. *Income allocation:* how the income of the portfolio is allocated in different asset classes;
e. *Liquidity index:* an indicator of the liquidity of the portfolio;
f. *Financial situation at retirement:* what will be the financial situation of the customer at retirement.

4.3.4 Database

At this point, all the screenshots were collected, stored and organized. Thus, it was possible to build up a spreadsheet, suitable for a further quantitative analysis. Each start-up is a row and each column a question/information. All the questions and information are organised in the macro categories, categories and single question/information as listed above.

To go further in details, even the single question and information above mentioned were divided based on two criterions. First of all, it was divided by the linguistic way the question is asked, thus, to any slight difference it was given a column. Secondly, it was divided by the graphical way the question is presented, if for example the customer has to answer by writing the response or selecting from a box.

4.3.4.1 Spreadsheet organization

Each start-up is a row, each question, variation of question or variable a column. For each question (for the questions part) and each information (for the outcome part), in the row of a start-up, a 0 means that the question was not asked or the information not present, a 1 represents that the question was asked, or the information shown. Moreover:

- When more columns are the subdivisions of another column (i.e. single questions that are part of the same category), the subdivisions are presented first, then the column composed by them;
- *Green characters*: the categories part of macro categories;
- *Black characters*: single questions/information;
- *Light grey characters*: different typologies of the same question/information.

Questions

In the database, together with each question, it is also specified the graphical type in which it is asked. The possible types are:

- *Write*: when the customer has to write the answer;
- *Scroll*: when there is a rolling bar;
- *Scroll/write*: when 'scroll' and 'write' are both possible;
- *Select*: when there are different options;
- *Select from a box*: when it is possible to select among different options from a box;
- *Y/N:* when the answer is yes or no (in general the format of two words with / in between is used for any binary question).
- *Calendar:* it is possible to select a data in a calendar;
- *+ and -*: there two buttons, a '+' and a '-' that can be used to change the answer;

- *Write/+ and -:* it is possible either to write the answer either to change with a '+' and a '-' buttons;
- *Calendar/select:* there is both the possibilities to select among options or in a calendar;
- *Select/+ and -:* it is possible either to select or to change with a '+' or a '-';
- *Tick:* the customer can tick an answer if it is true;
- *Add each kid:* it is a particular case in which customers are asked about their children and they can answer adding kids;

Output

The graphical types in which information are shown are:

- *Select*: when there are different options;
- *Pie chart*: when the information is displayed as a pie chart;
- *Half pie*: the chart is only a half of a pie chart;
- *Bubbles*: when it is shown as a bubble graph;
- *Bar chart*: the information is displayed as a bar chart;
- *List*: a list without a graph;
- *Time series plot*: a graph shows the trend of a variable over time;
- *Value*: the value of the variable is displayed without graphs;
- *Different scenarios*: there are more values, it is the case when different scenarios are presented;
- *Qualitative graph*: a graph without numbers;
- *Score (out of)*: value of an indicator from 1 to a maximum value;
- *Gauge*: a qualitative indicator on a continuous bar;
- *Level*: qualitative indicator in a discrete way;
- *Description*: qualitative description of an indicator;

- *%*: if the value is expressed in percentage;
- *% and amount*: if the value is shown both in percentage and in its absolute amount;
- *Pie chart and bar chart*: both kinds of graphs are displayed;
- *Bar chart and time series plot*: both are shown;
- *Map*: a map shows the geographical allocation.

4.3.4.2 Columns

Therefore, it was possible to reach the maximum level of detail in the database. Moreover, it is possible in the spreadsheet to count either how many start-ups present the same question in that specific way or how many of them present the question in general. At the same time, it is possible to count how many of them have at least one question in each category.

4.4 Data Analysis of the whole sample

Once the database was complete and detailed, it was possible to use the data gathered in order to conduct a further analysis. The first level of analysis is conducted considering the whole sample and it was done separately for the *questions part* and the *outcome part*.

4.4.1 Questions

Out of the 96 start-ups in the database, 52 have the possibility to simulate a portfolio online. On average, the questions asked are 10.35, with a median of 10 and a standard deviation of 6.11. Analysing the macro categories, figure 4.17 shows how the questions are subdivided in the macro categories (the sum of the averages of the macro categories do not corresponds to the total average only due to the approximation of the values to the second decimal):

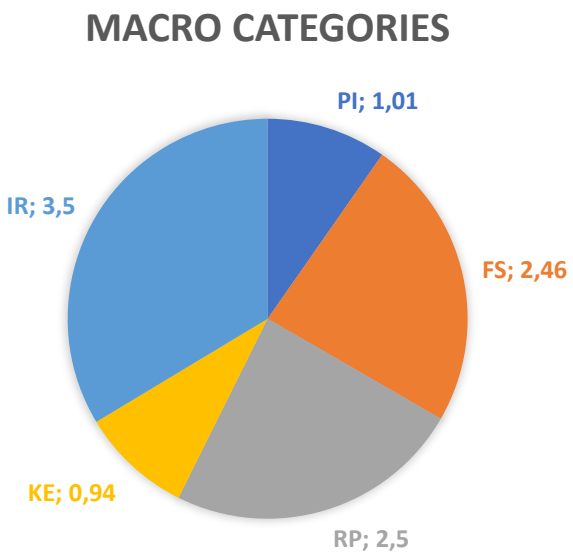


Figure 4.17 Macro Categories

- **Personal Information (PI):** 32 robo-advisors in the sample ask at least one question about this macro category, average is 1.10, the median 1 and the standard deviation is 1.59.
- **Financial Situation (FS):** 37 in the sample ask at least one question about investors' financial situation, the average is 2.46, the median 2 and the standard deviation is 2.67.
- **Risk Propensity (RP):** 49 start-ups ask at least one question about this macro category, average is 2.50, the median 2 and the standard deviation is 2.09.
- **Knowledge/Experience (KE):** 20 in the sample ask at least one question about investors' knowledge and experience. The average is 0.94, the median 0 and the standard deviation is 1.60.
- **Investment related (IR):** all the 52 robo-advisors in the sample ask at least one question about this macro category, average is 3.50, the median 3 and the standard deviation is 1.79.

4.4.1.1 Macro categories

The next level of analysis is related to the single category of each macro category. Figure 4.18 shows how many start-ups have at least one question in each category of **Personal Information**.

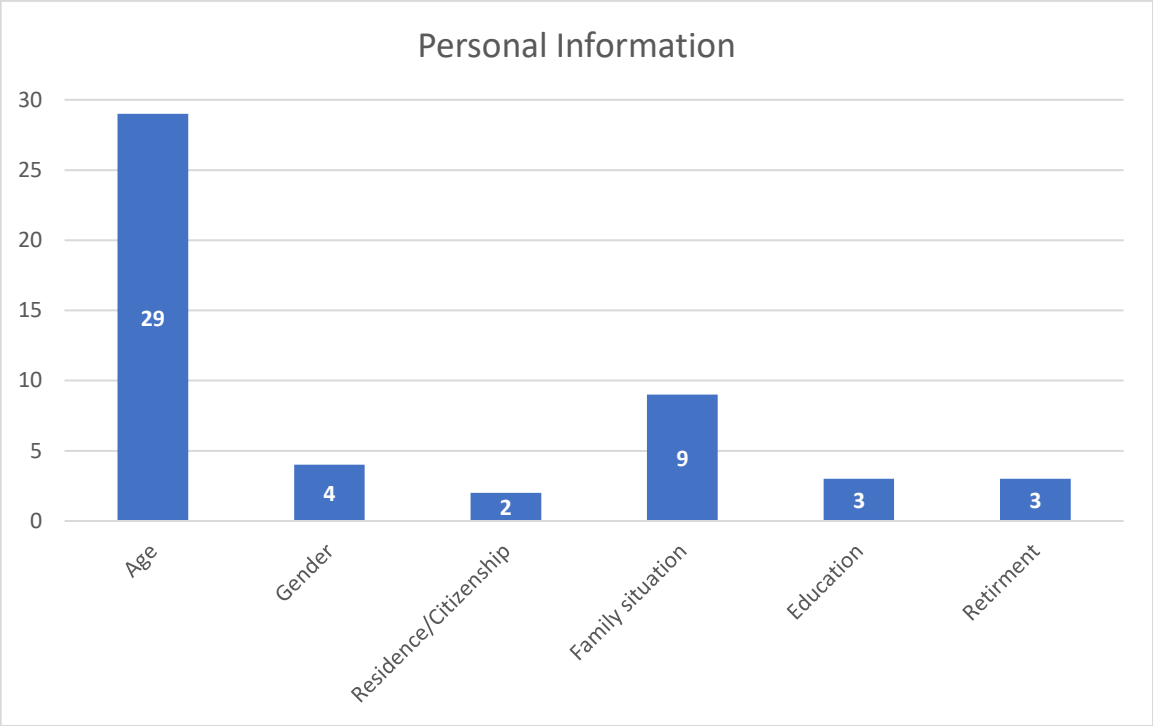


Figure 4.18 Personal Information

The most asked is *age,* of which[3]: 6 *date of birth,* 18 *precise age,* 5 *age classes.* As far as *family situation* is concerned, 2 ask the *marital status,* 3 about *children*, 5 *investor characteristics,* 1 *family characteristics.*

Moreover, figure 4.19 shows the categories of **Financial Situation:**

[3] The sum of the single questions does not correspond to the value of the category, because that value measures the number of start-ups that ask that question.

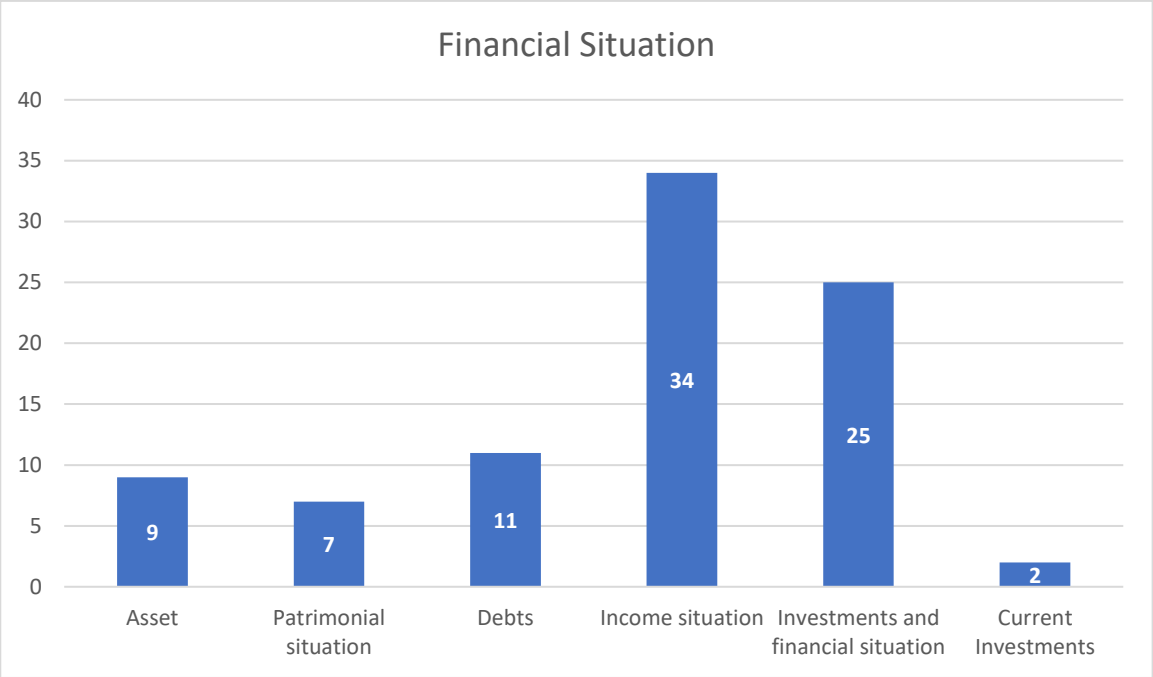


Figure 4.19 Financial Situation

The most present is *income situation*, of which: 17 *gross income,* 9 *net income,* 4 *income and expenses,* 2 *other components income,* 8 *source of income,* 2 *stability of income,* 4 *periodical expenses,* 2 *periodical expenses as % of income.*

Investments and financial situation is divided as follows: 8 *periodical savings,* 3 *periodical savings as % of income,* 1 *future expectations on savings,* 4 *months of savings quickly accessible,* 22 *financial-liquid assets,* 2 *sustainability.*

Furthermore, the next graph shows the categories of **Risk Propensity:**

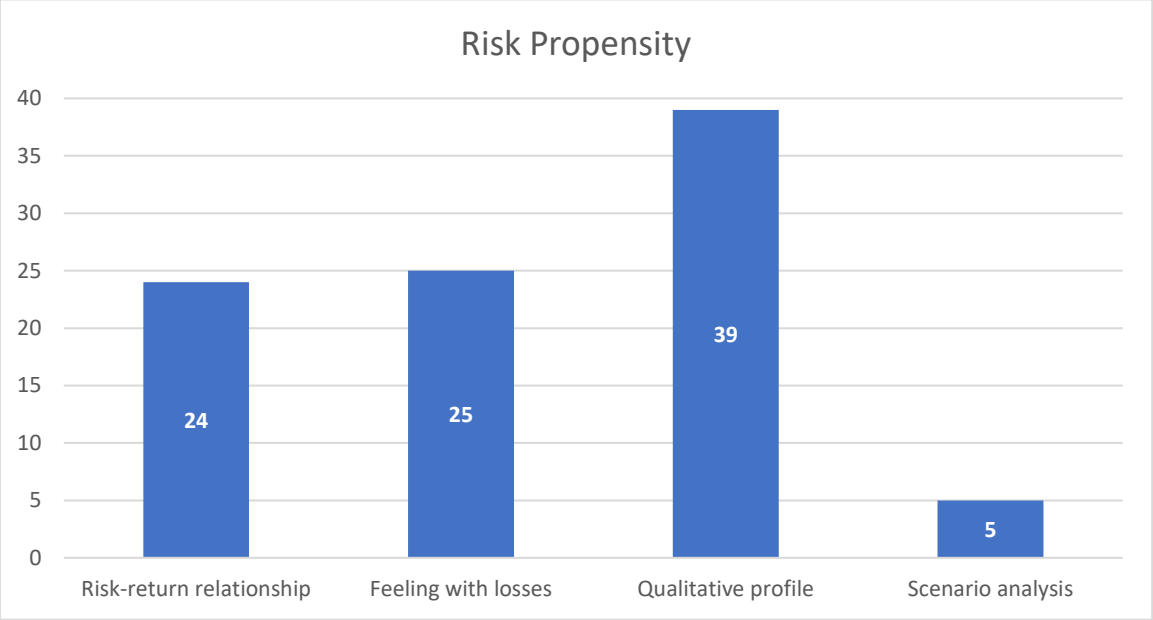


Figure 4.20 Risk Propensity

Qualitative profile is composed of: 22 *qualitative risk propensity,* 12 *type of investor,* 3 *safety of the investments,* 2 *what do you link word risk with,* 4 *description of the risk propensity,* 1 *risk taker,* 2 *future expectations*.

Feeling with losses is divided in: 17 *what would you do if… (scenarios),* 1 *how do you behave in a financial case,* 4 *maximum loss and strategy,* 6 *loss and reaction,* 1 *impact of losses,* 1 *quantitative definition.*

Furthermore, in **Knowledge/Experience** there are 10 start-ups with at least one question in *studies and financial knowledge* and 17 for *previous experience.*

As far as **Investment Related** is concerned, figure 4.21 highlights the categories of which it is composed:

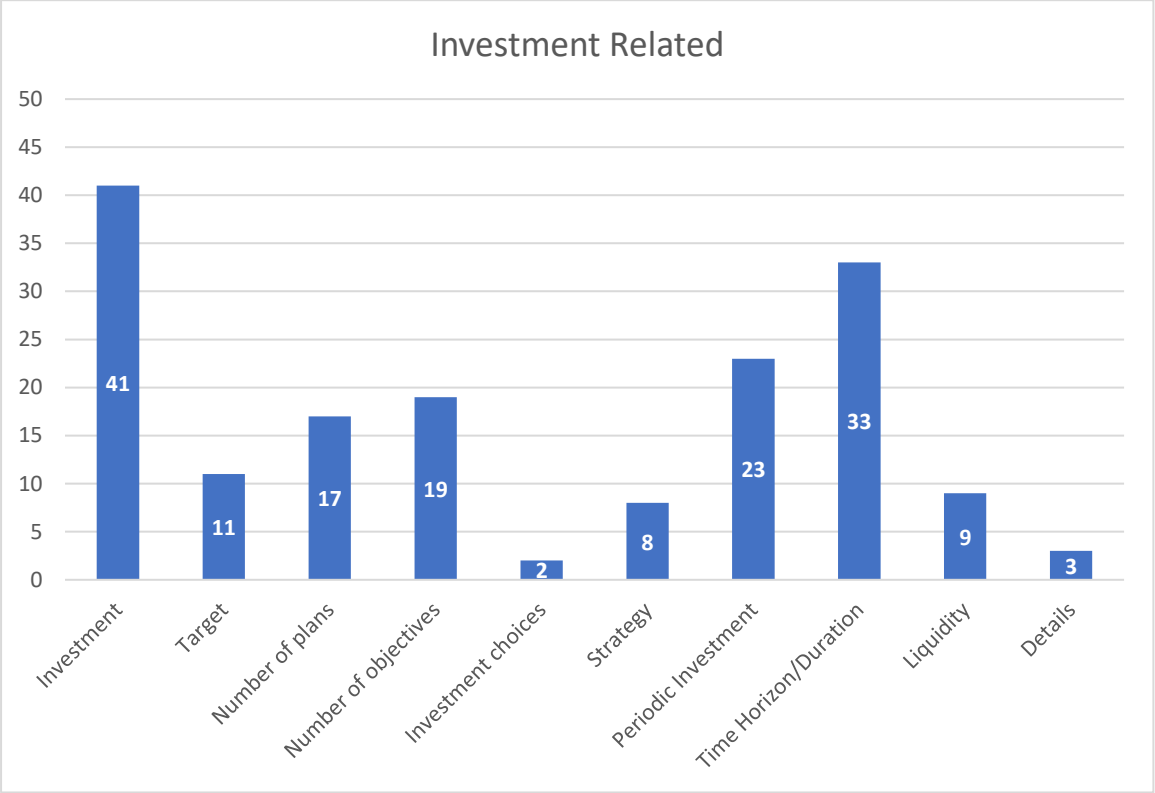


Figure 4.21 Investment Related

Investment: 40 a*mount,* 1 *Amount as % of savings*.

Time horizon/duration: 19 p*recise,* 12 *quantitative classes,* 1 q*ualitative*.

4.4.1.2 Graphical representation

As far as the graphical representation is concerned, it is possible to analyse how the robo-advisors graphically present their questions. The graph shows the distribution of the question among the possible types of graphical representations. The percentage represents how many questions are of that type with respect to the total.

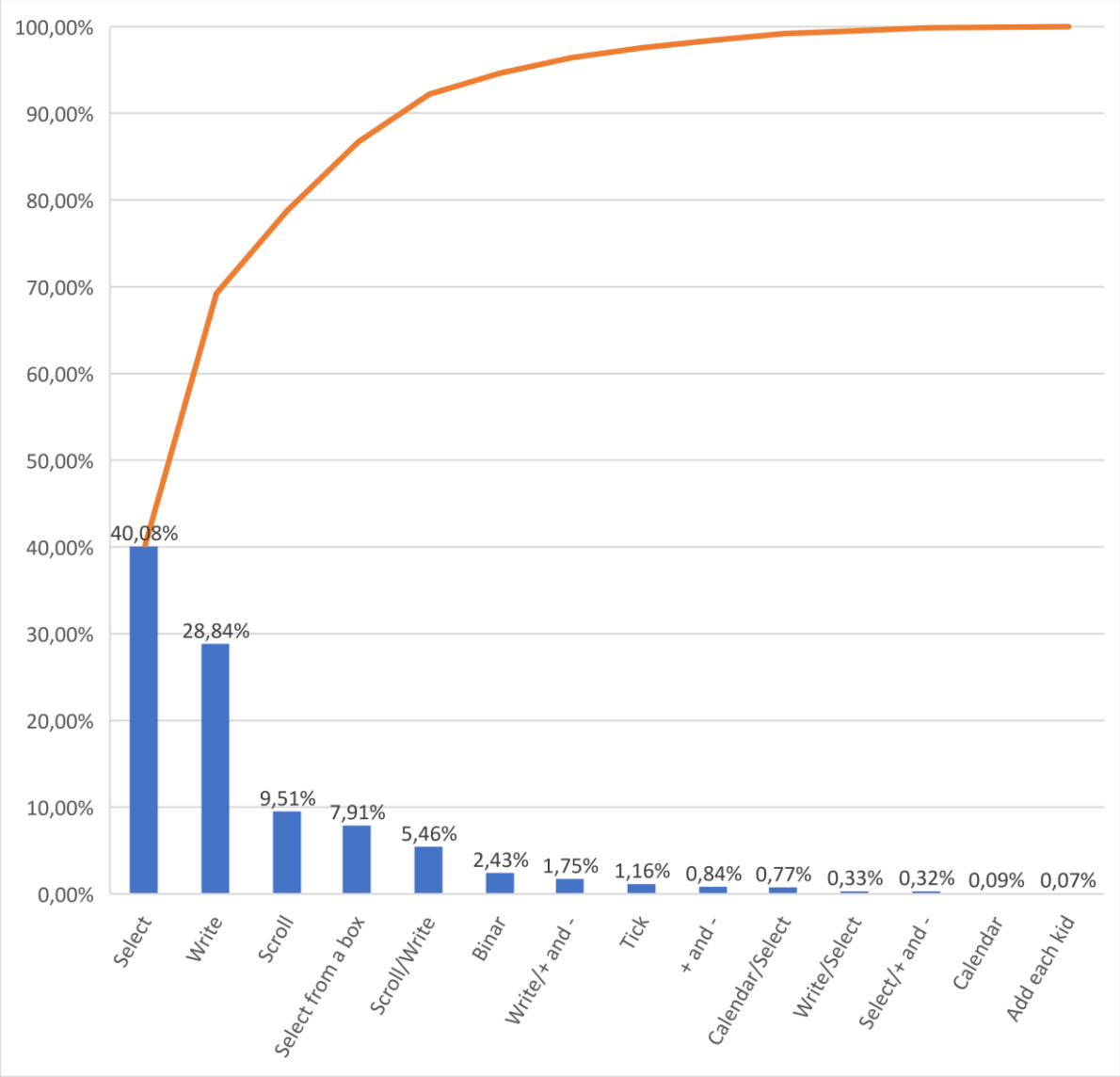


Figure 4.22 Graphical Representation

Therefore, the 91.80% of the questions are *select, write, scroll, select from a box* or *scroll/write. Select* and *Write* are the most common types.

More in details:

- 14 start-ups propose 50% or more questions with *write*. Quirion is the one with the highest percentage for *write*, 75%;
- 23 start-ups have 50% or more of the questions as *select*; 5 have 75% or more; Easyfolio have 100% of the questions as *select;*
- If we consider *select* and *select from a box* together, 31 start-ups have more than 50%, 7 more than 75%, Easyfolio 100%;
- 3 start-ups have 50% of questions as *scroll*, none more;
- 3 start-ups propose 50% or more questions as *scroll/write,* two of them have 60% of *scroll/write;*
- Warren has 66.67% of the questions as *write/+ and -*.

4.4.2 Outcome

On average, each start-up displays 4.02 types of information after the simulation of the portfolio. The median is 3 and the standard deviation is 2.75. Moreover, all the 52 robo-advisors show at least 1 type of information.

As far as the categories are concerned, figure 4.23 shows how many start-ups presents each category of outcome:

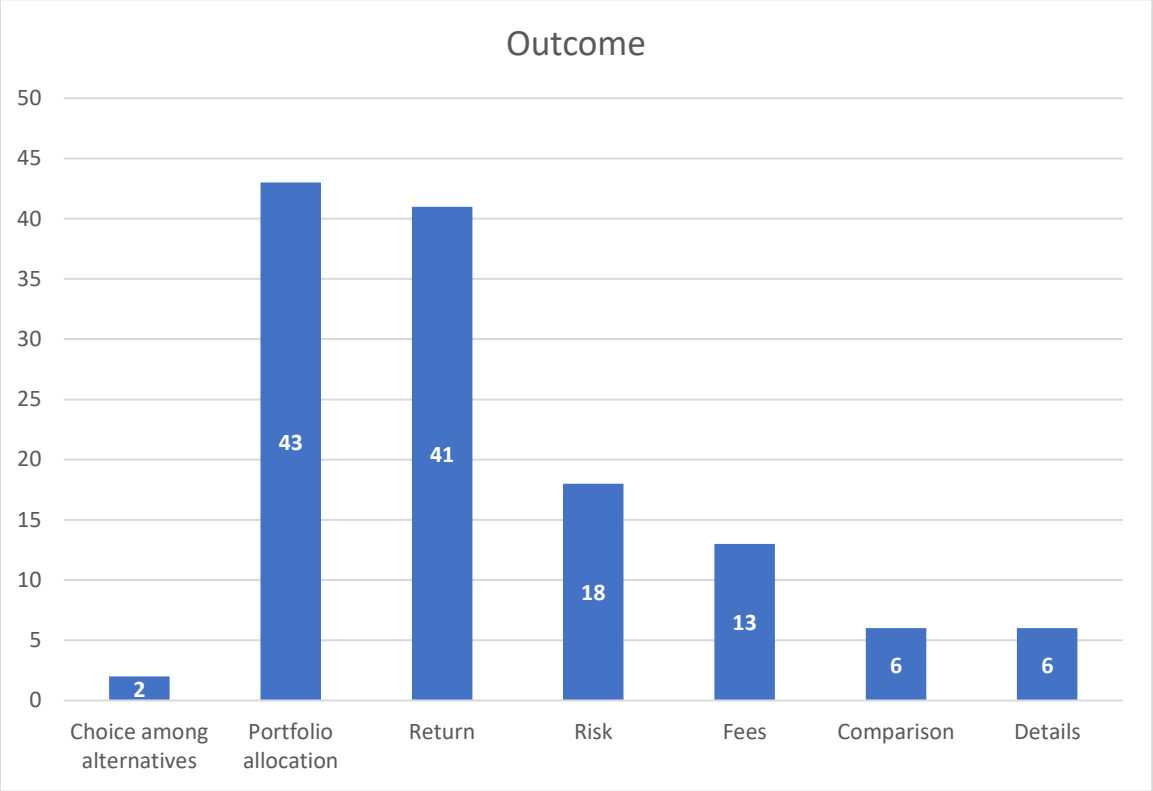


Figure 4.23 Outcome Breakdown

Going more in details, as far as *Choice among alternatives* is concerned 1 start-up gives the possibility to choose between different plans and 1 to choose different solutions among the same plan.

Considering the *Portfolio allocation*, 42 start-ups show the specific asset-classes, 5 of them the geographical allocation of the investments, 17 the specific ETFs and Funds of the asset allocation, 1 the *historical dynamic allocation.*

As far as *Return* is concerned, 1 start-up shows the *1-month return*, 16 the *Historical return,* 18 the *% return,* 12 the *Final value,* 29 the *Portfolio value over time*, 1 the *Historical Sharpe ratio,* 1 the *Historical Sortino ratio.*

Analysing *Risk,* 2 start-ups show the *Expected loss,* 2 the *Recovery time,* 2 the *Volatility,* 3 the *VaR/CVaR,* 2 the *Max drawdown,* 1 the *Diversification Index,* 1 the *Shortfall probability,* 10 the *Risk from 1 to x,* 4 the *Qualitative risk profile,* 1 the *Historical data.*

As far as *Fees* are concerned, 1 start-up provided the information about the *Administrative fees and product cost,* 1 the *Custody fees,* 1 the *Entry fees,* 2 the *Portfolio fees,* 5 the *Management fees,* 2 the *Fund fees,* 1 the *Trading fees,* 9 the *Total fees.*

Considering *Comparison,* 2 start-ups compare *Fees,* 1 the *Performance during crisis,* 2 the *Expected return,* 1 the *VaR.*

Analysing *Details,* the only information shown by more than 1 start-up is *Necessary investment.*

Furthermore, from a graphical point of view, figure 4.24 shows what are the most common types used to display information.

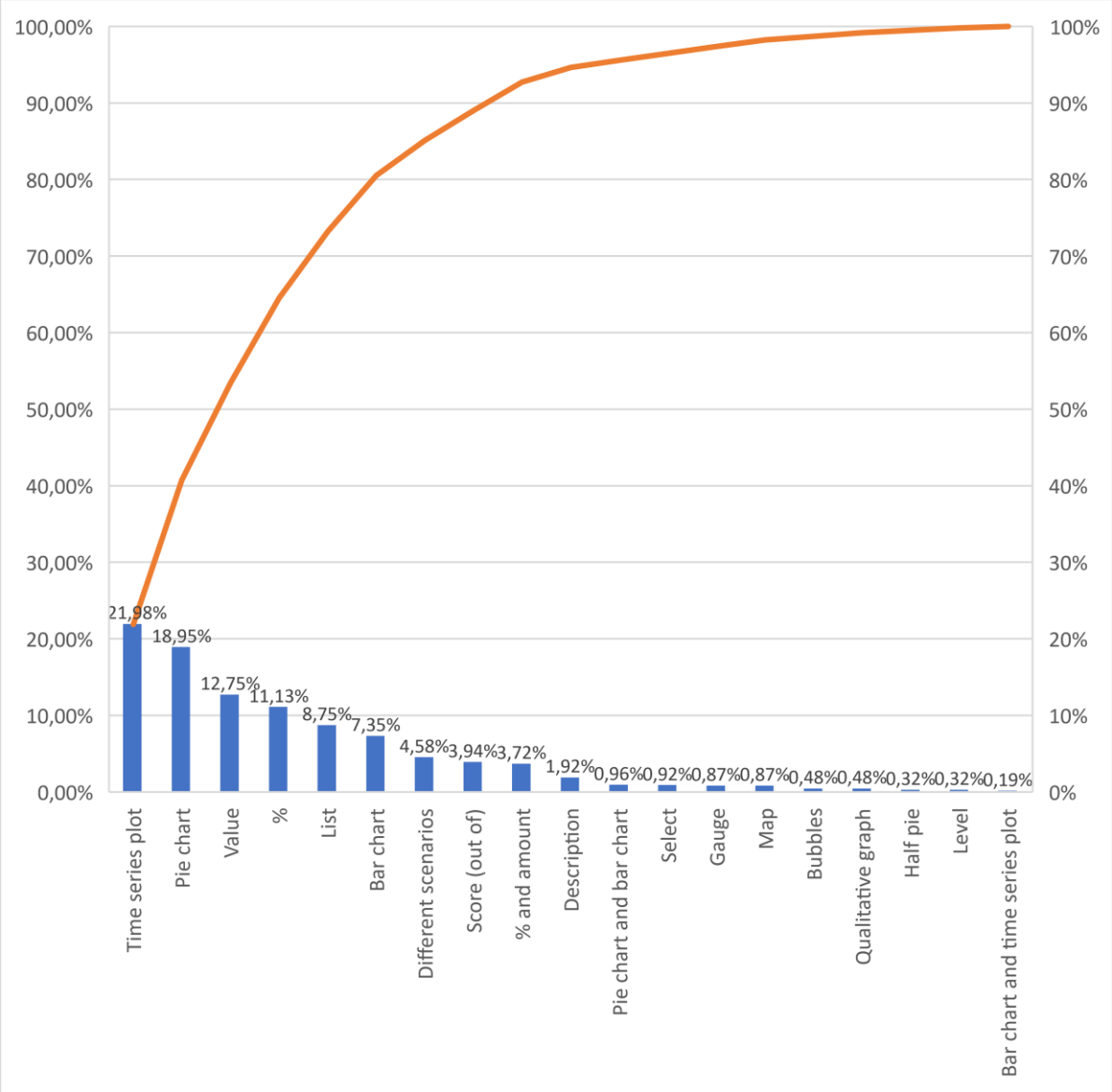


Figure 4.24 Outcome graphical representation

Therefore, the graphical types in which outcomes are shown is more disperse, there is more diversity due to the fact that outcomes are more various, since there are diverse kinds of information.

4.5 Data Analysis: MiFID II

In the next sections (4.5, 4.6 and 4.7), the data will be analysed dividing the sample by specific variables and then dividing it in different clusters. The first group that will be considered includes the start-ups directly subject to the Markets in Financial Instruments Directive II.

To go deeper in details on the Markets in Financial Instruments Directive II, the analysis conducted on the compliance is in section 4.8. In this section the focus is on the 19 start-ups that are registered in the ESMA register[4] and only on the variables presented before.

The first step will be the analysis of the questions. The results in terms of average number of total questions and average number of questions per macro category. In the second step the number of occurrences per category is presented, the relevance of the occurrences in this group per category with respect to the total occurrences in that category in the whole sample will be confronted to the relevance of this group with respect to the entire sample. The analysis of the questions will be concluded with the distribution of the questions on the types of graphical representation. As far as the outcome is concerned, the same analysis done for the questions was conducted on the categories of outcome and the outcomes' graphical representation.

4.5.1 Questions

The average total number of questions of this group is 10.90, the median is 10.

- **Personal Information (PI):** 10 of this group ask at least one question about this macro category, average is 0.84, the median 1;

[4] https://registers.esma.europa.eu/publication/searchRegister?core=esma_registers_upreg

- **Financial Situation (FS):** 12 in this group ask at least one question about investors' financial situation, the average is 2.63, the median 3;
- **Risk Propensity (RP):** 16 ask at least one question about this macro category, average is 2.58, the median 1;
- **Knowledge/Experience (KE):** 10 in the group ask at least one question about investors' knowledge and experience. The average is 1.42, the median 1;
- **Investment related (IR):** all the 19 robo-advisors in this group ask at least one question about this macro category, average is 3.42, the median 3.

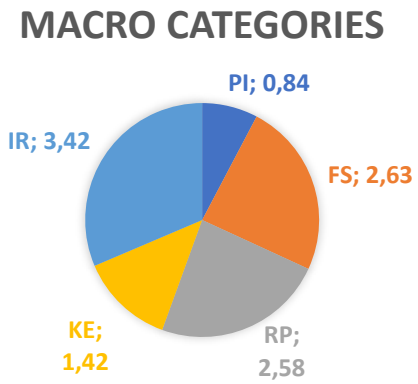


Figure 4.25 Macro Categories MiFID

Compared to the whole sample, the values are similar to the ones of the all 52. However, there is a significant difference in *Knowledge/Experience.* In fact, this group represents the 36.54% of the sample (19/52), but the 50.00% of the start-ups that ask at least a question in *Knowledge/Experience* are in this group. Moreover, this group, on average, asks the 50.85% more questions related to this macro category, with respect to the whole sample.

4.5.1.1 Macro Categories

Analysing the single categories in each macro category, it is possible to go deeper in detail with what is asked the most in this group of start-ups. Remembering that this group

represents the 36.54% of the sample, it is possible to compare this percentage to the percentage of the start-ups that ask a specific question in a category and are part of this group on the total number of start-ups of the sample that do so. Thus, it is possible to define if the occurrences of this group are relatively more frequent than the average of the whole sample.

Personal Information

In *Personal Information*, this group had the following occurrences in each category:

- *Age:* 8 start-ups ask a question in this category, 27.59% of the start-ups that ask at least a question in this category of the entire sample.
- *Gender:* 1, 25.00% of the start-ups that ask at least a question in this category of the entire sample.
- *Residence/Citizenship:* 2 start-ups, 100% with respect to the whole sample.
- *Family situation:* 3 start-ups, 33.33% with respect to the entire sample.
- *Education:* 2 start-ups, 66.66% compared to the entire sample.
- *Retirement:* 0 start-ups.

Financial Situation

As far as *Financial Situation* is concerned, the occurrences per category are the following:

- *Assets:* 4 start-ups ask a question in this category, 44.44% of the start-ups that ask at least a question in this category of the entire sample.
- *Patrimonial situation:* 3, 42.86% of the start-ups that ask at least a question in this category of the entire sample.

- *Debts:* 5 start-ups, 45.45% compared to the entire sample.
- *Income Situation:* 12 start-ups, 35.29% with respect to the entire sample.
- *Investments and Financial Situation:* 10 start-ups, 40.00% compared to the whole sample.
- *Current Investments:* 0 start-ups.

Risk Propensity

Analysing the *Risk Propensity,* the results per category are:

- *Risk-return relationship:* 7 start-ups ask a question in this category, 29.17% of the start-ups that ask at least a question in this category of the entire sample.
- *Feeling with losses:* 10, 40.00% of the start-ups that ask at least a question in this category of the entire sample.
- *Qualitative Profile:* 12 start-ups, 30.77% compared to the entire sample.
- *Scenario Analysis:* 2 start-ups, 40.00% with respect to the whole sample.

Knowledge/Experience

Considering *Knowledge/Experience* the occurrences per macro categories are:

- *Studies and financial knowledge:* 4 start-ups ask a question in this category, 40.00% of the start-ups that ask at least a question in this category of the entire sample.
- *Previous experience:* 10, 58.82% of the start-ups that ask at least a question in this category of the entire sample.

Investment Related

As far as *Investment Related* is concerned, the occurrences per category are the following:

- *Investment:* 17 start-ups ask a question in this category, 41.46% of the start-ups that ask at least a question in this category of the entire sample.
- *Target:* 2, 18.18% of the start-ups that ask at least a question in this category of the entire sample.
- *Plans:* 5 start-ups, 29.41% with respect to the entire sample.
- *Objectives:* 7 start-ups, 36.84% compared to the whole sample.
- *Investment choices:* 0.
- *Strategy:* 3 start-ups, 37.50% of the entire sample.
- *Periodic Investment:* 10 start-ups, 43.48% with respect to the entire sample.
- *Time Horizon/Duration:* 11 start-ups, 33.33% compared to the sample.
- *Liquidity:* 5 start-ups, 55.56% if confronted to the entire sample.
- *Details:* 0 start-ups.

4.5.1.2 Graphical representation

After having analysed the categories one by one, the next step is to analyse the graphical representation in which the questions are asked. The percentage is calculated as the occurrences per *Graphical representation* on the total occurrences of this specific group:

- *Select:* 39.94%
- *Write:* 26.13%
- *Scroll:* 13.64%
- *Select from a box:* 7.60%
- *Scroll/Write:* 6.73%
- *Binar:* 2.43%

- *Tick:* 1.99%
- *+ and -*: 0.75%
- *Write/+ and-*: 0.48%

4.5.2 Outcome

On average 5.68 types of information per start-up about the portfolio are displayed, the median 5. Therefore, the 'MiFID' group displays on average 41.29% more information than the whole sample. Considering the single categories, 0 start-ups give the possibility to have a *Choice among alternatives;* 17 start-ups show the *Portfolio Allocation* (39.53% compared to the entire sample); 19 start-ups display the *Return* (46.34% with respect to the whole sample); 11 start-ups show the *Risk* (61.11% compared to the whole sample); 6 the *Fees* (46.15%); 5 the *Comparison* (83.33%); 2 start-ups show other *Details* (33.33%). As far as the *Graphical Representation* is concerned, this is how the information are displayed:

- *Time series plot:* 25.20%
- *Value:* 18.22%
- *Pie Chart:* 16.34%
- *%:* 13.30%
- *List:* 9.63%
- *% and amount:* 6.22%
- *Score (out of):* 3.76%
- *Bar chart:* 3.29%
- *Gauge:* 1.05%
- *Map:* 1.05%
- *Half pie:* 0.88%
- *Bar chart and times series plot:* 0.53%
- *Different scenarios:* 0.53%

4.6 Data Analysis: Continents

Another level of analysis can be done dividing the sample in geographical continents: *Europe, Asia, Oceania, South America* and *North America,* in order to analyse how the profiling process changes based on the geographical position of the start-up and, in general, to show the results based on specific geographical scopes.

The first step will be the analysis of the questions. The results in terms of average number of total questions and average number of questions per macro category are illustrated. In the second step the number of occurrences per category is presented, the relevance of the occurrences in this group per category with respect to the total occurrences in that category in the whole sample will be confronted to the relevance of this group compared to the entire sample. The analysis of the questions will be concluded with the distribution of the questions on the types of graphical representation. As far as the outcome is concerned, the same analysis done for the questions was conducted on the categories of outcome and the outcomes' graphical representation.

4.6.1 Europe

The sample size is 27. All the start-ups are from the European Union (including the United Kingdom).

4.6.1.1 Questions

Moreover, the average total number of questions asked is 10.82, the median is 10.

- **Personal Information (PI):** 14 start-ups, average is 0.74, the median 1;

- **Financial Situation (FS):** 17 start-ups, the average is 2.52, the median 3;
- **Risk Propensity (RP):** 24 start-ups, average is 2.63, the median 2;
- **Knowledge/Experience (KE):** 13 start-ups. The average is 1.44, the median 0;
- **Investment related (IR):** all the 27 start-ups, average is 3.48, the median 3.

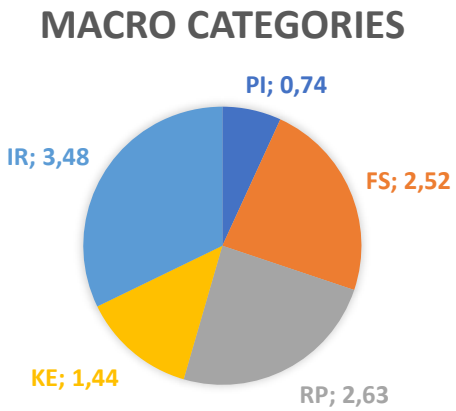


Figure 4.26 Macro Categories EUR

Macro Categories

Considering each category, the occurrences per category in this group of start-ups will be analysed, comparing the size of this group with respect to the sample (51.92%) to the number of occurrences per category of this group with respect to the occurrences in the whole sample. Thus, it is possible to define if the occurrences of this group are relatively more frequent than the average of the whole sample.

First of all, *Personal Information:*

- *Age:* 12 start-ups ask a question in this category, 41.38% of the start-ups that ask at least a question in this category of the entire sample.
- *Gender:* 0.
- *Residence/Citizenship:* 1 start-up, 50% with respect to the whole sample.
- *Family situation:* 4 start-ups, 44.44% with respect to the entire sample.

- *Education:* 2 start-ups, 66.67% compared to the entire sample.
- *Retirement:* 1 start-up, 33.33% with respect to the sample.

As far as *Financial Situation* is concerned, the occurrences per category are the following:

- *Assets:* 5 start-ups ask a question in this category, 55.56% of the start-ups that ask at least a question in this category of the entire sample.
- *Patrimonial situation:* 4, 57.14% of the start-ups that ask at least a question in this category of the entire sample.
- *Debts:* 6 start-ups, 54.54% compared to the entire sample.
- *Income Situation:* 14 start-ups, 41.18% with respect to the entire sample.
- *Investments and Financial Situation:* 15 start-ups, 60.00% compared to the whole sample.
- *Current Investments:* 1 start-up, 50%.

Considering *Risk Propensity,* the result is the following:

- *Risk-return relationship:* 11 start-ups have at least one question in this category, representing the 45.83% of the start-ups that in the whole sample ask a question in the category.
- *Feeling with losses:* 14 start-ups ask a question in this category, this means that the 56.00% of the start-ups with a question in this category comes from Europe.
- *Qualitative profile:* 20 start-ups, 51.28% with respect to the entire sample.
- *Scenario analysis:* 2 start-ups, 40.00% with respect to the whole sample.

Going further in details for *Knowledge/Experience:*

- *Studies and financial knowledge:* 7 start-ups of this group ask at least a question in this category, that represent the 70.00% of the ones that to do in the whole sample.

- *Previous experience:* 12 start-ups that account one question in this category, which means the 70.59%.

In the end, the last macro category is *Investment Related:*

- *Investment:* 24 start-ups have at least one question in this category, representing the 58.54% of the start-ups that in the whole sample ask a question in the category.
- *Target:* 4 start-ups ask a question in this category, this means that the 36.36% of the start-ups with a question in this category comes from Europe.
- *Plans:* 6 start-ups, 35.29% with respect to the entire sample.
- *Objectives:* 12 start-ups, 63.16% compared to the whole sample.
- *Investment choices:* 1 start-up, 50.00% with respect to the whole sample.
- *Strategy:* 4 start-ups, 50.00% confronting to the entire sample.
- *Periodic Investment:* 13 start-ups, 56.52% if compared to the entire sample.
- *Time horizon/Duration:* 19 start-ups, 57.57% with respect to the entire sample.
- *Liquidity:* 6 start-ups, 66.67% with respect to the whole sample.
- *Details:* 0.

Graphical Representation

After the macro categories, the next step is to analyse how graphically are shown the questions asked. The percentage is calculated as the occurrences per *Graphical representation* on the total occurrences of this specific group:

- *Select:* 45.40%
- *Write:* 23.10%
- *Scroll:* 10.48%
- *Scroll/write:* 9.04%
- *Select from a box:* 4.23%

- *Binar:* 2.85%
- *Tick:* 2.18%
- *Write/+ and -*: 0.91%
- *Calendar/Select:* 0.74%
- *+ and -*: 0.53%
- *Write/Select:* 0.37%
- *Calendar:* 0.17%

4.6.1.2 Outcome

On average European start-ups show 4.85 types of information per portfolio built, with a median of 5 types. Looking at the categories, 0 start-ups give the possibility to have a *Choice among alternatives;* 23 start-ups show the *Portfolio Allocation* (53.49% compared to the entire sample); 24 start-ups display the *Return* (58.54% with respect to the whole sample); 13 start-ups show the *Risk* (72.22% compared to the whole sample); 8 the *Fees* (61.54%); 4 the *Comparison* (66.67%); 3 start-ups show other *Details* (50.00%).

Considering the *Graphical representation,* the distribution is the following:

- *Time series plot:* 17.73%
- *Pie chart:* 17.06%
- *Value:* 13.93%
- *%:* 11.71%
- *List:* 9.37%
- *Different scenarios:* 7.90%
- *Bar chart:* 6.76%
- *% and amount:* 6.23%
- *Score (out of)*: 3.88%

- *Description*: 3.70%
- *Map*: 0.74%
- *Half pie*: 0.62%
- *Bar chart and time series plot*: 0.37%

4.6.2 North America

The sample size is 15, 8 from the United States and 7 Canadians.

4.6.2.1 Questions

The average total number of questions asked is 10.67, the median is 9.

- **Personal Information (PI):** 11 start-ups, average is 1.67, median 1;
- **Financial Situation (FS):** 12 start-ups, the average is 2.80, the median 2;
- **Risk Propensity (RP):** 15 start-ups, average is 2.40, the median 2;
- **Knowledge/Experience (KE):** 5 start-ups. The average is 0.40, the median 0;
- **Investment related (IR):** all the 15 start-ups, average is 3.40, the median 3.

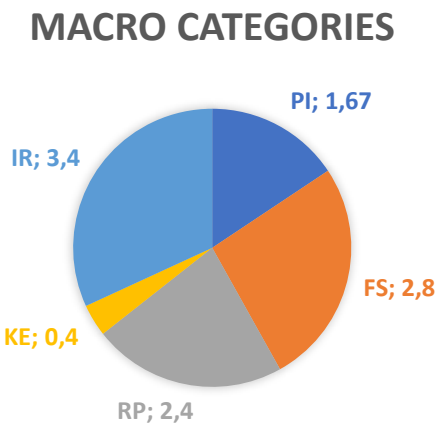


Figure 4.27 Macro Categories North America

North American start-ups' average total number of questions is aligned with the whole sample and European start-ups. However, there are relevant differences in *Personal Information* and *Knowledge/Experience*. In fact, North American start-ups ask on average the 52.10% more questions related to *Personal Information* than the whole sample, and the 124.97% more than European start-ups. Furthermore, the 73.33% of the North American start-ups ask at least one question in this macro category, compared to 51.85% of the European ones (61.54% the whole sample). As far as *Knowledge/Experience* is concerned, only 33.33% of the North American sample have a question in this macro category, compared to 38.46% of the whole sample and 48.15% of Europe. Moreover, the average if this macro category is the 57.54% lower than the whole sample and 72.30% lower than Europe.

Figure 4.28 summarizes the differences between Europe and North America:

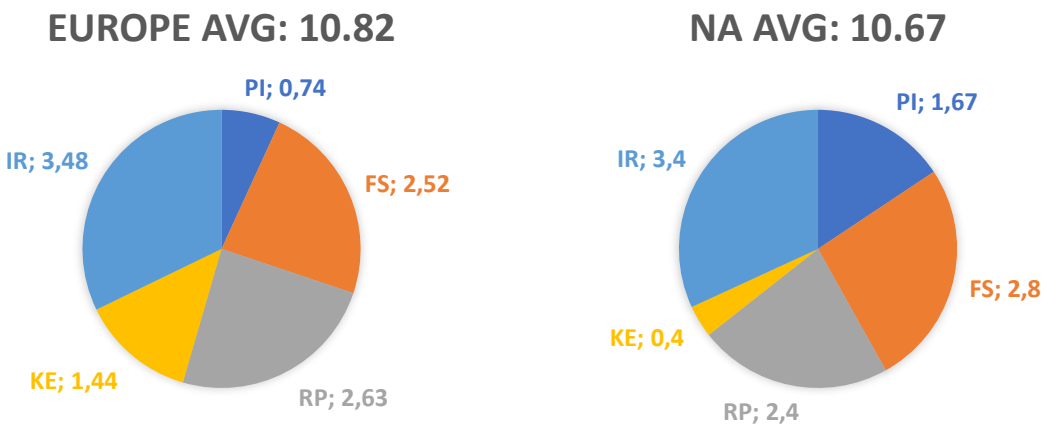


Figure 4.28 Macro Categories Europe and NA

Europe and North America are the largest groups. Moreover, all the European start-ups are from the European Union, thus have to be compliant with the same regulations. It can be interesting to divide North America in the two countries of which is composed, since they have different regulations: The United States and Canada.

United States

Sample size: 8; average total number of questions asked 8.13, median 7.

- **Personal Information (PI):** 6 start-ups, average is 1.13, median 1;
- **Financial Situation (FS):** 5 start-ups, the average is 1.63, the median 2;
- **Risk Propensity (RP):** 8 start-ups, average is 1.88, the median 1;
- **Knowledge/Experience (KE):** 2 start-ups. The average is 0.38, the median 0;
- **Investment related (IR):** all the 8 start-ups, average is 3.13, the median 3.

Canada

Sample size: 7; average total number of questions asked 13.57, median 12.

- **Personal Information (PI):** 5 start-ups, average is 2.87, median 1;
- **Financial Situation (FS):** 7 start-ups, the average is 4.14, the median 3;
- **Risk Propensity (RP):** 7 start-ups, average is 3.00, the median 3;
- **Knowledge/Experience (KE):** 3 start-ups. The average is 0.43, the median 0;
- **Investment related (IR):** all the 7 start-ups, average is 3.71, the median 2.

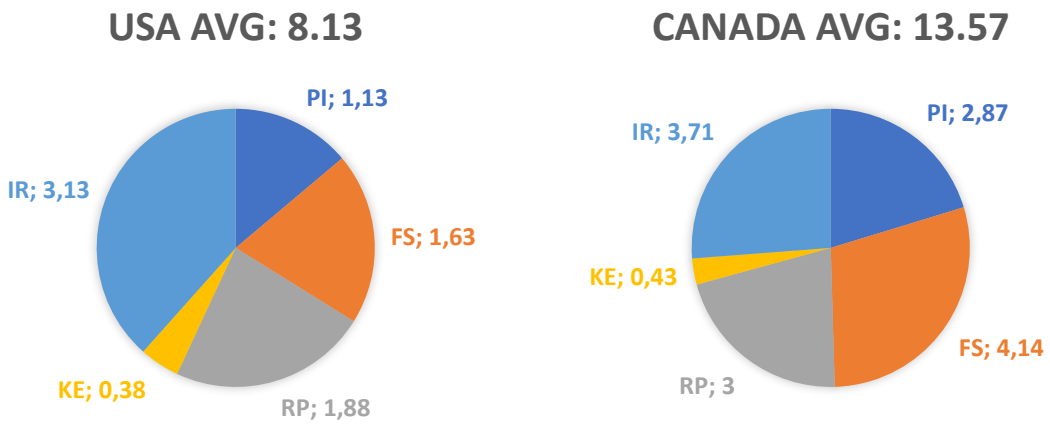


Figure 4.29 Macro Categories USA and Canada

This data shows that, despite the average total number of questions for North America and Europe is similar, Canada and the United States have different results. In fact, start-ups from Canada ask on average 66.91% more questions that the ones from the United States. If compared to Europe, the value of Canada is 25.42% higher, the value of the United States 33.09% lower.

The most relevant differences are related to the macro categories *Personal Information, Financial Situation* and *Risk Propensity:*

- *Personal Information:* the value of Canada is 153.98% higher than the United States and 287.84% higher than Europe, which is the 34.51% lower than the United States;
- *Financial Situation:* the value of Canada is 153.99% higher than the United States and 64.29% higher than Europe, which is the 54.60% higher than the United States;
- *Risk Propensity:* the value of Canada is 59.57% higher than the United States and 14.07% higher than Europe, which is the 39.89% higher than the United States.

Macro Categories

In this paragraph the occurrences per category in each macro category will be shown. Remembering that this group represents the 28.85% of the sample, it is possible to compare this percentage to the percentage of the start-ups that ask a specific question in a category and are part of this group on the total number of start-ups of the sample that do so. Thus, it is possible to define if the occurrences of this group are relatively more frequent than the average of the whole sample.

First of all, as far as *Personal Information* is concerned:

- *Age:* 10 start-ups ask at least one question in this category, this means that the 34.48% of the start-ups that have a question in this category are Northern American.

- *Gender:* 3 start-ups, this represents the 75.00% of the start-ups that ask at least one question in this category of the whole sample.
- *Residence/Citizenship:* 1 start-up, 50.00% compared to the entire sample.
- *Family situation:* 4 start-ups, 44.44% compared to the entire sample.
- *Education:* 0 start-ups.
- *Retirement:* 1 start-up, 33.33% with respect to the whole sample.

Considering *Financial Situation,* the occurrences per category are the following:

- *Assets:* 2 start-ups, therefore, the 22.22% of the start-ups in the whole sample that ask a question of this category is belong to this group.
- *Patrimonial situation:* 2 start-ups, 28.57% compared to the sample.
- *Debts:* 3 start-ups, 27.27% with respect to the sample.
- *Income Situation:* 12 start-ups, 35.29% with respect to the entire sample.
- *Investments and Financial Situation:* 8 start-ups, 32.00% with respect to the whole sample.
- *Current Investments:* 1 start-up, 50.00% compared to the entire sample.

Going further is detail with *Risk Propensity,* the result is the following:

- *Risk-return relationship:* 8 start-ups have a question in this category, which means that the 33.33% of the start-ups in the sample that ask a question in the category are from this group.
- *Feeling with losses:* 6 start-ups, that represent the 24.00% of the all start-ups in the entire sample that have at least one question in this category.
- *Qualitative profile:* 12 start-ups, 30.77% with respect to the whole sample.
- *Scenario analysis:* 2 start-ups, 40.00% with respect to the entire sample.

Analysing *Knowledge/Experience:*

- *Studies and financial knowledge:* 2 start-ups of this group have at least one question in this category, that represent the 20.00% of the start-ups in the sample that have a question in the category.
- *Previous experience:* 3 start-up has one question in this category, that represent the 17.65% with respect to ones that do so in the whole sample.

In conclusion, the macro category *Investment Related:*

- *Investment:* 9 start-ups have a question in this category, which means that the 21.95% of the start-ups in the sample that ask a question in the category are from this group.
- *Target:* 5 start-ups, that represent the 45.45% of the all start-ups in the entire sample that have at least one question in this category.
- *Plans:* 7 start-ups, 41.18% compared to the entire sample.
- *Objectives:* 5 start-ups, 29.32% with respect to the whole sample.
- *Investment choices:* 1 start-up, 50.00% with respect to the whole sample.
- *Strategy:* 2 start-ups, 25.00% compared to the whole sample.
- *Periodic Investment:* 5 start-ups, 21.74% with respect to the entire sample.
- *Time horizon/Duration:* 9 start-ups, 27.27% compared to the entire sample.
- *Liquidity:* 3 start-ups, 33.33% compared to the entire sample.
- *Details:* 2 start-ups, 66.67% compared to the whole sample.

Graphical representation

The percentage is calculated as the occurrences per *Graphical representation* on the total occurrences of this specific group:

- *Select:* 32.33%
- *Write:* 31.78%
- *Select from a box:* 15.52%

- *Scroll:* 8.26%
- *Binar:* 2.69%
- *Scroll/Write:* 2.67%
- *+ and -*: 1.94%
- *Tick:* 1.64%
- *Calendar/Select:* 1.33%
- *Select/+ and -*: 1.11%
- *Add each kid:* 0.24%

4.6.2.2 Outcome

On average Northern American start-ups display 3.13 types of information when they show the portfolio built, the median is 3. If split between the two countries:

- **Canada:** average 3.14, median 3;
- **United States:** average 3.13, median 3.

Therefore, all the European start-ups in the sample show the 20.65% more than the entire sample and the 54.95% more than North American start-ups. Thus, European start-ups, and also the ones that are subject to MiFID II, generally show more information than the other about the portfolio. In fact, MiFID II group shows 81.47% more information than the Northern America Group.

Considering the single categories, 2 start-ups give the possibility to have a *Choice among alternatives* (100% compared to the entire sample)*;* 12 start-up shows the *Portfolio Allocation* (27.91% compared to the entire sample); 8 start-ups display the *Return* (19.51% with respect to the whole sample); 2 start-ups show the *Risk* (11.11%); 5 the *Fees* (38.46%); 2 the *Comparison* (33.33%); 1 start-ups show other *Details* (16.67%).

Considering the *Graphical representation,* the distribution is the following:

- *Pie chart:* 30.34%
- *Time series plot:* 21.29%
- *%:* 15.07%
- *Value:* 10.00%
- *Bar chart:* 6.67%
- *List:* 3.45%
- *Score (out of):* 3.33%
- *Select:* 3.17%
- *% and amount:* 1.67%
- *Bubbles:* 1.67%
- *Gauges:* 1.67%
- *Map:* 1.67%

4.6.3 Asia

The sample size is 5, thus, it is very smaller than the European and North American samples.

4.6.3.1 Questions

The average total number of questions asked is 7.17, the median is 7.

- **Personal Information (PI):** 4 start-ups, average is 1.33, the median 1;
- **Financial Situation (FS):** 4 start-ups, the average is 1, the median 1;
- **Risk Propensity (RP):** 5 start-ups, average is 1.67, the median 2;
- **Knowledge/Experience (KE):** 1 start-up. The average is 0.50, the median 0;

- **Investment related (IR):** all the 5 start-ups, average is 2.67, the median 3.

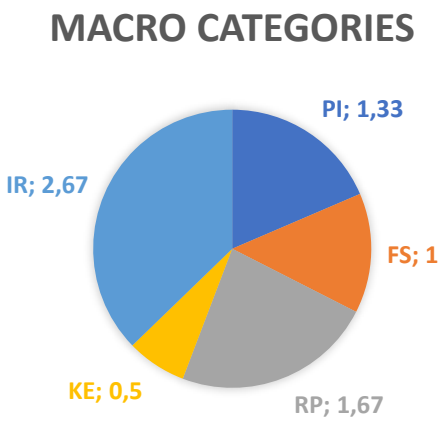


Figure 4.30 Macro Categories Asia

Asian start-ups ask on average the 30.73% less questions in total, resulting in less questions in each macro category, except for *Personal Information*. In fact, in this macro category, Asian start-ups ask the 21.62% more questions related to *Personal Information*.

Macro Categories

In this paragraph the occurrences per category in each macro category will be shown. Remembering that this group represents the 9.62% of the sample, it is possible to compare this percentage to the percentage of the start-ups that ask a specific question in a category and are part of this group on the total number of start-ups of the sample that do so. Thus, it is possible to define if the occurrences of this group are relatively more frequent than the average of the whole sample.

First of all, as far as *Personal Information* is concerned:

- *Age:* 4 start-ups ask at least one question in this category, this means that the 13.79% of the start-ups that have a question in this category are Asian.
- *Gender:* 1 start-up, this represents the 25.00% of the start-ups that ask at least one question in this category of the whole sample.
- *Residence/Citizenship:* 0 start-up.
- *Family situation:* 1 start-up, 11.11% compared to the entire sample.
- *Education:* 0 start-ups.
- *Retirement:* 1 start-up, 33.33% with respect to the whole sample.

Considering *Financial Situation,* the occurrences per category are the following:

- *Assets:* 1 start-up, therefore, the 11.11% of the start-ups in the whole sample that ask a question of this category is belong to this group.
- *Patrimonial situation:* 0 start-ups.
- *Debts:* 0 start-ups.
- *Income Situation:* 4 start-ups, 11.76% with respect to the entire sample.
- *Investments and Financial Situation:* 0 start-ups.
- *Current Investments:* 0 start-ups.

Going further is detail with *Risk Propensity,* the result is the following:

- *Risk-return relationship:* 1 start-up has a question in this category, which means that the 4.17% of the start-ups in the sample that ask a question in the category are from this group.
- *Feeling with losses:* 1 start-up, that represent the 4.00% of the all start-ups in the entire sample that have at least one question in this category.
- *Qualitative profile:* 5 start-ups, 12.82% with respect to the whole sample.
- *Scenario analysis:* 0 start-ups.

Analysing *Knowledge/Experience:*

- *Studies and financial knowledge:* 1 start-ups of this group have at least one question in this category, that represent the 10.00% of the start-ups in the sample that have a question in the category.
- *Previous experience:* 1 start-up has one question in this category, that represent the 5.88% compared to ones that do so in the whole sample.

In conclusion, the macro category *Investment Related:*

- *Investment:* 1 start-up has a question in this category, which means that the 2.44% of the start-ups in the sample that ask a question in the category are from this group.
- *Target:* 1 start-up, that represent the 9.09% of the all start-ups in the entire sample that have at least one question in this category.
- *Plans:* 2 start-ups, 11.76% compared to the entire sample.
- *Objectives:* 1 start-up, 5.26% with respect to the whole sample.
- *Investment choices:* 0 start-ups.
- *Strategy:* 0 start-ups.
- *Periodic Investment:* 3 start-ups, 13.04% with respect to the entire sample.
- *Time horizon/Duration:* 4 start-ups, 12.12% compared to the entire sample.
- *Liquidity:* 0 start-ups.
- *Details:* 1 start-up, 33.33% compared to the whole sample.

Graphical representation

The following step is to define the *Graphical representation* in which the questions are proposed. The percentage is calculated as the occurrences per *Graphical representation* on the total occurrences of this specific group:

- *Write:* 41.33%
- *Select:* 36.00%

- *Scroll:* 11.33%
- *Select from a box:* 11.33%

4.6.3.2 Outcome

On average Asian start-ups in the sample display 2.50 types of information each per portfolio built, the median is 2. Considering the single categories, 0 start-ups give the possibility to have a *Choice among alternatives;* 4 start-ups show the *Portfolio Allocation* (9.30% compared to the entire sample); 5 start-ups display the *Return* (12.20% with respect to the whole sample); 1 start-ups show the *Risk* (5.56% compared to the whole sample); 0 the *Fees*; 0 the *Comparison*; 1 start-ups show other *Details* (16.67%).

As far as the *Graphical results* are concerned, the distribution is the following:

- *Time series plot:* 40%
- *List:* 20%
- *Value:* 13.33%
- *Bar chart:* 10%
- *Pie chart and bar chart:* 10%
- *Level:* 3.33%
- *%:* 3.33%

4.6.4 Oceania

The sample size is 3. All the start-ups from Oceania are from Australia.

4.6.4.1 Questions

The average total number of questions asked is 11.33, the median is 11.

- **Personal Information (PI):** 2 start-ups, average is 1, median 1;
- **Financial Situation (FS):** 3 start-ups, the average is 3.33, the median 3;
- **Risk Propensity (RP):** 3 start-ups, average is 3.33, the median 4;
- **Knowledge/Experience (KE):** 1 start-up. The average is 0.33, the median 1;
- **Investment related (IR):** all the 3 start-ups, average is 3.33, the median 3.

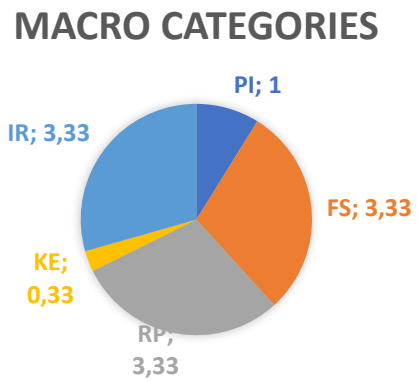


Figure 4.31 Macro Categories Australia

The sample is very small to be statistically relevant to be compared to other groups or to the entire database sample.

Macro Categories

Analysing the single categories in each macro category, it is possible to go deeper in detail with what is asked the most in this group of start-ups. Remembering that this group represent the 5.77% of the sample, it is possible to compare this percentage to the percentage of the start-ups that ask a specific question in a category and are part of this group on the total

number of start-ups of the sample that do so. Thus, it is possible to define if the occurrences of this group are relatively more frequent than the average of the whole sample.

In *Personal Information*, this group had the following occurrences in each category:

- *Age:* 2 start-ups ask a question in this category, 6.90% of the start-ups that ask at least a question in this category of the entire sample.
- *Gender:* 0 start-ups.
- *Residence/Citizenship:* 0 start-ups.
- *Family situation:* 0 start-ups, 33.33%.
- *Education:* 1 start-up, 33.33% compared to the entire sample.
- *Retirement:* 0 start-ups.

As far as *Financial Situation* is concerned, the occurrences per category are the following:

- *Assets:* 1 start-up ask a question in this category, 11.11% of the start-ups that ask at least a question in this category of the entire sample.
- *Patrimonial situation:* 1, 14.29% of the start-ups that ask at least a question in this category of the entire sample.
- *Debts:* 2 start-ups, 18.18% compared to the entire sample.
- *Income Situation:* 3 start-ups, 8.82% with respect to the entire sample.
- *Investments and Financial Situation:* 1 start-up, 4.00% compared to the whole sample.
- *Current Investments:* 0 start-ups.

Analysing the *Risk Propensity,* the results per category are:

- *Risk-return relationship:* 3 start-ups ask a question in this category, 12.50% of the start-ups that ask at least a question in this category of the entire sample.
- *Feeling with losses:* 3, 12.00% of the start-ups that ask at least a question in this category of the entire sample.

- *Qualitative Profile:* 1 start-up, 2.56% compared to the entire sample.
- *Scenario Analysis:* 0 start-ups.

Considering *Knowledge/Experience* the occurrences per macro categories are:

- *Studies and financial knowledge:* 1 start-up ask a question in this category, 10.00% of the start-ups that ask at least a question in this category of the entire sample.
- *Previous experience:* 1, 5.88% of the start-ups that ask at least a question in this category of the entire sample.

As far as *Investment Related* is concerned, the occurrences per category are the following:

- *Investment:* 2 start-ups ask a question in this category, 4.88% of the start-ups that ask at least a question in this category of the entire sample.
- *Target:* 1, 9.09% of the start-ups that ask at least a question in this category of the entire sample.
- *Plans:* 2 start-ups, 11.76% with respect to the entire sample.
- *Objectives:* 1 start-up, 5.26% compared to the whole sample.
- *Investment choices:* 0.
- *Strategy:* 2 start-ups, 25.00% of the entire sample.
- *Periodic Investment:* 1 start-up, 4.35% with respect to the entire sample.
- *Time Horizon/Duration:* 1 start-up, 3.03% compared to the sample.
- *Liquidity:* 0 start-ups.
- *Details:* 0 start-ups.

Graphical Representation

The next step is to consider how the questions asked are graphically represented. The percentage is calculated as the occurrences per *Graphical representation* on the total occurrences of this specific group:

- *Select:* 42.24%
- *Write:* 41.91%
- *Scroll:* 10.26%
- *Binar:* 3.03%
- *Select from a box:* 2.56%

4.6.4.2 Outcome

On average Oceanian start-ups show 3.67 types of information per portfolio proposed, while the median is 4. Looking at the single categories, 0 start-ups give the possibility to have a *Choice among alternatives;* 3 start-ups show the *Portfolio Allocation* (6.98% compared to the entire sample); 2 start-ups display the *Return* (4.88% with respect to the whole sample); 2 start-ups show the *Risk* (11.11% compared to the whole sample); 0 the *Fees*; 0 the *Comparison*; 1 start-ups show other *Details* (16.67%).

Furthermore, as far as the *Graphical representation* is concerned, the results are:

- *Pie chart:* 23.33%
- *Score (out of):* 16.67%
- *Time series plot:* 15%
- *Qualitative graph:* 8.33%
- *List:* 8.33%
- *%:* 6.67%

- *Value:* 6.67%
- *Gauge:* 6.67%

4.6.5 South America

The sample size is 2. Both are Brazilian.

4.6.5.1 Questions

The average total number of questions asked is 4.5, the median is 5.

- **Personal Information (PI):** 1 start-up, average is 0.50, median 1;
- **Financial Situation (FS):** 1 start-up, the average is 1.00, the median 1;
- **Risk Propensity (RP):** 2 start-ups, average is 1.50, the median 2;
- **Knowledge/Experience (KE):** 0 start-ups;
- **Investment related (IR):** all the 2 start-ups, average is 1.50, the median 2.

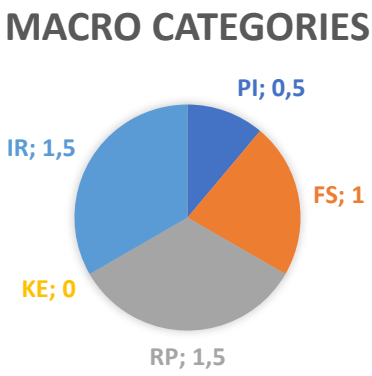


Figure 4.32 Macro Categories South America

The sample is very small to be statistically relevant to be compared to other groups or to the entire database sample.

Macro Categories

Considering each category, the occurrences per category in this group of start-ups will be analysed, comparing the size of this group with respect to the sample (3.85%) to the number of occurrences per category of this group with respect to the occurrences in the whole sample. Thus, it is possible to define if the occurrences of this group are relatively more frequent than the average of the whole sample.

First of all, *Personal Information:*

- *Age:* 1 start-up ask a question in this category, 3.45% of the start-ups that ask at least a question in this category of the entire sample.
- *Gender:* 0 star-ups.
- *Residence/Citizenship:* 0 star-ups.
- *Family situation:* 0 star-ups.
- *Education:* 0 star-ups.
- *Retirement:* 0 star-ups.

As far as *Financial Situation* is concerned, the occurrences per category are the following:

- *Assets:* 0 star-ups.
- *Patrimonial situation:* 0 star-ups.
- *Debts:* 0 star-ups.
- *Income Situation:* 1 start-up, 2.94% with respect to the entire sample.
- *Investments and Financial Situation:* 1 start-up, 4.00% compared to the whole sample.
- *Current Investments:* 0 star-ups.

Considering *Risk Propensity,* the result is the following:

- *Risk-return relationship:* 1 start-up has at least one question in this category, representing the 4.17% of the start-ups that in the whole sample ask a question in the category.
- *Feeling with losses:* 1 start-up asks a question in this category, this means that the 4.00% of the start-ups with a question in this category comes from South America.
- *Qualitative profile:* 1 start-up, 2.56% with respect to the entire sample.
- *Scenario analysis:* 0 star-ups.

Going further in details for *Knowledge/Experience:*

- *Studies and financial knowledge:* 0 star-ups.
- *Previous experience:* 0 star-ups.

In the end, the last macro category is *Investment Related:*

- *Investment:* 2 start-ups have at least one question in this category, representing the 4.88% of the start-ups that in the whole sample ask a question in the category.
- *Target:* 0 star-ups.
- *Plans:* 0 star-ups.
- *Objectives:* 0 star-ups.
- *Investment choices:* 0 star-ups.
- *Strategy:* 0 star-ups.
- *Periodic Investment:* 1 start-up, 4.35% if compared to the entire sample.
- *Time horizon/Duration:* 0 star-ups.
- *Liquidity:* 0 star-ups.
- *Details:* 0.

Graphical Representation

The *Graphical representation* of this group is prefect split in three types, with 33.33% each: *Write, Select* and *Write/+ and -.*

4.6.5.2 Outcome

On average South American start-ups shows 2.5 types of information, the median is 2. Looking at the categories, 0 start-ups give the possibility to have a *Choice among alternatives;* 1 start-up shows the *Portfolio Allocation* (2.33% compared to the entire sample); 2 start-ups display the *Return* (4.88% with respect to the whole sample); 0 start-ups show the *Risk*; 0 the *Fees*; 0 the *Comparison*; 0 start-ups show other *Details*. The 50.00% of the information are displayed as *Time series plot,* the 25.00% as *Value,* while both *Bar Chart* and *Different scenarios* account for the 12.50% each.

4.6.6 Final Remarks on MiFID II and Continents Analysis

In the sections 4.5 and 4.6 different groups of the sample were analysed in order to provide the results for smaller scopes (especially smaller geographical scopes) and, for larger groups such as MiFID II, and Europe, North America, due to their size, it was possible to make comparison in order to understand differences and similarities among them and with respect to the whole sample. Even if some differences were found in terms of average total number of questions, average number of questions per macro category, or number of information shown in the outcome, it is significant to highlight that those groups are not perfectly homogenous. In fact, all the groups score standard deviations relatively high, as the following table summarizes:

GROUP	TOTAL QUESTIONS	PI	FS	RP	KE	IR	TOTAL OUTCOME
MIFID II	7.18	1.01	2.56	2.67	1.74	1.74	3.20
EUROPE	6.75	0.86	2.36	2.47	1.99	1.58	3.16
NA	6.26	2.50	3.61	1.88	0.63	2.20	2.17
ASIA	5.00	1.51	1.10	1.37	1.22	1.97	1.97
OCEANIA	1.53	1.00	2.52	1.15	0.58	2.52	1.53
SA	2.12	0.71	1.41	0.71	NA	0.71	2.12

Figure 4.33 Standard Deviation

4.7 Data Analysis: Clusters

In this section, the 52 start-ups that offer the possibility to build online portfolios will be analysed, after being divided in different clusters. The clusters were found using the variables in the database that describe the most the investing strategy and the complexity of the portfolio. In fact, the objective of this analysis is to find out if start-ups that follow the same strategy and have similar complexity in portfolios profile customers in a similar way.

4.7.1 Variables

As said before, the sample was divided in clusters by two drivers: *Complexity* and *Strategy:*

- **Complexity:** as a proxy of the *Complexity* of portfolios was considered the number of asset classes used. In fact, most of the start-ups employ, as asset classes, with respect to the categorisation used in this research, Stocks (51 out of the 51 of which data are available), Fixed Income (51 out of 51) and Emerging Markets (50 out of 51), while other asset classes are less common and only 38 start-ups out of 51 employ more than 3 asset classes. Therefore, start-ups were divided into 2 groups by these variables: the ones that employ less than 4 asset classes and the ones that employ 4 or more.
- **Strategy:** as a proxy of *Strategy,* the instruments employed were used. Therefore, three possible strategies were identified: *Passive, Active, Both.* Since the proxy is represented by the instruments, following the categorisation used in this research and explained in section 4.1.2, as a proxy of *Passive* strategy were used *ETF* and *Index Funds;* as a proxy of *Active* strategy were used *Funds, Fund of Funds, Individual securities.* Therefore, this driver divides the sample in three categories: start-ups that use only a *Passive* strategy, start-ups that use only an *Active* strategy and start-ups that use both strategies.

4.7.2 The Clusters

With the variables, six different clusters were identified. Since the information about the instruments employed was available only for 49 start-ups, while that about the asset classes was available only for 51 start-ups, it was possible to collect information about both only for 48 of them.

Moreover, 10 start-ups use only a passive strategy and less than 4 asset classes, while 23 start-ups employ only a passive strategy but 4 or more asset classes, with a total of 33 start-ups employing only a passive strategy.

The start-ups employing only an active strategy are 4, of which 2 structure their portfolios with less than 4 asset classes, and 2 of them use 4 or more classes.

Furthermore, only one start-up has both strategies but less than 4 asset-classes. All the other 10 start-ups employing both strategies structure their portfolios with 4 or more asset classes.

In figure 4.34, the subdivision in clusters is highlighted:



Figure 4.34 Clusters

As the figure shows, it is already possible to have an idea of the distribution of the number of total questions of the start-ups in each cluster. Moreover, both the 2 clusters that employ and *Active* strategy are composed only by start-ups that that ask 10 or less questions in total (less than the 10.35 average of the whole sample). Ask 10 or less questions also the only one start-up that employs both strategies but uses less than 4 asset classes.

Furthemore, as far as the other 3 clusters are concerned:

- **Passive; Less than 4:** out of 10 start-ups, 4 ask between 11 and 20 total questions each, while the other 6 between 1 and 10.
- **Passive; 4 or more:** 1 start-up ask more than 30 total questions, while the other 22 in this cluster as split with 9 start-ups that ask between 11 and 20 total questions and 13 of them ask between 1 and 10 questions.
- **Both; 4 or more:** among these 10 start-ups, 6 of them ask between 1 and 10 questions, 3 of them between 11 and 20, only 1 start-up asks between 21 and 30 total questions.

4.7.2.1 Questions and outcome

The clusters have some differences in the number of questions they ask on average and the average number of information displayed:

- **Passive; Less than 4:** 10.33 questions asked on average, of which 0.89 Personal Information, 3.22 Financial Situation, 2.56 Risk Propensity, 0.44 Knowledge/Experience, 3.22 Investment Related. Moreover, the average number of information displayed is 3.67.
- **Passive; 4 or more:** the average number of questions asked is 10.70. Moreover, this are split as follows: 1.30 Personal Information, 2.78 Financial Situation, 2.13 Risk Propensity, 0.83 Knowledge/Experience, 3.65 Investment Related. Furthermore, the average number of information displayed is 3.87.
- **Active; Less than 4:** 6.00 questions asked on average, of which 1.00 Personal Information, 0.50 Financial Situation, 2.00 Risk Propensity, 0.00 Knowledge/Experience, 2.50 Investment Related. Moreover, the average number of information displayed is 2.00.
- **Active; 4 or more:** the average number of questions asked is 5.00. Moreover, this are split as follows: 0.00 Personal Information, 0.00 Financial Situation, 1.00 Risk Propensity, 0.00 Knowledge/Experience, 4.00 Investment Related. Furthermore, the average number of information displayed is 5.50.
- **Both; Less than 4:** 6.00 questions asked on average, of which 1.00 Personal Information, 2.00 Financial Situation, 2.00 Risk Propensity, 0.00 Knowledge/Experience, 1.00 Investment Related. Moreover, the average number of information displayed is 3.00.
- **Both; 4 or more:** the average number of questions asked is 12.44. Moreover, this are split as follows: 0.89 Personal Information, 2.67 Financial Situation, 3.33 Risk Propensity, 2.33 Knowledge/Experience, 3.22 Investment Related. Furthermore, the average number of information displayed is 4.00.

Therefore, there are some differences that are interesting to be highlighted. Even though three clusters (*Active, Less than 4; Active, 4 or more; Both, Less than 4*) are too small to be statistically relevant, being composed only by 1 or 2 start-ups, the other three have a more relevant size.

The 2 clusters that employ only a *Passive* strategy have an average that is pretty similar to the whole clusters, while the cluster of start-ups that uses both strategy and more than 4 asset classes ask on average a total number of questions that is the 20.19% larger than the entire sample.

Furthermore, the main and significant difference is related to the questions of the macro category Knowledge/Experience. In fact, the start-ups of the cluster *Both; 4 or more* ask 5.30 times the questions of the cluster *Passive; Less than 4* in this macro category, and 2.81 times the ones of the cluster *Passive; 4 or more.*

Although there are some differences and similarities among some clusters, it is necessary to remark that the clusters are not homogenous, being the standard deviations of the results mentioned above relatively high. The figure highlights what the standard deviations are (excluding the cluster *Both; Less than 4* since it is composed only by 1 start-up):

CLUSTER	TOTAL QUESTIONS	PI	FS	RP	KE	IR	TOTAL OUTCOME
PASSIVE; LESS THAN 4	4.85	1.05	2.17	1.88	0.73	1.79	3.08
PASSIVE; 4 OR MORE	6.19	2.12	3.81	1.84	1.34	1.90	2.90
ACTIVE; LESS THAN 4	4.24	1.41	0.71	1.41	NA	0.71	1.41
ACTIVE; 4 OR MORE	1.41	NA	NA	0	NA	1.41	2.12
BOTH; LESS THAN 4	NA	NA	NA	NA	NA	NA	NA
BOTH 4 OR MORE	7.35	1.05	2.24	2.24	2.50	1.64	2.60

Figure 4.35 Clusters Standard Deviation

4.8 Markets in Financial Instruments Directive II (MiFID II)

Having collected and analysed all the questions that are part of the customer profiling process, it is possible to assess the compliance of those questions with the requirements of what a questionnaire should be. In fact, the Markets in Financial Instruments Directive II (2014/65/EU) of the European Union, specifies how a customer profile should be assessed and what entities are subject to this directive. Moreover, according to the Directive, investment firms must assess the suitability and the appropriateness of the solution for the customer.

According to the Markets in Financial Instruments Directive II, all the investment firms that operates in the European Union has to be compliant with the directive. In particular, all the firms that are compliant must be registered in the official database of the European Securities and Markets Authorities (ESMA)[5]. Moreover, among the 96 start-ups of our sample, 25 of them registered in the ESMA's database. Furthermore, 19 of these 25 are among the ones that offer the possibility to invest online. Thus, the analysis of the MiFID compliance is focused on those 19.

In order to assess the compliance, it was firstly necessary to fill a list of information that must be asked to the client according to the directive. Defined the list, each kind of information was linked to specific questions collected in the spreadsheet. In this way, it was possible to understand for each type of information if it was asked or not by the start-up to assess the customer profile. Furthermore, the number of information asked per start-up were counted. The number of information asked out of the total number of information required by the directive represents the percentage of compliance.

[5] https://registers.esma.europa.eu/publication/searchRegister?core=esma_registers_upreg

4.8.1 Papers

Furthermore, the same methodology was used in previous researches on the same topic, mainly three papers were taken into account:

1. Jansen R., & Kilian A., & Loonen T. (2016) MiFID II: Suitability and Appropriateness;
2. Marinelli N., & Mazzoli C. (2011) Profiling investors with the MiFID: current practice and future prospects;
3. de Palma A., & Picard N. (2010) Evaluation of MiFID questionnaires in France.

The three papers use the same methodology but offer different perspectives about the information that must be asked in order to be compliant with the Markets in Financial Instruments Directive.

The first paper (Jansen R., & Kilian A., & Loonen T. (2016) MiFID II: Suitability and Appropriateness) identifies 10 information divided in 3 areas that are necessary to assess the suitability and the appropriateness of a portfolio for the customer, following the guidelines of MiFID II:

1. **Client's knowledge and experience**:
    a. *The types of service, transaction and the regulated investments with which the client is familiar;*
    b. *The nature, volume, frequency of the client's transactions with regulated investments;*
    c. *The level of education, profession or (if relevant) former profession of the client.*
2. **Client's financial situation**:
    a. *The source and extent of the client's regular income;*
    b. *The client's assets, including liquid assets, investments and real property;*
    c. *The client's regular financial commitments;*

   d. *The ability to bear losses.*

3. **Client's investment objectives**:
   a. *The client's investment horizon;*
   b. *The client's risk preferences, risk profile and risk tolerance;*
   c. *The purposes of the investment.*

The second paper (Marinelli N., & Mazzoli C. (2011) Profiling investors with the MiFID: current practice and future prospects) states that MiFID suggests 13 information divided in 3 areas in order to assess the suitability of the portfolio:

1. **Investment objectives**:
   a. *Information on the length of time for which the client wishes to hold the investment;*
   b. *The investor's preferences regarding risk taking;*
   c. *His/her risk profile;*
   d. *The purpose of the investment.*
2. **Financial capacity**:
   a. *Source and extent of his or her regular income;*
   b. *His or her assets (including liquid assets);*
   c. *Investment and real property;*
   d. *His or her regular financial commitments.*
3. **Experience and knowledge**:
   a. *Types of service, transaction and financial instrument with which the client is familiar;*
   b. *The nature, volume and frequency of the client's transactions in financial instruments;*
   c. *The period over which the client's transactions have been carried out;*
   d. *The level of education of the client;*
   e. *Profession or relevant former profession of the client.*

The third paper (de Palma A., & Picard N. (2010) Evaluation of MiFID questionnaires in France) is a research conducted for the French market regulator (Autorité des Marchés Financiers), and it explains two different solutions. The first one refers only to MiFID and states that a questionnaire to be compliant must ask 11 information, the second one refers also to the guidelines provided by the Autorité des Marchés Financiers (AMF) and proposes 8 information.

The first solution offers 11 information in 3 areas:

1. **Personal characteristics**:
    a. *Profession;*
    b. *Education.*
2. **Financial situation**:
    a. *Net worth;*
    b. *Income;*
    c. *Periodical Needs.*
3. **Investment objectives**:
    a. *Time horizon;*
    b. *Purpose;*
    c. *Risk aversion (quantitative);*
    d. *Risk aversion (qualitative).*
4. **Knowledge & experience**:
    a. *Experience;*
    b. *Knowledge.*

The second solution proposes 8 information in 3 areas:

1. **Financial situation**:
    a. *Net worth;*
    b. *Income;*

c. *Periodical Needs*.

2. **Investment objectives**:
    a. *Time horizon;*
    b. *Risk aversion (quantitative);*
    c. *Risk aversion (qualitative).*
3. **Knowledge & experience**:
    a. *Experience;*
    b. *Knowledge.*

4.8.2 Analysis

Starting from these papers and from the Directive, it was defined a final list. This list has the aim to be the most compliant possible to the Markets in Financial Instruments Directive II and as complete as possible, thus, the second solution of the third paper was not considered. The final list of the information used for this analysis is:

1. **Client's knowledge and experience**:
    a. *Services with which the client is familiar;*
    b. *Investments with which the client is familiar;*
    c. *The nature, volume, frequency of the client's transactions with regulated investments;*
    d. *The level of education of the client;*
    e. *Profession or (if relevant) former profession of the client.*
2. **Client's financial situation**:
    a. *The source of the client's regular income;*
    b. *Extent of client's regular income;*
    c. *The client's assets (or net worth, including liquid assets);*
    d. *Investments and real property;*
    e. *The client's regular financial commitments;*

f. The ability to bear losses.

3. **Client's investment objectives**:
    a. The client's investment horizon;
    b. Risk profile, preferences, tolerance (quantitative);
    c. Risk profile, preferences, tolerance (qualitative);
    d. The purposes of the investment.

Defined the list of the information that need to evaluate, the next step was to link each information to specific questions in the spreadsheet, in this way, with a binary model (1 or 0), it was possible to identify if each information is asked by a start-up.

The link between the information and the questions is the following:

1. **Client's knowledge and experience**:
    a. *Services with which the client is familiar* → 'Services you are familiar with', a subdivision of the question 'Knowledge of financial instruments/services';
    b. *Investments with which the client is familiar* → 'Instruments you know and used'; 'Experience and knowledge financial instruments'; 'Rate your knowledge in each instrument'; subdivisions of the question 'Knowledge of financial instruments/services';
    c. *The nature, volume, frequency of the client's transactions with regulated investments* → all the category 'Previous experience';
    d. *The level of education of the client* → 'Education';
    e. *Profession or (if relevant) former profession of the client* → there are no correspondences for this information in the database.
2. **Client's financial situation**:
    a. *The source of the client's regular income* → 'Source of income';
    b. *Extent of client's regular income* → 'Gross income' and 'Net income';
    c. *The client's assets (or net worth), including liquid assets* → 'Total assets' and 'Net worth';

d. *Investments and real property* → 'Non-financial assets' and 'Financial-liquid assets';
e. *The client's regular financial commitments* → all the category 'Debts';
f. *The ability to bear losses* → 'Monthly of savings quickly accessible'.

3. **Client's investment objectives**:
   a. *The client's investment horizon* → all the category 'Time horizon/duration';
   b. *Risk profile, preferences, tolerance (quantitative)* → all the category 'Risk-return profile';
   c. *Risk profile, preferences, tolerance (qualitative)* → all the category 'Qualitative profile';
   d. *The purposes of the investment* → 'Objective'; 'Plans' and the subdivision 'What is your investments goal' of 'type of investor' of 'Qualitative profile'.

4.8.3 Results

None of the 19 start-ups is 100% compliant. On average, the compliance is 31.58%, with a median of 26.67%. Figure 4.36 shows the distribution of the compliance of the 19 start-ups according to our methodology:

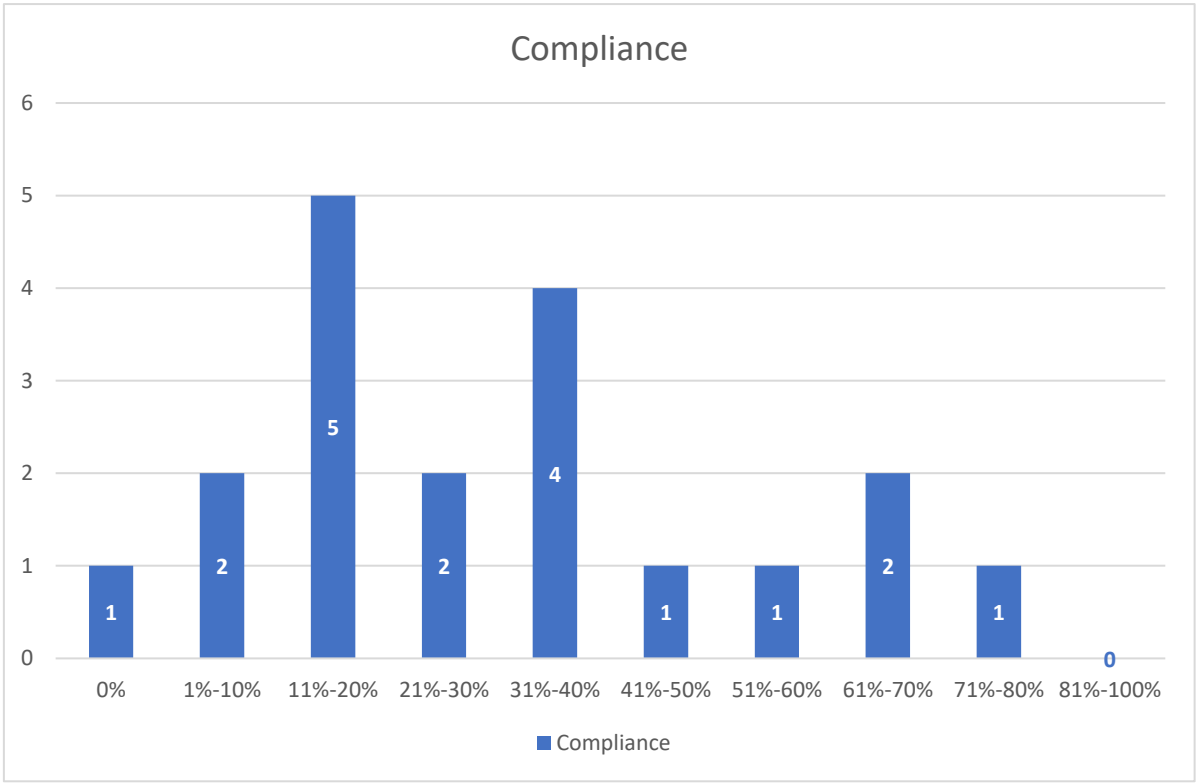


Figure 4.36 Compliance

As far as the information are concerned, on average each information is asked only by 6 start-ups, with a median of 5. Figure 4.37 shows in detail the number of start-ups that are compliant with each information:

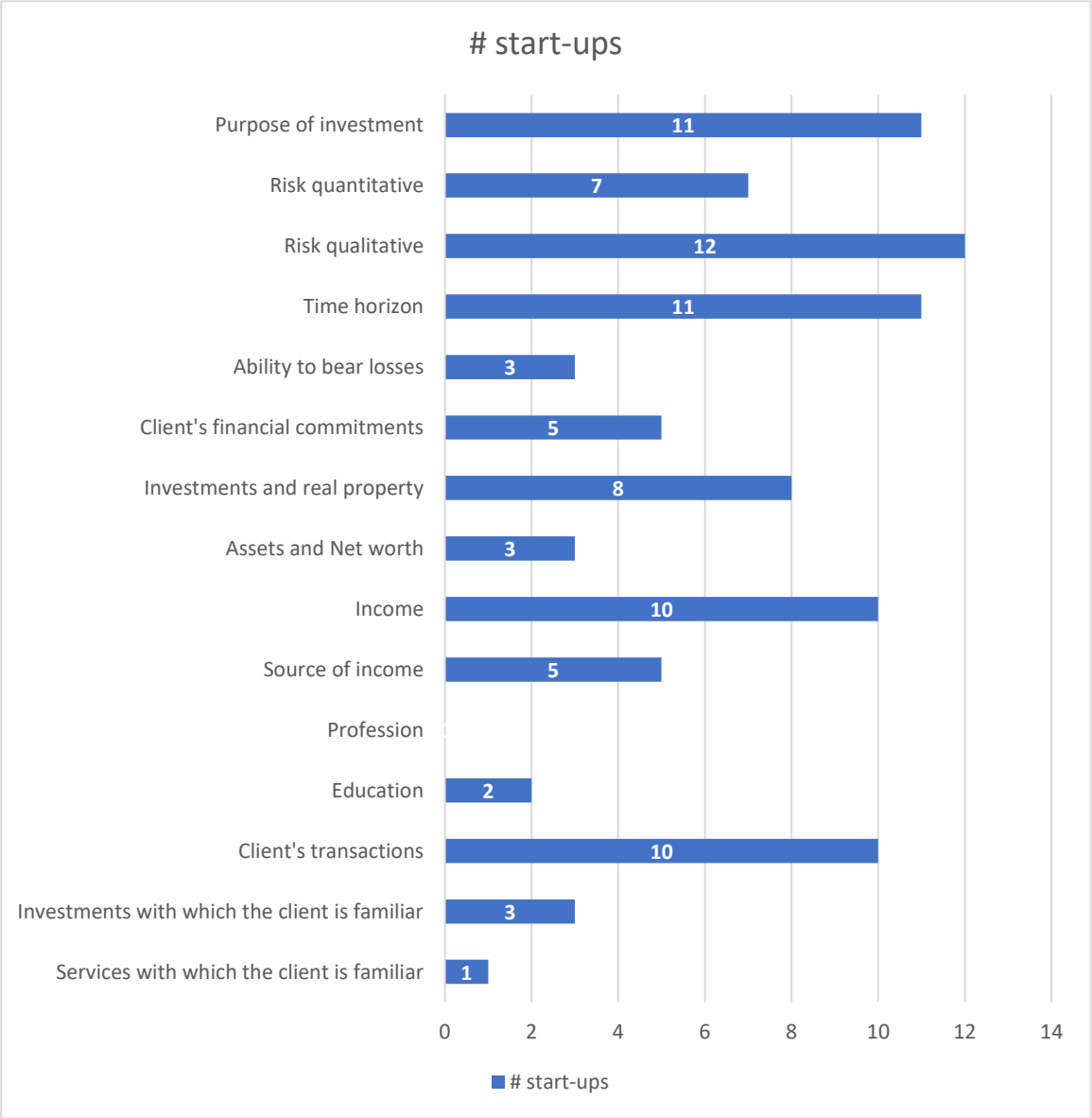


Figure 4.37 Number of start-ups per area

Therefore, there are 5 information that are asked by at least 10 start-ups out of 19, but there are 8 information asked by 5 or less. The most asked information is 'Risk qualitative' by 12. Moreover, 'Profession' is never asked.

4.9 Workshop

On July 3rd 2018 *Osservatorio Fintech & Insurtech* organized a workshop reserved for its partners, who came from financial institutions (banks, insurance companies, start-ups, etc.), market research companies and consultancy companies. The first part of the event concerned digital asset management and started with a collective activity: the participants were divided in 8 groups and were asked 2 questions, for the purpose of identifying the main information needed to offer an investment service. The 2 questions were posed from 2 different perspectives: that of the asset manager and that of the client. The questions are:

- *Question 1:* 3 pieces of information the asset manager should know to propose;
- *Question 2*: 3 pieces of information the client would like the asset manager to know.

4.9.1 Question 1: 3 pieces of information the asset manager should know to propose the investment service

Legend:

- "Objectives and needs" includes the following answers: "Driving needs for the investment", "Objectives", "Special needs", "Expectations & needs/projects".
- The answer "Product sophistication" has been attributed to "Preferences" because from the intervention of a participant it seems to be related to particular investment needs (e.g. investing in companies with only women in the BoD).
- The answer "How much money you save annually" has been attributed to "Flows (income/expenditure)" as savings can be computed as the difference between income flows and expenditure flows.

- Group 8 has provided answers not related to those listed in the table (the answers were: 1. profiling, needs, new clusters, asset allocation; 2. which and how many assets; 3. relationship/how), probably due to a different interpretation of the question, so its cells have been left blank.

	Group 1	Group 2	Group 3	Group 4	Group 5	Group 6	Group 7	Group 8
Objectives and needs	■	■	■	■	■		■	
Assets	■	■	■	■				
Time horizon	■			■	■	■		
Risk				■	■	■		
Flows (income/expenditure)				■		■		
Knowledge and experience			■					
Investments preferences			■					
Type of service (self/advised)			■					
Channel (digital vs human)		■						
Relationship with money							■	
Frequency and contact mode							■	

Figure 4.38 Results question 1

It is evident that almost all agree on the necessity to learn about the client's objectives in order to offer a customized service. This is probably related to the perception of asset & wealth management as a complete financial planning service, which helps the customer with the overall administration of assets and with the fulfilment of particular financial needs, rather than as a generic investment service. In that direction goes the intervention of one of the attendees, who highlights the importance of understanding whether the client is interested in a service related to the financial assets only or other components too (e.g. real estates, generational transfer, if he/she is an entrepreneur…). Information about investment

time horizon, investable capital and risk lag behind. In order to make a comparison with the typologies of information requested by MiFID and with the analysed start-ups, it is appropriate to examine the results at a lower level of detail:

	Group 1	Group 2	Group 3	Group 4	Group 5	Group 6	Group 7	Group 8
Investment								
Patrimonial/economic situation								
Risk propensity								
Knowledge/experience								
Service								

Figure 4.39 Lower level of detail question 1

Legend:

- "Investment" includes anything that is pertinent to the specific investment, namely "Objectives and needs", "Time horizon" and "preferences"
- "Assets" and "Flows (income/expenditure)" are part of "Patrimonial/economic situation"
- "Relationship with money" has not be attributed to any of the previous clusters
- "Service" includes the other answers that are not related to the 4 preceding clusters because they concern the characteristics of the service that the client wants from the asset manager: channel, contact mode, type of service (self/advised)

First of all, it can be noted that the predominant clusters are also consistent with 2 categories expected by MiFID (investment objectives, financial situation). A large proportion of the groups, however, believes that information on risk is not essential for providing the investment service. This is quite surprising for two reasons: on the one hand traditional

investment management models are based on the relationship between risk and return and on the construction of the so-called efficient frontier, and it is difficult to derive these variables from information on the investment objective or the financial situation; on the other hand, following the financial crisis, much emphasis was put on the necessity of correctly identifying the risk and the new regulation aims at protecting the client so that the service offered is consistent with his risk profile.

The cluster “knowledge/experience”, despite being another category required my MiFID, appears only once, probably because it is not essential for the definition of the service (for instance an investment portfolio). A similar argument applies to the absence of personal data (e.g. age). One of the participants, indeed, states that in order to offer a portfolio it is sufficient to know the time horizon, the risk appetite and the goal, while other questions that are asked are of "fine tuning".

4.9.2 Question 2: 3 pieces of information the client would like the asset manager to know

	Group 1	Group 2	Group 3	Group 4	Group 5	Group 6	Group 7	Group 8
Context (life)								
Events/needs								
Objectives								
Financial situation								
Expectations (of a gain)								
Previous choices and experiences								
Discretion degree								
Investment preferences								
Fears								
Favourite channel								

Figure 4.40 Question 2

Legend:

- Group 8 has not provided precise answers to the question, so its cells have been left blank
- "Events/needs" includes 2 answers written on whiteboards ("Events/goals expected/predictable that impact on financial needs", "events") as well as an answer arisen during the discussion (*«the expectations, needs and projects in general, not expectations on the investment»*)
- Answers given by groups 1,3,7 were not displayed on the whiteboards but inferred from the discussion

- 2 cells are coloured with a lighter shade because the answer given by group 5 was unusual: it supposed the existence of a matching system between the promoter and the client, based on life context and needs
- Group 6 has provided, among the answers, "trust", in the sense that there is a promise of a certain rate/yield, thus it has been associated to "Expectations (of a gain)"

The answers to the second question (displayed on the whiteboards and/or emerged from the discussion) apparently seem to be very different from the previous ones; actually, they are diverse in the form but not in the substance:

1. Putting themselves in customers' shoes induced attendees to use different terms (related to the emotional sphere) to express similar concepts: trust is related to the promise of a return, dreams and ambitions can be traced back to goals and projects and finally, fears can determine the investor's risk characteristics
2. Personal data, which was previously absent, is now present to the extent that certain objectives/needs derive from the family situation and the age or it allows to derive current and prospective flows

It can also be noted that the participants took as a reference the traditional human service and not robo-advisory, in the first place due to references to the emotional sphere and in the second place due to some speeches: *«demanding that our advisor knows us»; «matching between the promoter's investment style and my needs»; «we would like our asset manager to know our problems in life, to know my fears».*

The difference between form and substance is then found in the discussion of the different types of channels. In general, the participants agree that the biggest difference between human and digital channels lies in the way information is requested and not in its type: *«on digital you can probably choose different forms but in substance what we need to study our client is this»; «for the totally digital part we obviously need to have some information and bring it to the client in a very different manner».*

4.9.3 Comparison with start-ups

Of the 52 startups that request at least one piece of input information in the sample of this research, 32 (61%) ask at least one personal data question, 37 (71%) at least one on the balance sheet/economic situation, 49 (94%) at least one on the risk appetite, only 20 (38%) at least one on previous experiences and financial knowledge and 52 (100%) at least one on the investment. Therefore, it can be noticed that start-ups are in line with participants' interventions with regard to the predominance of questions about the investment, which include for instance the objectives, and to the marginal importance attached to questions about knowledge and experience. Probably this is related to the argument made previously on the types of questions designed to define the service and the portfolio. The biggest difference, instead, concerns the questions about the risk propensity: unlike what emerged during the workshop, almost all start-ups pose at least one such question. As mentioned above, the reason is twofold: on one hand, the risk component is fundamental to the choice of the portfolio/investment (due to the known relationship between return and risk), on the other there is a theme of regulation and protection of clients.

Given this premise, it seems that start-ups draw elements from both approaches (asset manager side and client side), in fact:

- The medium/high relevance of the patrimonial/economic information is consistent with the first perspective.
- The good presence of personal questions is ascribable to the second point of view.

Probably, what really lacks to start-ups to be able to fully enter the customer perspective is the aforementioned emotional sphere. However, this should not be surprising: the digital channel and in particular the use of algorithms require a high standardization of the questions, from which one needs to extract useful information for the investor profiling and the portfolio definition. Yet it is necessary to clarify that the participants have adopted the human channel as a reference, therefore, unless they use sophisticated chatbots and/or a

hybrid model (possibility to engage with a human consultant), it is difficult for start-ups to put themselves in this perspective. Hence, for a deeper analysis it would be appropriate to pose the same questions to “digital” customers: maybe their needs are different from those of “traditional” clients and from those emerged from the discussion with industry experts (professional deformation is unavoidable).

Finally, it is interesting to notice that some start-ups, with regard to the risk appetite, ask non-traditional, somehow "psychological" questions. This expedient also arose from the discussion: according to one of the participants, an idea that should be applied to the financial advice service of an Italian online bank is that of replacing the classic MiFID questionnaire with a behavioural one, conceived and developed by a team of psychologists too. Although this turns out to be less burdensome in the eyes of the customer (*«with digital certain types of questions have a very strong impact»*) there is a significant disadvantage: it is difficult to translate the answers into useful information to accurately define the risk appetite.

4.10 Questionnaire

In order to further understand the process of profiling of customers, a questionnaire was designed. The aim of the questionnaire is to gather information about the start-up's customers and, especially, about how they design the process, decide which questions they ask and measure their compliance with regulations (i.e. Markets in Financial Instruments Directive II (2014/65/EU) of the European Union). The main sources taken into account to develop the correct methodology to design the questionnaire were *Yin R. K. (2009) Case Study Research Design and Methods 4th Edition* and *Bradburn N. M., Sudman S., Wansink B. (2004) The Definitive Guide to Questionnaire Design—For Market Research, Political Polls, and Social and Health Questionnaires, Revised Edition.*

4.10.1 The Questionnaire

The sample of this further analysis is the same of the analysis of the portfolio simulation. Thus, only the 52 start-ups in the database that offer the possibility to invest online after answering some questions were considered.

Once the questionnaire was designed, an email address for each start-up was found and the survey was sent to each of them. Moreover, the possibility of a written answer or to schedule a call was offered.

The questions to submit in the questionnaire are the following:

1. **General information:** this section has the aim to introduce the person in charge of responding to the questionnaire and to gather some general information about the start-up itself. The questions designed for this part are:
    a. What is your professional experience and your role in the company?

   b. How was this start-up born, what is its history and how would you describe its strategy?
   c. What is your company's total AUM?
   d. How many customers does it have?

2. **Information about customers:** this section has the aim to gather information about the typical customer of the start-up. The following questions are the ones part of this section of the questionnaire:
   a. Who are your typical customer profiles? (in terms of age, education, size of the investment, duration of the investment, financial situation such as income, assets or net worth, objective of the investment)
   b. Which are the main risk profiles of your customers? How much risk are the typical customers willing to take?
   c. What is the average experience or knowledge in financial instruments and services of your typical customers?
3. **Customer profiling and portfolio building:** the aim of this part is to better understand how start-ups design their process of profiling, review it, and measure its compliance with the regulations. The questions are:
   a. Could you describe the process of the customer profiling and portfolio building? How do you profile your customers and how the information gathered affect the portfolio presented?
   b. How did you design the questions you ask to profile customers? What was taken into account, what affected the type and the number of questions?
   c. Do you frequently rearrange the questions? If yes, what do you consider when you decide to change?
   d. What kind of advisors do you consult to design questions? (i.e. legal)
   e. How do regulations (especially MiFID II for EU firms) affect the questions you ask? How do you analyse the compliance?

4.10.2 Results

In total, 4 start-ups provided a written answer and one scheduled a conference call. The information gathered was useful to deeper understand the start-ups' point of view about customer profiling.

4.10.2.1 General Information

Following the same path of the survey, the first question is about the role in the company of the person responding the survey. The answers came from members of the financial data science teams, strategic partnership teams and customer relationship management, with 2 of them that were the head of their teams.

The story behind each start-up is various. A common factor among some of them is the idea of creating a new business to enlarge the offer in the Asset Management market proposing new efficient and technological solutions at lower fees. The aim is to give customers the possibility to achieve higher returns at a lower cost. As this research highlighted in the previous chapter, ETFs are a fundamental instrument for robo-advisor and thus it is the most employed. Moreover, in their history, some of the start-ups managed to grow enough to be able to acquire other firms while other signed important partnership with the some of the biggest banks in the world.

Unfortunately, most of them consider confidential, and thus do not disclose, data about the number of customers and Asset under Management. Among the ones that provided the data, the average AuM is more than € 500m with more than 30,000 customers.

4.10.2.2 Information about customers

About customers start-ups provided information about who they target and who are their typical customers. For some of them the aim is to target mass affluent, but they think their service can be useful to everyone. Moreover, the general clientele of these start-ups is varied, with any kind of customer and very different incomes. Thus, it is complicated to describe the typical customer. Only one start-up provided a specific description of its general customer, a 45 years old male with mid-high education that invests around € 30k, which represent ¼ of his total investible assets. This typical customer has € 28k of annual net income and has the aim to cover or beat inflation. The risk profile is generally low, and it is distributed as a gaussian curve. Furthermore, it is possible to understand from some answers that higher income clients have a better knowledge and experience of financial instruments.

Focusing more on the Italian market, the general ideas gathered from the questionnaires received and the call, is that in general the average Italian has a low financial education. Therefore, Italians tend to invest less and invest less in assets such as stock and bonds. Moreover, there is also a cultural problem with technological solutions such as robo-advisors, that is the cause for both the lower offer than other countries and the lower demand. According to these considerations is more difficult than in other countries to target mass affluent, which is a problem for Asset Management in general and even more for robo-advisory.

4.10.2.3 Customer Profiling and Portfolio Building

First of all, the most important issue to consider to profile customers is regulations. Regulations, especially in the European Union with MiFID II, are strict on the topic. For example, for the case of the EU, it is fundamental to assess the suitability and appropriateness of a solution for a customer. According to some answers, the size of a MiFID II compliant questionnaire can vary a lot, from 7 or 8 questions to more than 20.

Thus, for European start-ups the MiFID questionnaire is the starting point, used to assess the profile of the customer and, especially, the risk profile. Not always there is an implied relationship between the risk profiles that can be assigned to a customer and the available portfolios. Moreover, some of the main drivers to define the portfolio are: investment goal, % investment on total investable asset, investment timeline and risk level.

As said before, the main issue to consider when designing a questionnaire to profile customers is regulations, but the questionnaire has also to be clear and not too long, in order to be efficient. In fact, one answer states that each question's importance is considered based on its value compared to the cost (i.e. from a time perspective).

To assure the compliance and the correctness of the questionnaire, different strategies are pursued. Some rely only on the internal expertise, some others rely on external consulting, such as legal, or both. The main expertise employed is legal, financial, economic, investments, behavioural finance, but also engineering. The number of expertise and teams that participate in designing the questionnaire for the customer profiling is a signal of how important this process is.

In conclusion, some start-ups answered that they do not periodically review their questionnaires, while others review them once in at least 2 or 3 years. They are reviewed in order to assure their efficiency and to keep them precise and accurate, and to stay compliant with changing regulations. In fact, the compliance is continuously measured. For example, according to MiFID II the 'ongoing suitability' is an important requirement for investors protection. Moreover, some start-ups have a Compliance Officer in charge of supervising employees' work and assessing its compliance with regulations.

4.11 Coherence with literature

In section 2.2.3.2 it was shown a table with all items that should be asked in questionnaires for profiling customers according to literature. In this section it will be evaluated to what extent start-ups questionnaires cover those items; the advantage of this analysis is that it can be performed for all companies, not only those subject to MiFID II regulation. The analysis will be carried out in three steps: description of the variables considered by literature and correspondence with variables of our database; analysis of the results; highlighting of the main mistakes contained in start-ups questionnaires.

4.11.1 Variables

With reference to Figure 2.7, 24 variables that are relevant for literature have been identified, divided in 5 areas. Some of them were present also in the previous discussion of MiFID; for the sake of simplicity, 2 variables have been united ("regular financial commitments" and "other financial commitments" have been combined in "financial commitments") while 1 variable has been eliminated as it was unclear and unexplained in the original paper (perception of probability).

1. **Socio-demographic characteristics**
    a) Gender → "gender"
    b) Age → "age"
    c) Marital status → derived from "marital status/children" and "investor characteristics", considering only questions related to the marital status
    d) Household composition → derived from "marital status/children" and "investor characteristics", considering only questions related to number of family components/children
2. **Experience and knowledge**

a) Profession → no correspondence
b) Education → "education"
c) Previous investment experience → all subcategories of "previous experience" except for "losses"
d) Outcome of previous investment experience → "losses"
e) Knowledge of financial products → all subcategories of "knowledge of financial instruments/services" apart from "services you are familiar with"
f) Knowledge of how financial markets work, furtherly divided in:
    I. risk-return trade-off → "high profit means high risk", subcategory of "specific tests"
    II. risk dimensions → no correspondence
    III. portfolio diversification principle (the fourth variable has been eliminated as said before) → no correspondence
g) Overconfidence and optimism → "future expectations"

3. Financial situation

a) Investments and real property → "non-financial assets" and "financial/liquid assets"
b) Assets → "total assets" and "net worth"
c) Source of regular income → "source of income"
d) Extent of regular income → "gross income" and "net income"
e) Financial commitments → "debts"

4. Investment objectives

a) Holding period → "time horizon/duration"
b) Time preferences (degree of impatience) → no correspondence with any variable but assessed checking all the questions individually (one occurrence has been found)
c) Liquidity needs → "liquidity"
d) Purpose of the investment → "plans" and "objectives"
e) Amount → "investment"

5. Risk tolerance

a) Risk attitude (objective risk) → "risk-return relationship" and "scenario analysis"
b) Emotional capacity to assume risk (subjective risk) → entire category "qualitative profile" without "future expectations", "what would you do if… (scenarios)", "how do you behave in a case (financial)" and "loss and reaction"
c) Loss aversion → no correspondence

The risk tolerance area deserves particular attention. Risk attitude (objective risk) refers to risk-return trade-off, which is included in "risk-return relationship" questions, and choice among different financial instruments with different risk-return profiles, which is included in "scenario analysis" questions. Emotional capacity to assume risk has been connected to questions on qualitative risk profile as well as to questions on emotional reaction to losses. Loss aversion is "people's tendency to strongly prefer avoiding losses to acquiring gains. Some studies suggest that losses are twice as powerful, psychologically, as gains" (Linciano and Soccorso, 2012). A couple of tests that may be used to elicit loss aversion are the following:

Lottery	Accept	Reject
#1. If the coin turns up heads, then you lose €2; if the coin turns up tails, you win €6.	O	O
#2. If the coin turns up heads, then you lose €3; if the coin turns up tails, you win €6.	O	O
#3. If the coin turns up heads, then you lose €4; if the coin turns up tails, you win €6.	O	O
#4. If the coin turns up heads, then you lose €5; if the coin turns up tails, you win €6.	O	O
#5. If the coin turns up heads, then you lose €6; if the coin turns up tails, you win €6.	O	O
#6. If the coin turns up heads, then you lose €7; if the coin turns up tails, you win €6.	O	O

Figure 4.41 Lottery Test
Source: Gächter S., Johnson E. J., Herrmann A., 2010

Which gambles would you be willing to take? (circle whichever alternative you prefer)

100% chance of winning $0	-vs-	50% chance of losing $10, 50% chance of winning $10
100% chance of winning $0	-vs-	50% chance of losing $10, 50% chance of winning $12
100% chance of winning $0	-vs-	50% chance of losing $10, 50% chance of winning $14
100% chance of winning $0	-vs-	50% chance of losing $10, 50% chance of winning $16
100% chance of winning $0	-vs-	50% chance of losing $10, 50% chance of winning $18
100% chance of winning $0	-vs-	50% chance of losing $10, 50% chance of winning $20
100% chance of winning $0	-vs-	50% chance of losing $10, 50% chance of winning $22
100% chance of winning $0	-vs-	50% chance of losing $10, 50% chance of winning $24
100% chance of winning $0	-vs-	50% chance of losing $10, 50% chance of winning $26
100% chance of winning $0	-vs-	50% chance of losing $10, 50% chance of winning $28
100% chance of winning $0	-vs-	50% chance of losing $10, 50% chance of winning $30
100% chance of winning $0	-vs-	50% chance of losing $10, 50% chance of winning $32

Figure 4.42 Gamble Test
Source: PLOS

In these types of tests, one outcome is kept constant and you can measure loss aversion considering when the respondent starts choosing the answers with the gamble (in the first example) or starts accepting the deal (in the second example). Through a comparison with these results it is possible to say that no start-up in the sample asks a question aimed at eliciting loss aversion as meant by Linciano and Soccorso (2012) and figures 4.41 and 4.42.

4.11.2 Analysis of the results

The average coverage is 21% for socio-demographic questions, 8% for experience and knowledge, 29% for financial situation, 44% for investment objectives and 44% for risk

tolerance. This result is coherent with what has been said during the Workshop (see section 4.9).

Independently of their coverage, the two areas showing more critical issues are knowledge/experience and risk tolerance. None of the questionnaires contain questions designed to test knowledge of basic concepts such as portfolio diversification, different risk dimensions, while only one inquires about the risk-return trade-off. Furthermore, except for one start-up, questions on overconfidence and loss aversion, which are among the investors' propensities affecting risk tolerance, are not present. The same could be said for the other psychological propensities highlighted in section 2.2.3.2; therefore, behavioural finance findings are not considered at all in designing questionnaires.

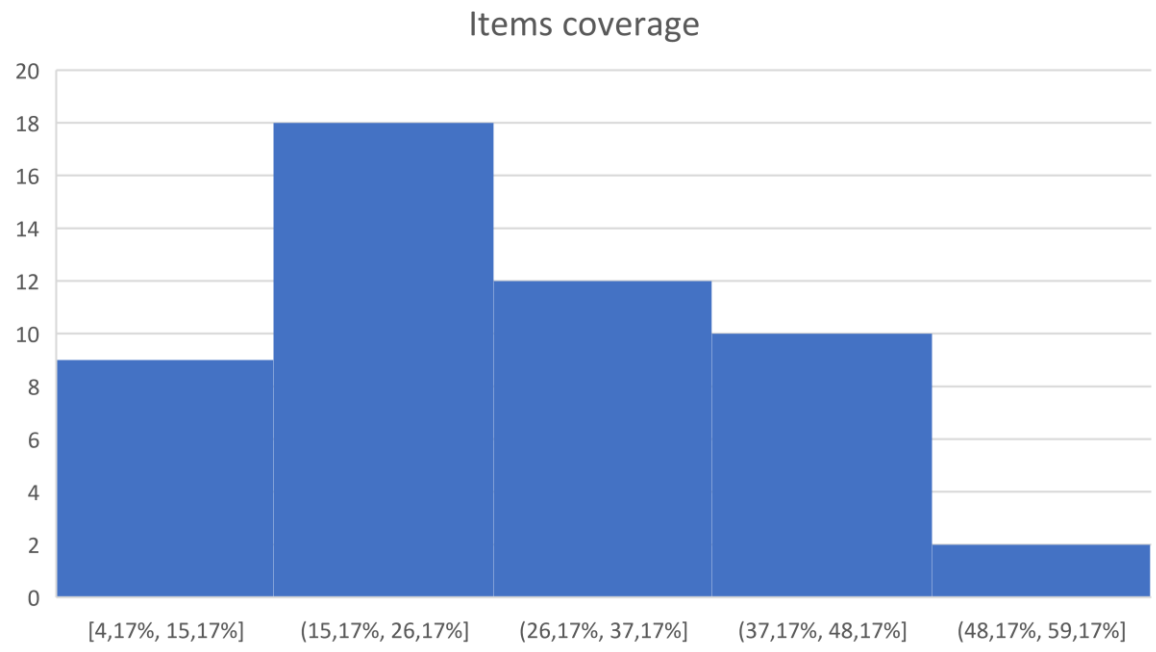


Figure 4.43 Items Coverage

As it can observed from the histogram, start-ups coverage of the items considered by literature is quite low; only 2 start-ups cover at least 50% of the items and the average coverage is 26.5%. However, this is not surprising for at least 2 reasons:

- Literature is stricter than MiFID regulation: there are some additional variables such as knowledge of how financial markets work, overconfidence and optimism, degree of impatience and loss aversion that are seldom, if ever, asked in questionnaires
- Digital advisors usually use short questionnaires because they provide simple financial services/rudimentary advice and they want to keep the churn rate low (some customers may abandon the platform if the questionnaire is too long or complicated)

Up to now topic was the quantitative aspects of questionnaires (i.e. coverage of areas and items) but it was not said anything about their quality: this will be the subject of the last section.

4.11.3 Main problems

In *"Assessing investors' risk tolerance through a questionnaire"* (2012), Linciano and Soccorso identify some issues that might undermine questionnaires' validity and reliability. In this section the focus is on the most common ones in start-ups questionnaires.

- Double-barrelled questions: more than one issue is asked in a single question, which consequently is ambiguous. Three evident instances of such problem were found: two of them are questions that elicit knowledge and experience of financial instruments at the same time (whereas they should be separated), the third refers to a question asking investment's objective and time horizon together.
- Mixing investment objectives and risk preferences: some questions may relate to both investment objectives and risk preferences, while financial literature recommends keeping them separated as they are influenced by different factors. In the questionnaires around ten instances of such mistake were found.
- Imprecise questions: the use of vague adjectives such as moderate/prudent/balanced or dynamic/aggressive in questions that ask to describe one's investment approach may make the client choose the answer that is viewed as more socially

acceptable/appropriate, instead of the correct one. In the sample 4 examples of imprecise questions were found.

- Self-evaluation: clients are generally asked to self-evaluate their financial literacy or risk profile, but "self-evaluation may be biased by overconfidence, optimism, the outcomes of previous investments and also by the tendency to improve one's image" (Linciano and Soccorso, 2012). Start-ups questionnaires contain seven examples of self-assessment in questions on knowledge and experience (almost always) and more than twenty in questions on risk tolerance (these are usually qualitative questions in which the investor has to choose his/her risk profile based on a score or describe his/her approach with the adjectives mentioned in the previous point). Moreover, two start-ups try to avoid self-evaluation, asking the clients how their friends or family would describe their risk profile (but even these questions could be biased).

Chapter 5

Conclusions

This research focused on the customer profiling of robo-advisors. At the beginning an analysis was conducted on the academic literature with the aim of defining the industry of asset management. It was defined what asset management is, the main theories applied; the actors involved and key numbers about the industry were provided, with a focus on the most important challenges for the future.

In fact, the asset management industry is facing key challenges that could be disruptive in the future. As it was explained in chapter 1, the fact that millennials are approaching the industry is shifting the preferences of the customers, increasing the interest in new technological solutions and online services. Moreover, the changes in customer preferences are affecting also the HNWI. Furthermore, passive asset management is rising and growing at a faster pace than active asset management. In fact, the AuM passively managed grew by 25% from 2016 to 2017, and actively managed AuM represent now only one third of the total, compared to the 57% of 2003. (BCG, 2018). Robo-advisor is a great example of the digital disruption that the market is facing (Pal, Tikam, Vij, 2016), due to the previous considerations.

Moreover, Assets under Management of robo-advisors are forecasted to account for more than $ 1 trillion by 2022. Are already advanced in this market countries such as the United States, China, the United Kingdom, Japan, Canada, Singapore and Australia. Other large economies such as Germany and France are developing, while Italy is considered only an emerging market. (Burnmark, 2017). Furthermore, in Chapter 2 the main benefits and risks of robo-advisors and the main trends were analysed. The two main possible scenarios were highlighted: in the first possibility, robo-advisor will gain market shares, and incumbents will have to either develop their own automated solution accepting lower margins or to focus more on high-end customers; the second possibility is that robo-advisors will commoditize also high-value services pushing traditional players to develop automated functionalities and offer customized services to a broader customer base.

Defined the key elements of the industry, the research focused on its scope, the analysis of the customer profiling. First of all, it was built a database of 96 start-ups worldwide that offer digital services related to asset management. The instrument employed the most by start-ups (almost 76%) is ETFs, this is because of the rise of passive management and the advantages such as low costs, liquidity, accessibility, transparency and high diversification. Considering asset classes, the ones that start-ups invest the most in are Equity (98.63% of the sample), Fixed Income (100%) and Emerging Markets (94.52%). In fact, stocks and bonds are the most traditional asset classes and can provide a high level of diversification and different risk profiles.

The very majority of the sample is made by European (45) and North American (31) start-ups, thus, these two continents represent more than the 79% of the sample. Being the most statistically relevant, it is interesting to compare these two groups. The most represented countries are the United States (23), the United Kingdom (14) and Germany (12). Moreover, even if there are start-ups that were founded in 2006 and 2008, the 60% of the sample was launched in 2014 or after. Furthermore, although there are more European start-ups than Northern American, the latter are the older and the first ones that entered the market. All the start-ups in the sample founded before 2009 are from North America, and among the 10

start-ups born before 2011, only 3 are Europeans and the rest from Canada or the US. Moreover, North Americans were able to collect more funds, with an average of $ 60m collected per start-up versus the $ 14.6m of average in Europe, that ranked third (behind Asia with an average of $ 18.2m). Similar results can be highlighted for the average Asset under Management, with an average of $ 1.6bn in North America versus $ 0.57bn scored by Europe.

The customer profiling phase was analysed for the 52 start-ups (all only or also B2C) that offer the possibility to build or simulate a portfolio online. This subset of the first sample has similar characteristics. The most represented continents are still Europe (27) and North America (15) accounting together for almost the 81% of the sample. Germany (9), the US (8), the UK (7), are still the most represented countries together with Canada (7). Similar differences occurred in terms of age, funding and AuM: the average fund collected is less than $ 20m for Europe and more than $ 64m for North America, the average AuM is $ 0.663m vs $ 3.0bn.

In the analysis of the customer profiling, all the questions asked to customers were registered and the same for the information displayed when the portfolio is built. This research was very useful to build a full and detailed database of all the questions asked and the information provided. Therefore, it was possible to conduct different analyses and understand the areas on which start-ups focus the most to profile customers, what are in each area the most asked questions, and, thus, how customers are profiled. In order to provide the highest level of details, also the graphical representation in which the questions are asked was illustrated. The same kinds of analyses were conducted also for the information displayed about the portfolios built. Thus, it was possible to understand what kind of information start-ups disclose about a portfolio they propose, and how they display the information.

In Chapter 4 a breakdown of the results per continent was provided, but due to the statistical relevance, these final remarks focus on the differences between Europe and North America. First of all, it is important to highlight that the standard deviations of the average results for the whole sample and single continents is relatively high, thus, the groups of start-ups headquartered in the same continent are not homogenous. Therefore, the rationale behind

the choice of the questionnaire to assess the customer profile could be much more related to the specific algorithm or technological and efficiency related choices made by the specific start-up, than related to other variables such as the geographical position. Moreover, even if it is not discussed in this work, similar results in terms of inhomogeneity were found dividing the sample in subsets using the other variables in the database.

Considering the whole sample, on average the questions asked are 10.35, of which 1.10 related to Personal Information, 2.46 to the Financial Situation, 2.50 Risk Propensity and 0.94 Knowledge/Experience. The averages are similar even if we consider Europe (10.82) and North America (10.67). However, there are some large differences regarding to Personal Information and Knowledge/Experience: North American start-ups resulted to ask 52.10% questions of Personal Information with respect to the entire sample, 124.97% more than Europeans. It is also noticeable that the 73.33% of North American start-ups ask at least one Personal Information, while the European ones that do so are the 51.85%. Moreover, only the 33.33% of North American start-ups have a question regarding Knowledge/Experience, compared to the 48.15% of Europe. The average number of questions in Knowledge/Experience is the 72.30% lower for North American with respect to Europeans start-ups. It is also remarkable that all the European start-ups in the sample that offer the possibility to build a portfolio online are from the European Union, thus subject to the same regulations, while North Americans are either from the United States or from Canada. In fact, the results presented for these two countries separately highlighted huge differences: start-ups from Canada ask on average 66.91% more questions that the ones from the United States and the most relevant differences are related to the macro categories Personal Information, Financial Situation and Risk Propensity. Therefore, the results show that European start-ups try to assess a customer profile that is more accurate, since the questions asked are more, especially for what regards the knowledge in finance of customers or their previous experience. As far as the outcome is concerned, the average number of information displayed of the whole sample is 4.02. Moreover, European start-ups show the 20.65% more information than the entire sample and the 54.95% of North Americans. Therefore, European start-ups tend to be more transparent with respect to the information related to the

portfolio. In fact, European start-ups disclose more information about the specific Portfolio Allocation, the possible Returns and Risks. However, North American start-ups are a bit more transparent for what regards the Fees: 5 out of 15 in North America display information related to this category, the 33.33%, compared to the 8 out of 27 in Europe, that is the 29.63%.

Moreover, the sample was also analysed divided in clusters. In fact, the data gathered was useful to try to identify a link between the variables collected and the way in which start-ups profile customers. Six clusters were identified using two variables as proxies of *Complexity* of the portfolios and of the *Strategy* employed (if Active, Passive or both). The main outcome of this analysis was that, as far as the customer profiling is concerned, the clusters found did not have humongous results. Therefore, the way in which portfolios are structured, as for the geographical position, is not the main rationale to explain how questionnaires are designed.

The data collected gives the possibility to conduct further analyses on the sample. The first analysis that was presented in this work is the compliance with the Markets in Financial Instruments Directive II (2014/65/EU) of the European Union. Therefore, an assessment of the compliance was presented. In fact, any investment firm has to be registered in the official database of the European Securities and Markets Authorities (ESMA). Out of the 27 European start-ups in the subset of the ones that offer online portfolios, 19 were found in this database. According to the directive, for any solution offered to a specific customer, its suitability and appropriateness have to be assessed. Moreover, specific questions have to be asked for this assessment. After a review of the academic literature, a list of areas in which is fundamental to ask questions was determined. Matching these areas with the database, it was possible to estimate the compliance of the 19 start-ups. As said before, no start-up resulted to be 81% compliant or more. In fact, 8 start-ups scored a compliance of only 20% or lower, 6 of 40% or lower and 5 between 41% and 60%. Moreover, there are no areas in the list that are covered by the all 19 start-ups. Only Purpose of Investment, Risk Qualitative, Time Horizon, Income and Client's Transaction were covered by 10 or more start-ups (with a maximum of 12), while Profession scored 0. Therefore, this analysis highlights that questionnaires tend to be too

short and to cover not enough areas to assess the profile of customers. In fact, with respect to the 15 areas in the list found with the academic review of studies on MiFID II, on average, these 19 start-ups ask 10.90 questions in total. Therefore, the data gathered for this work resulted to be very useful to understand how customers are profiled and to perform analysis on the correctness of the questionnaires that are provided to customers to assess the appropriateness and the suitability of the portfolios.

Other information about the customer profiling phase was gathered through workshops organised by Politecnico di Milano. In this work the results presented concern the one organised on July 3rd 2018 by the *Osservatorio Fintech & Insurtech* reserved for its partners, who came from financial institutions (such as banks, insurance companies, start-ups). The information retrieved was important to compare the results of this research to the opinion of experts on this sector. The views of the participants were aligned to the results of the research especially for the importance of questions related to the investment, including i.e. customers' objectives, and the marginality of questions related to the previous experience of customers and their knowledge about finance. However, there were significant differences with respect to questions related to the risk profile. Probably, what should be assessed is also the emotional profile, but digital channels and algorithms require high standardization of the questions. Therefore, it is interesting to notice that some start-ups ask non-traditional and almost psychological questions regarding the risk appetite. An idea arisen in the workshop is to replace the standard MiFID questionnaire with a behavioural one, but it would also be difficult to gather from this kind of questions information to define an accurate risk appetite.

Another source of information used in this research was a questionnaire designed to be submitted by the stat-ups in the subset of the start-ups that offer the possibility to build online portfolios. The answers gathered were fundamental to better understand the point of view of start-ups in designing their questionnaires. What emerged to be key in the phase of designing their questionnaires are regulations. Moreover, it is important to design a questionnaire that is efficient in terms of time spent to answer questions and importance of information gathered from a question. It is interesting to compare this view with respect to

the results of this research. In fact, even though regulation seems to be the most important driver, start-ups from the same market (i.e. start-ups from the European Union all subject to MiFID II), resulted to apply very different solutions. In fact, as remarked before, the group of European start-ups is not homogenous in terms of questions asked to profile customers. Moreover, the analysis about the compliance with the Markets in Financial Instruments Directive II (2014/65/EU) of the European Union highlighted that start-ups are not fully compliant with the areas that must be asked to follow the Directive, according to the academic literature.

Therefore, what this research suggests is that the solutions employed by start-ups to profile their customers are various, and strictly related to factors endogenous to the start-up rather than exogenous factors such as regulations.

In conclusion, the results found by this research were compared to what the literature suggests being important to be asked to profile customers. The result of this comparison is that the difference between literature and solutions employed by start-ups is large. In fact, the start-ups' coverage of items that the literature considers necessary is quite low, only 2 start-ups cover at least the 50%, with an average of 26.5%. Literature, indeed, is stricter than the Regulation, as it includes some additional variables that are hardly ever asked in questionnaires. After this quantitative analysis, some common mistakes that can undermine validity and reliability of such instruments were analysed.

Therefore, the key findings of this work and that practical solutions really employed are different from what theoretical paper say and there are also differences from the views of experts of the financial sectors. Moreover, the way in which start-ups profile customers is various: in fact, the standard deviation of the results is relatively high, both for the whole sample and for subdivisions of the sample based on specific variables, such as the geographical position.

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