

# The role of robo-advising in the asset management industry: a study on differences in robo-advised portfolio compositions for investors with similar risk

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## ABSTRACT,

The ever growing fintech industry produced one of the biggest changes in the asset management industry this century; robo-advisors. The implementation of robo-advisors has already had a huge impact on the investment advisory industry, with the assets under management by robo-advisors expected to reach more than \$2,5 trillion USD this year. Though, weirdly enough, a lot of people are still not very familiar with the concept of robo-advisors. Furthermore, there are still many possible flaws in the robo-advisor industry. This study aims at investigating one of these flaws, being the efficacy of robo-advisors. Robo-advisors create and manage portfolios based on algorithms that turn input data from users into a risk profile, consequently resulting in a portfolio. This study will use 3 robo-advisory platforms to investigate the efficacy problems of this new advisory service. Why do different platforms create different portfolios for the exact same risk profile? That is the question that will be investigated in this study. In order to do so, 3 risk profiles were setup. Each of the risk profiles were tested on all the robo-advisors by 3 students. The testing showed that the influential factors on why different robo-advisors give different portfolio compositions for investors with similar risk preferences are the questionnaire methodology, the investment philosophy, the asset allocation methodology, the investment universe and the risk management strategy, while some of these factors are inter-connected.

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# 1. INTRODUCTION

In recent years, the asset management sector has seen tremendous change, largely due to technological improvements. The emergence of robo-advisors, which are automated investment platforms that provide investors with algorithm-based portfolio management services, is one of the most noticeable innovations. Because of their ability to offer accessible and affordable investment advice to people who lack financial expertise, robo-advisors have grown in popularity.

Robo advisors are automated investment platforms that, after examining a user's financial situation (current assets and cash flow), goals, aspirations, time horizons, risk tolerance, and capital market expectations, offer algorithm-based solutions for tailored investment portfolios. Robo advising services were originally presented in the US in 2008, and thanks to their low cost, simplicity of use, and minimal investment, they quickly gained popularity. The services offered by these platforms include automated plans, goal-based asset allocation, automated portfolio reallocation and rebalancing, and thorough financial advising. Robo-financial advisory services are nearly entirely powered by artificial intelligence (AI) and run entirely automatically (Bhattacharyya & Bhattacharyya, 2022).

The criteria or filters that the system uses to choose the best stock or even to advise switching out an existing stock in a portfolio are based on aspects relating to performance, valuations and governance, among other things. Even though the code is designed by humans, it doesn't take human prejudice or emotion into account. When a user registers, these platforms or bots typically ask them a few questions. The main goal of this is to comprehend a person's risk tolerance and investment objectives in order for the AI to recommend the appropriate equities or, in many cases, mutual fund schemes or even exchange-traded funds (ETFs) (Bhattacharyya & Bhattacharyya, 2022).

Human financial advisors frequently face significant conflicts of interest, which might interfere in a negative manner from the quality and reliability of their financial advice. Many people have a high level of mistrust for human financial consultants, because they are afraid of being taken advantage of financially. Nevertheless, recent technological advancements in the financial services sector have paved the way for automated financial advisors that are less likely to be exposed to potential conflicts of interest because they offer significantly lower and more transparent cost structures than human financial advisors who are

frequently vulnerable to flawed incentive-based compensation schemes and potentially conflicting kickback payments (Brenner & Meyll, 2020).

Generally speaking, robo-advisors ask clients about their financial condition and investment goals before creating an investment portfolio fit for their (risk-)profile, frequently employing affordable exchange traded funds (ETFs). Following that, the portfolio is typically managed by an algorithm, which may involve actions like rebalancing and reinvested dividends or contributions to savings plans. Robo-advisors offer a number of additional important advantages, such as instant accessibility, improved time efficiency, and lower fees and charges than human financial advisors (Brenner & Meyll, 2020).

Additionally, research has shown that using robo-advisors reduces common behavioral investment biases including trend chasing and the disposition effect. However, robo-advisors have drawn criticism for transferring control over the suitability of investment decisions from the financial institution to the individual investor. If investors lack the required financial understanding to make wise financial decisions, this can be very harmful (Brenner & Meyll, 2020).

## 1.1 Research problem:

Despite robo-advising's detrimental growth in popularity, empirical data on its uptake and effects on portfolio performance in the asset management sector are lacking. Though, an even bigger lack in empirical data can be found when looking at the efficacy of robo-advisors; how risk profiles of private investors affect robo-advised portfolios. This should be studied, because the outcomes could determine whether or not RA's in general are fully capable of aligning the risk profile of an investor with the risk profile of an RA created portfolio. Furthermore, the outcome of this study could help with giving (future) investors a better understanding of RA's and with the fact that there might be significant differences between different RA's.

## 1.2 Research question:

As mentioned before, this study looks at the efficacy of robo-advisors in building investment portfolios. Whether or not RA's can create the desired result (portfolio) for the administered risk profile of the investor. Furthermore, this study specifically, aims to further investigate the main research question: **What are the differences in portfolio composition and risk/return profiles between different robo-advisors for investors with similar risk preferences, and how are they caused?**

In order to be able to fully answer the main research question, it is important that we investigate and are able to answer the following sub questions:

### 1.2.1 Sub-questions:

1. How do various robo-advisors build their portfolios of investments for investors with similar risk preferences?
  - Robo advisors use surveys and algorithms to construct investment portfolios for investors, but what exact steps are undertaken and what the possible differences in surveys and algorithms are is important to investigate.
2. What investment philosophies do different robo-advisors utilize, and how do these philosophies affect portfolio composition and risk/return profiles?
  - Investment philosophies among robo-advisors may vary, with some emphasizing value investing and others growth investing, for example. Variations in portfolio composition and risk/return profiles may result from these discrepancies. Therefore, it is important to investigate this sub-question.
3. What factors contribute to differences in robo-advisors' asset allocation for investors with comparable risk preferences?
  - There may be variations in asset allocation even among robo-advisors with (nearly) identical investment philosophies. For instance, one robo-advisor might invest more in equities, whilst another might invest more in bonds. Therefore, it is important to investigate what these exact differences are and what are they caused by.
4. How is risk managed by different robo-advisors, and what is the impact of this on the risk/return profiles of their portfolios?
  - Robo-advisors may employ a variety of risk management techniques, including, asset allocation, diversification and rebalancing. The risk/return profiles of the portfolios they construct may be impacted by these variations.

## 2. LITERATURE REVIEW

When a private investor is planning on using a robo-advisor, this person needs to understand that robo-advisors will pretty much all ask the same questions, according to investing and retirement specialist Arielle O'Shea. Though, what is important for this private investor to understand, is that the outcome of every robo-advisor will not be the same. Even though the questions asked are almost all similar and the investor profile is the same, the outcome of portfolio compositions and risk/return profiles from different robo-advisors will differ. (NEBA Financial Solutions, 2018)

A study first published in 2017, relating to the evaluation of risk preferences by robo-advisors concluded the following about RA's. Robo-advising, a rapidly expanding segment of the advisory market, has a number of shortcomings. The assessment procedure is inconsistent, with different robo-advisers asking different questions. As a result, some RA's are unable to determine an investor's risk tolerance or aversion effectively. Additionally, the algorithms used frequently produce shallow results. The psychometric process must be made more effective by using big data, artificial intelligence, and social media in order to overcome these problems. Making the user experience better by making it more engaging is also essential. The existing rigorous risk assessment approach produces less than ideal outcomes, and it is crucial to take into account the risk perceptions of individual investors from a variety of angles. (Tertilt & Scholz, 2017)

The same study also suggested the following about RA's. The key causes of differences in risk recommendations could be the risk management strategies and the investment philosophy employed by different robo-advisors. Whereas one robo-advisor might be more focused on diversification and risk management, another robo-advisor can be more concentrated on having a more aggressive investment philosophy. Furthermore, differing between robo-advisors, one might use a risk model which is more sophisticated than the one employed by another. Ultimately, that could also result in dissimilar risk recommendations. (Tertilt & Scholz, 2017)

Though, the results from Tertilt & Scholtz their study that have regards to this study were sometimes only suggestions. Furthermore, their study can be classed as outdated, since it was published 5 years ago and the AI technology sector has been growing and innovating massively over the last few years.

Therefore, this study will aim at investigating what the current situation is with regards to the efficacy of robo-advisors.

Another research paper named "How Risk Profiles of Investors Affect Robo-Advised Portfolios" by Dmitri Boreiko and Francesca Massarotti was published in 2020. This research paper concluded the following about robo-advisors: For investors with similar risk choices, there may be noticeable discrepancies in the portfolio composition and risk/return profiles of various robo-advisors. According to the study, a number of reasons can be responsible for these disparities, namely investment philosophy, asset allocation, risk management and investment universe (Boreiko & Massarotti, 2020). This study will follow-up on the study of Boreiko and Massarotti.

## 2.1 Key theories

The main theory for this study will be the **Modern Portfolio Theory**, which contends that a well-diversified portfolio can optimize returns while limiting risk, will also be used in the study. "The modern portfolio theory (MPT) is a practical method for selecting investments in order to maximize their overall returns within an acceptable level of risk. This mathematical framework is used to build a portfolio of investments that maximize the amount of expected return for the collective given level of risk. (Team, 2021)"

The study by Michael Tertilt and Peter Scholz also revealed that the assignment of investment portfolios suggested by robo-advisors commonly complies with MPT. According to the well-known MPT theory, the best investment portfolio is the one that maximizes expected return for a particular level of risk. Investment portfolios should be built based on the expected return and risk of each asset. (Tertilt & Scholz, 2017)

The paper does point out several restrictions on the usage of MPT in the context of robo-advisors, though. In particular, MPT makes the supposition that investors are risk averse and that they rationally weigh the risks and returns of various scenarios when making decisions. The study does, however, point out that certain private investors can have cognitive biases that cause them to make illogical investing choices. (Tertilt & Scholz, 2017)

Another important theory is the **Efficient Market Hypothesis (EMH)**. "The efficient market hypothesis (EMH), alternatively known as the efficient market theory, is a hypothesis that states that share prices reflect all information and consistent alpha generation is impossible. According to the EMH, stocks always trade at their fair value on exchanges, making it impossible for

investors to purchase undervalued stocks or sell stocks for inflated prices. Therefore, it should be impossible to outperform the overall market through expert stock selection or market timing, and the only way an investor can obtain higher returns is by purchasing riskier investments. (Downey, 2022)"

## 2.2 Hypothesis:

The hypothesis for this study is based on literature review, key theories and own expectations. With regards to the research question, it is hypothesized that the main differences in portfolio composition and risk/return profiles between different RA's for investors with similar preferences are the aggressiveness of the investment philosophy, the sophistication of the risk management strategy, underlying preferences with regards to asset allocation and possible limits in the robo-advisor's investment universe. All these differences are hypothesized to be caused by the underlying algorithm that every robo-advisor employs. Though, specific and more detailed causes cannot possibly be predicted yet.

## 3. METHODOLOGY

This study will test 3 risk profiles on 3 RA's. The purpose of the testing is to be able to compare outcomes and with the outcomes create conclusions for the sub-questions and then the research question. The specific profiles and amount of robo-advisors; from different backgrounds; should allow for sophisticated outcomes with regards to both the sub- and main research question(s) of this study.

- Choosing the right platforms (which factors and criteria)

This research required a distinctive approach towards the selection of the used platforms(robo-advisors). Certain criteria were selected which the robo-advisors should meet. These specific criteria are listed and explained below.

- o **Availability in the Netherlands.** Robo-advisors are most common in the USA, with most of these platforms not allowing non-US residents to be able to use its robo-advisors. Therefore, there is a need to carefully pick out the platforms that allow Dutch residents to make use of their robo-advisor. This criteria has already eliminated a vast majority of the robo-advisors.
- o **Multiple risk profiles/portfolios.** This research will use multiple risk profiles to test the efficacy of RA's as extensively as possible. For this to happen, the

platforms have to allow me to test multiple risk profiles and therefore create multiple portfolios.

- **Trustworthiness.** The robo-advisors need to be trusted and well-rated in order to be classed as trustworthy. If this is not the case for a certain RA, than it can't be used in this research. The reputation of the RA indicates the competence for this research.
- **No initial required investment.** This research is purely targeted at understanding robo-advisors more, with the research being done by a 20 year old student. Therefore, it would be ideal to be able to use platforms that are fully free to use; with regards to this research. Some platforms require an initial investment of thousands of euro's before allowing to see results, others require only an initial investment of only about 50 euro's, and some even have a fully free demo function or show the portfolio before making an investment. This last option is the ideal option, though if not enough can be selected, the second option will also be fine.

With all the above mentioned criteria in mind, a selection process resulted in the following. Ultimately, it came down to the 3 best RA platforms for this research being IndexaCapital, SwissQuote and StashAway. Table 1 below shows the most important characteristics of the different platforms, explaining why they were the most suitable for this study.

- Defining the risk profiles

This research required risk profiles to be setup. Logically 3 profiles were setup, with the names being conservative, moderate and aggressive. These 3 have historically been the 3 main types of investors. It also makes the most sense for this research, since 3 types can most easily be tested. A lot of questionnaires for RA's tend to give answer options for the questions with every possible answer corresponding with one specific risk profile.

This research deals with investigating the efficacy of RA's. Therefore the research will be about the differences in portfolio's for the same investor risk profile when using different RA's. This means that the 3 profiles (conservative, moderate and aggressive) shown in Table 2, that will be tested need to have exactly the same characteristics; not applying to risk. This implies, for instance, gender, age, investment horizon, etc. In Table 2 found on the page below, the 3 risk profiles are shown with all their significant characteristics.

3 students, including myself, will act as these personas/profiles and fill in the questionnaires of the different RA's accordingly. This method will give this study more robustness. The platforms also indicate what risk profile was created; from the questionnaires, for the portfolio once it has been created. This helps with proofing that the portfolios are aligned with the risk profiles shown in Table 2. This methodology is based on and supported by an earlier study on this subject (Boreiko & Massarotti, 2020).

| <i>Platform</i>      | <i>Country of origin</i> | <i>Demo /real</i> | <i>Minimum investment</i> | <i>Investment universe</i>  | <i>Risk level determination</i>                    | <i>Composition of portfolio</i>   | <i>Assets under management</i> |
|----------------------|--------------------------|-------------------|---------------------------|---|--|---|--------------------------------|
| <i>IndexaCapital</i> | Spain                    | Real              | €0                        | Equities<br>Bonds   | Based on questionnaire                             | Min. 2<br>Max. 12<br>ETF's  | Over €1.7 billion              |
| <i>SwissQuote</i>    | Switzerland              | Demo              | €50.000                   | Equities<br>Bonds<br>Commodities<br>Real estate<br>Fixed income<br>Cash | Based on number chosen between 1 and 10            | Differs with regards to risk profile.<br>On average between 17 and 20 securities. | Over €378 million              |
| <i>Stashaway</i>     | Singapore                | Real              | €0                        | Equities<br>Bonds<br>Commodities<br>Cash equivalents<br>Cash            | Template for conservative, moderate and aggressive | Differs with regards to risk profile.<br>Option to add as many as there are(68)   | Over €1 billion                |

**Table 1: General Information on RA's**

*Risk preference*      *Conservative*      *Moderate*      *Aggressive*

|                              |                        |  |                         |
|------------------------------|------------------------|--|-------------------------|
| <i>Gender</i>                | Male                   | Male   | Male                    |
| <i>Age</i>                   | 35                     | 35   | 35                      |
| <i>Marital status</i>        | Single                 | Single   | Single                  |
| <i>Field of work</i>         | Sales                  | Sales  | Sales                   |
| <i>Investing experience</i>  | 2-5 years              | 2-5 years  | 2-5 years               |
| <i>Investment horizon</i>    | 5-10 years             | 5-10 years   | 5-10 years              |
| <i>Yearly income</i>         | €40.000                | €40.000  | €40.000                 |
| <i>Initial investment</i>    | €50.000                | €50.000  | €50.000                 |
| <i>Aim of investment</i>     | Wealth building        | Wealth building                                    | Wealth building         |
| <i>Investment philosophy</i> | Minimization of losses | Minimization of losses and maximization of returns | Maximization of returns |

**Table 2: Risk Profiles**

For this research, the risk tolerance/preference differs, but the rest of the profile is the same. Therefore, this research has used the profile of the average male in the Netherlands. The average income in the Netherlands in 2023 is around €40.000 (YoungCapital, 2023). A 35 year old sales worker, earning around €40.000 also makes sense (Verkoper Salaris in Nederland - Gemiddeld salaris, z.d.). Most 35 year old males that work in sales probably have some experience in investing. Furthermore, it isn't shocking for a 35 year old single man to have built up at least €50.000 of free cash flow. Hypothetically, this person has been saving up €5.000 per year for a period of 10 active working years. Building wealth over a period of 5-10 years should not be a problem either and should give significant results for the output of the RA's (the created portfolios).

- How will the RA's be analyzed

After setting up all the portfolios, by filling out the questionnaires for every one of the 3 risk profiles on every one of the 3 platforms, the RA's will be analyzed. The RA's will be analyzed on several factors. These factors are listed below:

- The questionnaire:
  - o The differences and similarities in the questions
- The portfolio:
  - o Investment universe
  - o Asset allocation (ratio of stocks to bond, or even other assets)
  - o Which markets are used (European, US, Japanese, Global, etc.)
  - o Can a specific investment philosophy be recognized or is it already known from their website
  - o How is risk managed

## 4. RESULTS

### 4.1 Questionnaire

All 3 of the platforms asked the same "general" question. The following can be understood for the term "general" questions. The questions are with regards to age, sex, annual income, marital status, investment horizon, etc. The setup of specific questions that were pointed at recognizing ones risk preferences really showed a difference. Whereas some literature and experts say that these questions are all almost the same, this is not always true. Arielle O'Shea, NerdWallet's investing and retirement specialist claimed the following: "Before you even sign up, robo-advisors will pretty much all ask the same questions,". Though, this study showed that 2 out of the 3 used platforms didn't ask questions to figure out the users risk preference, but instead just let the user pick their own risk profile. The first platform, IndexaCapital, asks specific questions to determine the users risk profile. Some good examples are listed below (Conoce tu perfil inversor - cartera de fondos, z.d.) (Schrodt, 2018) :

- o "The global stock market is often volatile. Imagine that your investment portfolio loses 10% of its value in a month, what would you do?"
- o "If you think of the word "risk", which of the following words comes to mind?"
- o "In the past, have you invested in stocks or mutual funds?"

The second platform, SwissQuote, asks the user to pick a number between 1 and 10 of risk level that the users wants to employ, though these risk levels do include a description of what the specific level entails. The third platform, StashAway, is even less specific. This platform lets you choose between template risk profiles. On their platform the templates are also called conservative, moderate and aggressive.

## 4.2 Portfolios

Every platform produced 3 different portfolios per person. One with a conservative, one moderate and one aggressive risk profile. Ultimately this led to this research having 27 total portfolios to investigate. All the exact portfolios can be found in the appendices. This section of this study contains the most important results that were found from the 27 different portfolios.

### 4.2.1 Investment Universe

| <i>Platform</i>      | <i>Investment universe (all ETF's, excluding Cash)</i>                               |
|----------------------|--|
| <i>IndexaCapital</i> | Equities<br>Bonds<br>(Number of assets is dependent on amount of money invested)     |
| <i>SwissQuote</i>    | 928 Equities<br>9 Bonds<br>16 Commodities<br>5 Real estate<br>Cash                   |
| <i>StashAway</i>     | 47 Equities<br>16 Bonds<br>1 Commodity<br>1 Cash equivalent<br>2 Real estate<br>Cash |

**Table 3: Investment Universe**

### 4.2.2 Asset Allocation

This subchapter contains the results of the portfolios' asset allocation. The full table is shown on the page below, in subchapter 4.2.2.4. in Table 4.

#### 4.2.2.1 IndexaCapital

It can clearly be observed that the conservative portfolios on the platform IndexaCapital employ a more traditional approach than the other platforms. The allocation of bonds is extremely high, which refers to the portfolio having a very low risk level. The allocation of bonds for Daan and Tom's portfolios is quite similar (91% and 82% respectively), while Stefan's allocation is way

lower(55% respectively). This means that Stefan probably is a slightly more aggressive investor by heart, shifting his view on the terms conservative, moderate and aggressive, as can be seen in most of his portfolios. Furthermore, the portfolios don't show much diversification in terms of different types of assets, since they don't include any of the following: commodities, real estate, cash equivalents or just cash. For the moderate and aggressive portfolios, no remarkable changes can be found. Though, the aggressive portfolios might be the most aggressive out of the 3 platforms. The equities percentage ranges between 81% to 90% throughout the portfolios, pointing to what can be seen as a more growth-oriented strategy. This implies that IndexaCapital is very extreme in underlining the fact of a portfolio being either aggressive or conservative.

#### 4.2.2.2 SwissQuote

SwissQuote's portfolios show the most diversification in terms of the amount of types of assets. While the conservative portfolios show a dominance of bonds, this changes to a slight dominance of equities at the moderate portfolios and a distinct dominance at the aggressive portfolios. Though, the portfolios remain varied and diversified at any moment. The percentage of real estate and cash isn't influenced by the aggressiveness of the portfolios, while the percentage of commodities slightly increases when the aggressiveness increases. Also notable, is that the percentage of cash is at 5% at any time. This is quite a high percentage. Holding such a percentage in cash gives multiple benefits. It is a form of risk management, because when a market is in a downturn, the investor can capitalize on this easily with the liquidity it gives. Also, having cash in a portfolio is another way of diversifying a portfolio.

#### 4.2.2.3 StashAway

StashAway's conservative portfolios are almost entirely made up out of bonds and cash equivalents making their conservative portfolios the most conservative ones out of the 3 platforms. Cash equivalents are even more conservative in terms of risk than bonds, even though some short-term bonds do sometimes get classed as cash equivalents. In general though, cash equivalents carry less risk with them than bonds do. When a moderate and aggressive portfolio is employed at StashAway, equities become the dominant factor, while the percentage of bonds slightly decreases and the percentage of cash equivalents fastly decreases. The percentage of cash stays at 1% all throughout the different risk levels, which is quite low, but this is of course made up for by the cash equivalents.

#### 4.2.2.4 General

| Platform         | Respondent       | Asset            | Conservative | Moderate | Aggressive |
|------------------|------------------|------------------|--------------|----------|------------|
| IndexaCapital    | Daan             | Equities         | 9%           | 45%      | 90%        |
|                  |                  | Bonds            | 91%          | 55%      | 10%        |
|                  |                  | Commodities      | -            | -        | -          |
|                  |                  | Real Estate      | -            | -        | -          |
|                  |                  | Cash Equivalents | -            | -        | -          |
|                  |                  | Cash             | -            | -        | -          |
|                  | Tom              | Equities         | 18%          | 45%      | 81%        |
|                  |                  | Bonds            | 82%          | 55%      | 19%        |
|                  |                  | Commodities      | -            | -        | -          |
| Real Estate      |                  | -                | -            | -        |            |
| Cash Equivalents |                  | -                | -            | -        |            |
| Cash             |                  | -                | -            | -        |            |
| Stefan           | Equities         | 45%              | 72%          | 90%      |            |
|                  | Bonds            | 55%              | 28%          | 10%      |            |
|                  | Commodities      | -                | -            | -        |            |
|                  | Real Estate      | -                | -            | -        |            |
|                  | Cash Equivalents | -                | -            | -        |            |
|                  | Cash             | -                | -            | -        |            |
| SwissQuote       | Daan             | Equities         | 20%          | 35%      | 60%        |
|                  |                  | Bonds            | 56%          | 36%      | 13%        |
|                  |                  | Commodities      | 5%           | 7%       | 8%         |
|                  |                  | Real Estate      | 14%          | 16%      | 14%        |
|                  |                  | Cash Equivalents | -            | -        | -          |
|                  |                  | Cash             | 5%           | 5%       | 5%         |
|                  | Tom              | Equities         | 23%          | 40%      | 55%        |
|                  |                  | Bonds            | 51%          | 32%      | 17%        |
|                  |                  | Commodities      | 6%           | 8%       | 9%         |
| Real Estate      |                  | 15%              | 16%          | 14%      |            |
| Cash Equivalents |                  | -                | -            | -        |            |
| Cash             |                  | 5%               | 5%           | 5%       |            |
| Stefan           | Equities         | 20%              | 40%          | 60%      |            |
|                  | Bonds            | 56%              | 32%          | 13%      |            |
|                  | Commodities      | 5%               | 8%           | 8%       |            |
|                  | Real Estate      | 14%              | 16%          | 14%      |            |
|                  | Cash Equivalents | -                | -            | -        |            |
|                  | Cash             | 5%               | 5%           | 5%       |            |
| StashAway        | Daan             | Equities         | -            | 35%      | 60%        |
|                  |                  | Bonds            | 41%          | 35%      | 22%        |
|                  |                  | Commodities      | 8%           | 9%       | 9%         |
|                  |                  | Real Estate      | -            | -        | -          |
|                  |                  | Cash Equivalents | 50%          | 21%      | 8%         |
|                  |                  | Cash             | 1%           | 1%       | 1%         |
|                  | Tom              | Equities         | -            | 35%      | 60%        |
|                  |                  | Bonds            | 41%          | 35%      | 22%        |
|                  |                  | Commodities      | 8%           | 9%       | 9%         |
| Real Estate      |                  | -                | -            | -        |            |
| Cash Equivalents |                  | 50%              | 21%          | 8%       |            |
| Cash             |                  | 1%               | 1%           | 1%       |            |
| Stefan           | Equities         | -                | 35%          | 60%      |            |
|                  | Bonds            | 41%              | 35%          | 22%      |            |
|                  | Commodities      | 8%               | 9%           | 9%       |            |
|                  | Real Estate      | -                | -            | -        |            |
|                  | Cash Equivalents | 50%              | 21%          | 8%       |            |
|                  | Cash             | 1%               | 1%           | 1%       |            |

**Table 4: Asset Allocation of portfolios**



Comparing the different platforms at the same risk level, multiple things can be concluded. The conservative portfolios provided by SwissQuote are relatively diversified, but are the least conservative risk wise. They include commodities and real estate and don't include cash equivalents. IndexaCapital and Stashaway's portfolios are more similar in the sense of lower risk, though Stashaway does a better job of diversifying. The moderate portfolios are all quite well balanced and don't show any weird irregularities, though of course IndexaCapital still only uses bonds and equities. The aggressive portfolios show, again, that IndexaCapital is the most aggressive in terms of risk with such a high allocation towards equities.

Lastly, comparing the different students, the portfolios at IndexaCapital all have a different asset allocation. This is caused by the questionnaire being more extensive and detailed. Logically, this forces differences sooner. The portfolios at SwissQuote are very similar, though do have some differences. This is the case because the questionnaire is way less extensive, but more based on a picked number between 1 and 10 ranking the different risk possibilities. Lastly, Stashaway has no difference in the portfolios for the different students. This is because the portfolios are based on templates that the platform gives for the different risk profiles; being conservative, moderate and aggressive.

#### 4.2.3 Region

In this subchapter the use of different regions will be explained. The exact details of the portfolios' regions can be found in the full portfolios displayed in the appendices

The first platform, IndexaCapital, uses mainly US and Europe as its regions. Associating Europe more with conservative assets and US with more aggressive. Also, when becoming more aggressive, the portfolios include more and more Japanese and stocks from other unknown regions.

The second platform, SwissQuote, uses the US and Switzerland as its main regions. The other regions that are employed are named UK, Global, Other Developed Countries, Other Emerging Countries and Global. This shows that this platform categorizes its regions, since it uses a vary wide variety of different regions and markets.

The third and final platform, Stashaway, uses the US as its main region. Though this region becomes less of a leader when the portfolios become more aggressive. After the US, Japan is the most used region, apart from the region classed as "other" which

includes many regions. The other less used regions are France, Germany, UK and China. Japan and China's influence in the portfolios become larger when the portfolio has a higher risk profile.

#### 4.2.4 Investment Philosophy

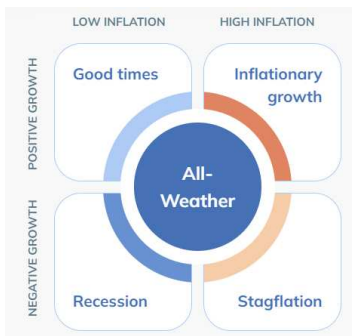
The investment philosophies of the 3 RA's are explained in this subchapter. While every all 3 of the RA's are based on the Modern Portfolio Theory, they do all have their own underlying way of working. These ways will be made clear in this subchapter.

The first platform, Indexa Capital, combines the principles of the Modern Portfolio Theory(MPT) and the Black-Litterman model to construct portfolios that balance risk and expected return. The MPT model establishes the baseline relationship between risk and return, while the Black-Litterman model incorporates investor views to perfect the asset allocation for optimal performance. (Web & Da Silva, 2023)

The second and third platform (SwissQuote and Stashaway) also employ MPT and a little bit of the Black-Litterman model, but they also make use of their own concepts, which are explained below.

The second platform, SwissQuote, have their investment philosophy clearly stated as the dynamic management approach. "The dynamic management approach is based on algorithms developed by Swissquote Bank and involves the use of a quantitative model to select stocks with solid upside potential while controlling the overall level of risk in the portfolio, as measured by the Value-at-Risk." (Investment Funds: Invest in Funds Online | Swissquote, z.d.).

The third platform, StashAway, also have their investment philosophy clearly stated as the Economic Regime Asset Allocation(ERAA). "Economic Regime-based Asset Allocation, is the intelligent investment framework that minimizes your risk and maximizes your returns." (Our Investment Methodology, z.d.). An economic regime is described as the state of the current economy, while the current regime is being recognized through macroeconomic data. There are 4 clear regimes, and when unclear the all-weather regime applies:



**Figure 1: ERAA Regimes**

ERAA has the ability to adjust your portfolio's asset allocation in accordance with the prevailing economic conditions, as different asset classes exhibit distinct behaviors in various economic regimes. This process, referred to as "Re-optimization," ensures that your portfolio is well-prepared for the current or anticipated regime while still aligning with your risk preferences.

#### 4.2.5 Risk management

All 3 RA's use the same methods for risk management. First of all, the RA's use asset allocation in order to align the set risk preference with the risk of the portfolio. All the conservative portfolios are mostly made up out of bonds while the aggressive portfolios are all mostly made up out of equities, as shown in Table 4 in subchapter 4.2.2. of this research. And while bonds tend to carry very little risk with them, equities tend to be some of the riskiest form of investment. Secondly, all 3 of the RA's also use the diversification method in order to diminish risk. SwissQuote states their way of diversification in the follow manner, "a dynamic allocation is created to maximize diversification while keeping the volatility of the portfolio at a reasonable level, as per the client's requirements. This volatility value depends on the risk level, with dependency between asset classes." (Technology | Swissquote, z.d.) Lastly, and again, all the 3 RA's use the same method named monitoring & rebalancing. The RA's do have some slight differences in the detail with rebalancing, though this is not significant towards this research.

## 5. DISCUSSION

Based on the analysis done in this study, conclusions can be made on the earlier created sub-questions. The key findings of this study are concluded below.

Various robo-advisors build their portfolios of investments for investors with similar risk preferences in different ways. Following this study there are already a minimum of 3 ways. Where the most detailed method is the questionnaire used by

IndexaCapital, the least detailed is the template method employed by StashAway where there are only 3 portfolio options; conservative, moderate and aggressive. The final method, by SwissQuote, is where a risk level between 1 and 10 is picked and correlated with a risk profile. Furthermore, portfolios are also build based on the underlying investment philosophy used by a platform, their method of asset allocation and their ways of risk management.

Investment philosophies have a significant impact on portfolio composition and risk/return profiles. The most prominent philosophies are (a combination of) the Modern Portfolio Theory and the Black-Litterman model which balance risk and expected return in portfolio composition. This is also used by IndexaCapital. Though various other RA's will use other and sometimes their own philosophy. SwissQuote, for instance, follows a dynamic management approach. This approach is focused on upside potential stock selection, meanwhile controlling portfolio risk. This resulted in very diversified portfolios. Another philosophy, employed by StashAway, is the Economic Regime-based Asset Allocation. This approach is focused on adjusting the portfolio's asset allocation based on prevailing economic conditions to maximize returns and minimize risk. This approach also led to very diversified portfolios.

As mentioned earlier, asset allocation is one of the basis's for portfolio composition. Asset allocation is influenced by several factors, but when investors have similar risk preferences not many of these influences still apply. As mentioned above, the investment philosophy is of influence in the asset allocation process. Furthermore, what also does still apply is the investment universe of a robo-advisor. Some platforms include more types of assets in their universe than others. Not all include, for example, real estate, commodities, cash equivalents and just cash. This influences the diversification of a portfolio and with that the actual risk of the portfolio. Also the weight given to the specific assets is of influence. The portfolio risk should be aligned with the risk profile of the investor using the RA. This is, again, also determined through the investment philosophy and risk model of the platform. Moreover, another important factor is the regions that the assets stem from. Using assets from various regions and markets can help with diversification of a portfolio. Based on this study, RA's prefer using the US as a region for conservative risk portfolios and start using Asian regions increasingly when the portfolio becomes more risky. Also, this

study implies that platforms tend to prefer using the region that they originate from as well. Lastly, the amount of single assets per asset type is of influence, with more single assets giving the possibility for a more personified portfolio.

The final important key finding is the influence of how risk is managed by different robo-advisors. Of course, RA's use asset allocation as a risk management method. Conservative portfolios dominantly allocate more to bonds and cash equivalents, while aggressive portfolios dominantly allocate more to equities. Moreover, diversification is also used by RA's to reduce risk generally. Lastly, monitoring and rebalancing techniques are frequently employed by RA's to maintain an aligned asset allocation with the risk profile.

All of the findings support the findings of the studies that were dealt with in the literature review. Where Tertilt and Scholz suggested that the key causes of differences in risk recommendations could be the risk management strategies and the investment philosophy employed by different robo-advisors, Boreiko and Massarotti claimed that even more was of influence. They believed that investment philosophy, asset allocation, risk management and investment universe were the reason for disparity in the portfolios of different RA's for investors with similar risk preferences. This study shares the same conclusions, though based on a methodological different study.

Lastly, it was hypothesized that the main differences in portfolio composition and risk/return profiles between different RA's for investors with similar preferences are the aggressiveness of the investment philosophy, the sophistication of the risk management strategy, underlying preferences with regards to asset allocation and possible limits in the robo-advisor's investment universe. This also turned out to be correct, based on the full study.

## 6. CONCLUSION

This research aimed to identify what the differences in portfolio composition and risk/return profiles are between different robo-advisors for investors with similar risk preferences, and how they are caused. Based on the analysis conducted in this study, it can be concluded that different robo-advisors employ varying methodologies, investment philosophies, and risk management techniques, leading to differences in portfolio composition and risk/return profiles for investors with similar risk preferences.

Factors such as the questionnaire or risk assessment process, investment philosophies, and the specific asset allocation and diversification strategies contribute to these differences. Investors should consider these factors when choosing a robo-advisor that aligns with their risk preferences and investment goals.

Possible limitations that could be pointed out for this study are the following: only 3 platforms/RA's were used, making it a small sample size and not per se representative of the whole market. Furthermore, people might have different perceptions on what conservative risk, moderate risk and aggressive risk is in terms of portfolios and questionnaires. So, possibly the student sample of 3 can be seen as too small as well to have a "correct" general perception of these 3 terms.

The recommendations that follow from this study are very clear. Future investors who are planning on using a robo-advisor should be very careful with selecting the correct platform that fits their needs. As earlier mentioned in this study, some experts and studies claim that all robo-advisors ask the same questions and it therefore doesn't matter which platform is picked. According to this study, this couldn't be more wrong. Future users of robo-advisors should read into the investment philosophy of platforms, but also the investment universe of the platforms to match their ideal platform with their needs. Another recommendation is the one that was already made by Tertilt and Scholz, shown in the literature review. "The assessment procedure is inconsistent, with different robo-advisors asking different questions. As a result, some RA's are unable to determine an investor's risk tolerance or aversion effectively. Additionally, the algorithms used, frequently produce shallow results. The psychometric process must be made more effective by using big data, artificial intelligence, and social media in order to overcome these problems. Making the user experience better by making it more engaging is also essential. The existing rigorous risk assessment approach produces less than ideal outcomes, and it is crucial to take into account the risk perceptions of individual investors from a variety of angles."

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## 8. APPENDICES

All the full portfolios are shown below

| ASSET CLASS                        | INVESTMENT                                   | %            | WORTH              |
|------------------------------------|--|--------------|--------------------|
| <b>Total shares (%)</b>            |  | <b>9.0%</b>  | <b>€ 4,500.00</b>  |
| United States Stocks               | Vanguard US 500 Stk Idx Eur -Ins Plus        | 5.0%         | € 2,500.00         |
| Europe Stocks                      | Vanguard European Stk Idx Eur -Ins Plus      | 4.0%         | € 2,000.00         |
| <b>Total bonuses (%)</b>           |  | <b>91.0%</b> | <b>€ 45,500.00</b> |
| US government bonds hedged to Euro | Vanguard US Gov Bnd Idx Eur Hdg -Ins Plus    | 25.0%        | € 12,500.00        |
| European government bonds          | Vanguard Eur Gov Bnd Idx-Ins Plus            | 25.0%        | € 12,500.00        |
| European corporate bonds           | Vanguard Euro Inv Gr Bnd Idx Eur -Ins Plus   | 18.0%        | € 9,000.00         |
| US corporate bonds hedged to Euro  | Vanguard US Inv Gr Bnd Idx Eur Hdg -Ins Plus | 14.0%        | € 7,000.00         |
| European inflation-linked bonds    | Vanguard Euroz Inf Lk Bnd Idx Eur -Ins Plus  | 9.0%         | € 4,500.00         |
| <b>Total</b>                       |  | <b>100%</b>  | <b>€ 50,000.00</b> |

Table 5: IndexaCapital; Conservative – Portfolio Daan

| ASSET CLASS                        | INVESTMENT                                   | %            | WORTH              |
|------------------------------------|--|--------------|--------------------|
| <b>Total shares (%)</b>            |  | <b>45.0%</b> | <b>€ 22,500.00</b> |
| United States Stocks               | Vanguard US 500 Stk Idx Eur -Ins Plus        | 20.0%        | € 10,000.00        |
| Europe Stocks                      | Vanguard European Stk Idx Eur -Ins Plus      | 10.0%        | € 5,000.00         |
| Small Cap Global Stocks            | Vanguard Global Small Cap Idx Eur -Ins Plus  | 5.0%         | € 2,500.00         |
| Emerging economy stocks            | Vanguard Emrg Mk Stk Idx Eur -Ins Plus       | 5.0%         | € 2,500.00         |
| Japan Stocks                       | Vanguard Japan Stk Idx Eur -Ins Plus         | 5.0%         | € 2,500.00         |
| <b>Total bonuses (%)</b>           |  | <b>55.0%</b> | <b>€ 27,500.00</b> |
| US government bonds hedged to Euro | Vanguard US Gov Bnd Idx Eur Hdg -Ins Plus    | 15.0%        | € 7,500.00         |
| European government bonds          | Vanguard Eur Gov Bnd Idx-Ins Plus            | 15.0%        | € 7,500.00         |
| US corporate bonds hedged to Euro  | Vanguard US Inv Gr Bnd Idx Eur Hdg -Ins Plus | 10.0%        | € 5,000.00         |
| European corporate bonds           | Vanguard Euro Inv Gr Bnd Idx Eur -Ins Plus   | 10.0%        | € 5,000.00         |
| European inflation-linked bonds    | Vanguard Euroz Inf Lk Bnd Idx Eur -Ins Plus  | 5.0%         | € 2,500.00         |
| <b>Total</b>                       |  | <b>100%</b>  | <b>€ 50,000.00</b> |

Table 6: IndexaCapital; Moderate – Portfolio Daan

| ASSET CLASS                     | INVESTMENT                                  | %            | WORTH              |
|---------------------------------|---|--------------|--------------------|
| <b>Total shares (%)</b>         |   | <b>90.0%</b> | <b>€ 45,000.00</b> |
| United States Stocks            | Vanguard US 500 Stk Idx Eur -Ins Plus       | 35.0%        | € 17,500.00        |
| Europe Stocks                   | Vanguard European Stk Idx Eur -Ins Plus     | 23.0%        | € 11,500.00        |
| Emerging economy stocks         | Vanguard Emrg Mk Stk Idx Eur -Ins Plus      | 13.0%        | € 6,500.00         |
| Japan Stocks                    | Vanguard Japan Stk Idx Eur -Ins Plus        | 10.0%        | € 5,000.00         |
| Small Cap Global Stocks         | Vanguard Global Small Cap Idx Eur -Ins Plus | 9.0%         | € 4,500.00         |
| <b>Total bonuses (%)</b>        |   | <b>10.0%</b> | <b>€ 5,000.00</b>  |
| European government bonds       | Vanguard Eur Gov Bnd Idx-Ins Plus           | 4.0%         | € 2,000.00         |
| European inflation-linked bonds | Vanguard Euroz Inf Lk Bnd Idx Eur -Ins Plus | 3.0%         | € 1,500.00         |
| European corporate bonds        | Vanguard Euro Inv Gr Bnd Idx Eur -Ins Plus  | 3.0%         | € 1,500.00         |
| <b>Total</b>                    |   | <b>100%</b>  | <b>€ 50,000.00</b> |

Table 7: IndexaCapital; Aggressive – Portfolio Daan

| Security  | Currency | Asset Class | Sector                | Region                    | Quantity | Value      | Weight |
|---|----------|-------------|-----------------------|---------------------------|----------|------------|--------|
| IS C BD LG CAP UCITS EUR DS                                     | EUR      | Bonds       | Other                 | Other Developed Countries | 38       | 4,566 EUR  | 9.13%  |
| UBS (Lst) Bond SICAV – Asian High Yield P Acc                   | USD      | Bonds       | Other                 | Other Emerging Countries  | 53       | 4,713 EUR  | 9.4%   |
| ISHARES iBBOX HIGH YIELD BOND                                   | USD      | Bonds       | Other                 | USA                       | 68       | 4,709 EUR  | 9.4%   |
| ISHARES TIPS BOND ETF   | USD      | Bonds       | Other                 | USA                       | 47       | 4,736 EUR  | 9.5%   |
| VANGUARD SHORT TERM COR BD ETF                                  | USD      | Bonds       | Other                 | USA                       | 86       | 4,987 EUR  | 9.9%   |
| VANGUARD SHORT TERM GOVERNMENT                                  | EUR      | Bonds       | Other                 | USA                       | 87       | 4,710 EUR  | 9.4%   |
| IS C BD LG CAP UCITS EUR DS                                     | EUR      | Cash        | Cash                  | Currency                  | 7,055    | 7,285 EUR  | 14.5%  |
| TMOCI UBS C   | USD      | Commodities | Commodities           | Global                    | 9        | 854 EUR    | 1.7%   |
| BARC SERIES B AGRICULTURE                                       | USD      | Commodities | Commodities           | USA                       | 29       | 845 EUR    | 1.7%   |
| BARC SERIES B INDUSTRIAL METAL                                  | USD      | Commodities | Commodities           | USA                       | 12       | 823 EUR    | 1.7%   |
| BARC SERIES B METALS  | USD      | Commodities | Commodities           | USA                       | 10       | 857 EUR    | 1.7%   |
| Swissquote Quant European Equities                              | EUR      | Equities    | Global equity indices | Global                    | 24       | 2,166 EUR  | 4.3%   |
| ISHARES MSCI EMERGING MARKETS                                   | USD      | Equities    | Global equity indices | Other Emerging Countries  | 49       | 1,760 EUR  | 3.5%   |
| Swissquote Quant Swiss Equities                                 | CHF      | Equities    | Global equity indices | Switzerland               | 15       | 1,385 EUR  | 2.8%   |
| UBS ETF - FTSE 100  | GBP      | Equities    | Global equity indices | United Kingdom            | 24       | 1,190 EUR  | 2.4%   |
| ISHARES S&P 500   | USD      | Equities    | Global equity indices | USA                       | 50       | 1,958 EUR  | 3.9%   |
| AXA WF Framlington Europe Real Estate Securities A Cap          | EUR      | Real Estate | Financial             | Other Developed Countries | 3        | 327 EUR    | 0.7%   |
| Schroder ISF Global Cities Real Estate A Acc                    | USD      | Real Estate | Financial             | Other Emerging Countries  | 4        | 595 EUR    | 1.2%   |
| UBS SWISS   | CHF      | Real Estate | Financial             | Switzerland               | 4        | 545 EUR    | 1.1%   |
| Neuberger Berman US Real Estate Securities Fund USD Class A Acc | USD      | Real Estate | Financial             | USA                       | 28       | 553 EUR    | 1.1%   |
| <b>Total</b>  |          |             |                       |                           |          | 50,000 EUR | 100%   |

Table 8: SwissQuote; Conservative – Portfolio Daan

| Security  | Currency | Asset Class | Sector                | Region                    | Quantity | Value      | Weight |
|---|----------|-------------|-----------------------|---------------------------|----------|------------|--------|
| EUR   | EUR      | Cash        | Cash                  | Currency                  | 2,542    | 2,542 EUR  | 5.1%   |
| BARC SERIES B AGRICULTURE                                       | USD      | Commodities | Commodities           | USA                       | 40       | 190 EUR    | 0.4%   |
| BARC SERIES B INDUSTRIAL METAL                                  | USD      | Commodities | Commodities           | USA                       | 17       | 82 EUR     | 0.2%   |
| BARC SERIES B METALS  | USD      | Commodities | Commodities           | USA                       | 14       | 84 EUR     | 0.2%   |
| TMOCI UBS C   | USD      | Commodities | Commodities           | Global                    | 12       | 871 EUR    | 1.7%   |
| ISHARES MSCI EMERGING MARKETS                                   | USD      | Equities    | Global equity indices | Other Emerging Countries  | 89       | 3,196 EUR  | 6.4%   |
| ISHARES S&P 500   | USD      | Equities    | Global equity indices | USA                       | 90       | 3,524 EUR  | 7.0%   |
| Swissquote Quant European Equities                              | EUR      | Equities    | Global equity indices | Global                    | 43       | 1,980 EUR  | 4.0%   |
| Swissquote Quant Swiss Equities                                 | CHF      | Equities    | Global equity indices | Switzerland               | 27       | 3,302 EUR  | 6.6%   |
| UBS ETF - FTSE 100  | GBP      | Equities    | Global equity indices | United Kingdom            | 44       | 1,947 EUR  | 3.9%   |
| HIGH YIELD ETF  | USD      | Bonds       | Other                 | Switzerland               | 255      | 6,066 EUR  | 12.1%  |
| IS C BD LG CAP UCITS EUR DS                                     | EUR      | Bonds       | Other                 | Other Developed Countries | 51       | 6,102 EUR  | 12.2%  |
| VANGUARD SHORT-TERM BOND ETF                                    | USD      | Bonds       | Other                 | USA                       | 85       | 6,021 EUR  | 12.0%  |
| AXA WF Framlington Europe Real Estate Securities A Cap          | EUR      | Real Estate | Financial             | Other Developed Countries | 11       | 1,933 EUR  | 3.9%   |
| Neuberger Berman US Real Estate Securities Fund USD Class A Acc | USD      | Real Estate | Financial             | USA                       | 103      | 2,033 EUR  | 4.1%   |
| Schroder ISF Global Cities Real Estate A Acc                    | USD      | Real Estate | Financial             | Other Emerging Countries  | 14       | 2,082 EUR  | 4.2%   |
| UBS SWISS   | CHF      | Real Estate | Financial             | Switzerland               | 15       | 2,044 EUR  | 4.1%   |
| <b>Total</b>  |          |             |                       |                           |          | 49,000 EUR | 100%   |

Table 9: SwissQuote; Moderate – Portfolio Daan

| Security  | Currency | Asset Class | Sector                | Region                    | Quantity | Value      | Weight |
|---|----------|-------------|-----------------------|---------------------------|----------|------------|--------|
| EUR   | EUR      | Cash        | Cash                  | Currency                  | 2,590    | 2,590 EUR  | 5.2%   |
| TMOCI UBS C   | USD      | Commodities | Commodities           | Global                    | 13       | 941 EUR    | 1.9%   |
| Swissquote Quant European Equities                              | EUR      | Equities    | Global equity indices | Global                    | 74       | 6,653 EUR  | 13.4%  |
| IS C BD LG CAP UCITS EUR DS                                     | EUR      | Bonds       | Other                 | Other Developed Countries | 51       | 2,154 EUR  | 4.4%   |
| AXA WF Framlington Europe Real Estate Securities A Cap          | EUR      | Real Estate | Financial             | Other Developed Countries | 10       | 1,758 EUR  | 3.5%   |
| ISHARES MSCI EMERGING MARKETS                                   | USD      | Equities    | Global equity indices | Other Emerging Countries  | 151      | 1,423 EUR  | 2.9%   |
| Schroder ISF Global Cities Real Estate A Acc                    | USD      | Real Estate | Financial             | Other Emerging Countries  | 11       | 1,880 EUR  | 3.7%   |
| Swissquote Quant Swiss Equities                                 | CHF      | Equities    | Global equity indices | Switzerland               | 67       | 4,909 EUR  | 10.0%  |
| HIGH YIELD ETF  | USD      | Bonds       | Other                 | Switzerland               | 81       | 2,212 EUR  | 4.4%   |
| UBS SWISS   | CHF      | Real Estate | Financial             | Switzerland               | 12       | 1,183 EUR  | 2.4%   |
| UBS ETF - FTSE 100  | GBP      | Equities    | Global equity indices | United Kingdom            | 74       | 3,999 EUR  | 8.0%   |
| BARC SERIES B AGRICULTURE                                       | USD      | Commodities | Commodities           | USA                       | 44       | 1,772 EUR  | 3.6%   |
| BARC SERIES B INDUSTRIAL METAL                                  | USD      | Commodities | Commodities           | USA                       | 19       | 888 EUR    | 1.8%   |
| BARC SERIES B METALS  | USD      | Commodities | Commodities           | USA                       | 16       | 983 EUR    | 2.0%   |
| ISHARES S&P 500   | USD      | Equities    | Global equity indices | USA                       | 154      | 4,939 EUR  | 10.1%  |
| VANGUARD SHORT-TERM BOND ETF                                    | USD      | Bonds       | Other                 | USA                       | 31       | 2,186 EUR  | 4.4%   |
| Neuberger Berman US Real Estate Securities Fund USD Class A Acc | USD      | Real Estate | Financial             | USA                       | 18       | 1,888 EUR  | 3.8%   |
| <b>Total</b>  |          |             |                       |                           |          | 50,000 EUR | 100%   |

Table 10: SwissQuote; Aggressive – Portfolio Daan

| Asset Classes    | Type                                   | Investment  | Weight      | Value              |
|------------------|--|---|-------------|--------------------|
| Cash Equivalents | US 1-3M Treasury Bills                 | SPDR Bloomberg Barclays 1-3 Month T-Bill ETF                    | 50%         | € 25,000.00        |
| Aggregate Bonds  | Global Investment-grade Local Currency | iShares Core Global Aggregate Bond UCITS ETF                    | 20%         | € 10,000.00        |
|                  | Ex-US Investment Grade USD-hedged      | Vanguard Total International Bond ETF                           | 10%         | € 5,000.00         |
| Commodities      | Precious Metals (Gold)                 | SPDR Gold Trust   | 8%          | € 4,000.00         |
| Government Bonds | Ex-US Inflation-linked                 | SPDR FTSE International Government Inflation-Protected Bond ETF | 3%          | € 1,500.00         |
|                  | Emerging markets                       | iShares J.P. Morgan USD Emerging Markets Bond ETF               | 3%          | € 1,500.00         |
| Corporate Bonds  | Global High Yield USD                  | iShares \$ High Yield Corporate Bond UCITS ETF                  | 5%          | € 2,500.00         |
| Cash             | Cash (SGD)                             | Cash (SGD)  | 1%          | € 500.00           |
| <b>Total</b>     |  |   | <b>100%</b> | <b>€ 50,000.00</b> |

Table 11: StashAway; Conservative – Portfolio Daan

| Asset Classes    | Type                                   | Investment  | Weight      | Value              |
|------------------|--|---|-------------|--------------------|
| Cash Equivalents | US 1-3M Treasury Bills                 | SPDR Bloomberg Barclays 1-3 Month T-Bill ETF                    | 21.03%      | € 10,515.00        |
| Aggregate Bonds  | Ex-US Investment Grade USD-hedged      | Vanguard Total International Bond ETF                           | 12.70%      | € 6,350.00         |
|                  | Global Investment-grade Local Currency | iShares Core Global Aggregate Bond UCITS ETF                    | 8.30%       | € 4,150.00         |
| Global Equities  | All Country World                      | iShares MSCI ACWI UCITS ETF                                     | 8.78%       | € 4,390.00         |
|                  | Emerging Markets                       | SPDR Portfolio Emerging Markets ETF                             | 5.18%       | € 2,590.00         |
|                  | Ex-US Large-cap                        | Vanguard FTSE All World ex-US ETF                               | 4.65%       | € 2,325.00         |
|                  | Japan                                  | iShares MSCI Japan ETF  | 2.25%       | € 1,125.00         |
| US Equities      | Healthcare                             | Health Care Select Sector SPDR Fund                             | 6.45%       | € 3,225.00         |
|                  | Technology                             | Technology Select Sector SPDR Fund                              | 5.18%       | € 2,590.00         |
|                  | Energy                                 | Energy Select Sector SPDR Fund                                  | 2.10%       | € 1,050.00         |
| Commodities      | Precious Metals (Gold)                 | SPDR Gold Trust   | 8.75%       | € 4,375.00         |
| Government Bonds | Ex-US Inflation-linked                 | SPDR FTSE International Government Inflation-Protected Bond ETF | 3.25%       | € 1,625.00         |
|                  | Emerging Markets USD                   | iShares J.P. Morgan USD Emerging Markets Bond ETF               | 2.28%       | € 1,140.00         |
| Corporate Bonds  | Global High Yield USD                  | iShares \$ High Yield Corporate Bond UCITS ETF                  | 6.50%       | € 3,250.00         |
| Cash             | Cash (SGD)                             | Cash (SGD)  | 1%          | € 500.00           |
| <b>Total</b>     |  |   | <b>100%</b> | <b>€ 50,000.00</b> |

Table 12: StashAway; Moderate – Portfolio Daan

| Asset Classes    | Type                                   | Investment  | Weight      | Value              |
|------------------|--|---|-------------|--------------------|
| Global Equities  | All Country World                      | iShares MSCI ACWI UCITS ETF                                     | 18.47%      | € 9,235.00         |
|                  | Emerging Markets                       | SPDR Portfolio Emerging Markets ETF                             | 9.27%       | € 4,635.00         |
|                  | Ex-US Large-cap                        | Vanguard FTSE All World ex-US ETF                               | 8.47%       | € 4,235.00         |
|                  | Japan                                  | iShares MSCI Japan ETF  | 4.00%       | € 2,000.00         |
| US Equities      | Healthcare                             | Health Care Select Sector SPDR Fund                             | 9.40%       | € 4,700.00         |
|                  | Technology                             | Technology Select Sector SPDR Fund                              | 7.60%       | € 3,800.00         |
|                  | Energy                                 | Energy Select Sector SPDR Fund                                  | 3.20%       | € 1,600.00         |
| Aggregate Bonds  | Ex-US Investment Grade USD-hedged      | Vanguard Total International Bond ETF                           | 9.07%       | € 4,535.00         |
|                  | Global Investment-grade Local Currency | iShares Core Global Aggregate Bond UCITS ETF                    | 2.93%       | € 1,465.00         |
| Commodities      | Precious Metals (Gold)                 | SPDR Gold Trust   | 9.33%       | € 4,665.00         |
| Cash Equivalents | US 1-3M Treasury Bills                 | SPDR Bloomberg Barclays 1-3 Month T-Bill ETF                    | 7.59%       | € 3,795.00         |
| Government Bonds | Ex-US Inflation-linked                 | SPDR FTSE International Government Inflation-Protected Bond ETF | 2.67%       | € 1,335.00         |
|                  | Emerging Markets USD                   | iShares J.P. Morgan USD Emerging Markets Bond ETF               | 2.33%       | € 1,165.00         |
| Corporate Bonds  | Global High Yield USD                  | iShares \$ High Yield Corporate Bond UCITS ETF                  | 4.67%       | € 2,335.00         |
| Cash             | Cash (SGD)                             | Cash (SGD)  | 1%          | € 500.00           |
| <b>Total</b>     |  |   | <b>100%</b> | <b>€ 50,000.00</b> |

Table 13: StashAway; Aggressive – Portfolio Daan

| ASSET CLASS                        | INVESTMENT                                   | %            | WORTH              |
|------------------------------------|--|--------------|--------------------|
| <b>Total shares (%)</b>            |  | <b>18.0%</b> | <b>€ 9,000.00</b>  |
| United States Stocks               | Vanguard US 500 Stk Idx Eur -Ins Plus        | 8.0%         | € 4,000.00         |
| Europe Stocks                      | Vanguard European Stk Idx Eur -Ins Plus      | 7.0%         | € 3,500.00         |
| Emerging economy stocks            | Vanguard Emrg Mk Stk Idx Eur -Ins Plus       | 3.0%         | € 1,500.00         |
| <b>Total bonuses (%)</b>           |  | <b>82.0%</b> | <b>€ 41,000.00</b> |
| US government bonds hedged to Euro | Vanguard US Gov Bnd Idx Eur Hdg -Ins Plus    | 22.0%        | € 11,000.00        |
| European government bonds          | Vanguard Eur Gov Bnd Idx-Ins Plus            | 22.0%        | € 11,000.00        |
| US corporate bonds hedged to Euro  | Vanguard US Inv Gr Bnd Idx Eur Hdg -Ins Plus | 15.0%        | € 7,500.00         |
| European corporate bonds           | Vanguard Euro Inv Gr Bnd Idx Eur -Ins Plus   | 15.0%        | € 7,500.00         |
| European inflation-linked bonds    | Vanguard Euroz Inf Lk Bnd Idx Eur -Ins Plus  | 8.0%         | € 4,000.00         |

Table 14: IndexaCapital; Conservative- Portfolio Tom

| ASSET CLASS                        | INVESTMENT                                   | %            | WORTH              |
|------------------------------------|--|--------------|--------------------|
| <b>Total shares (%)</b>            |  | <b>45.0%</b> | <b>€ 22,500.00</b> |
| United States Stocks               | Vanguard US 500 Stk Idx Eur -Ins Plus        | 20.0%        | € 10,000.00        |
| Europe Stocks                      | Vanguard European Stk Idx Eur -Ins Plus      | 10.0%        | € 5,000.00         |
| Small Cap Global Stocks            | Vanguard Global Small Cap Idx Eur -Ins Plus  | 5.0%         | € 2,500.00         |
| Emerging economy stocks            | Vanguard Emrg Mk Stk Idx Eur -Ins Plus       | 5.0%         | € 2,500.00         |
| Japan Stocks                       | Vanguard Japan Stk Idx Eur -Ins Plus         | 5.0%         | € 2,500.00         |
| <b>Total bonuses (%)</b>           |  | <b>55.0%</b> | <b>€ 27,500.00</b> |
| US government bonds hedged to Euro | Vanguard US Gov Bnd Idx Eur Hdg -Ins Plus    | 15.0%        | € 7,500.00         |
| European government bonds          | Vanguard Eur Gov Bnd Idx-Ins Plus            | 15.0%        | € 7,500.00         |
| US corporate bonds hedged to Euro  | Vanguard US Inv Gr Bnd Idx Eur Hdg -Ins Plus | 10.0%        | € 5,000.00         |
| European corporate bonds           | Vanguard Euro Inv Gr Bnd Idx Eur -Ins Plus   | 10.0%        | € 5,000.00         |
| European inflation-linked bonds    | Vanguard Euroz Inf Lk Bnd Idx Eur -Ins Plus  | 5.0%         | € 2,500.00         |

Table 15: IndexaCapital; Moderate- Portfolio Tom





| Security  | Currency | Asset Class | Sector                | Region                     | Quantity  | Value             | Weight      |
|---|----------|-------------|-----------------------|----------------------------|-----------|-------------------|-------------|
| EUR   | EUR      | Cash        | Cash                  | Currency                   | 2500.2500 | EUR               | 52%         |
| INGCLUSD  | USD      | Commodities | Commodities           | Global                     | 11.941    | EUR               | 19%         |
| Swissquote Quant European Equities                            | EUR      | Equities    | Global equity indices | Global                     | 76.493    | EUR               | 15%         |
| SLC.BD.US.CAP UCITS E.R.20                                    | EUR      | Bonds       | Other                 | Other Developing Countries | 11.214    | EUR               | 4%          |
| AAA.WT.Finlogica Europe Real Estate Securities A.sop          | EUR      | Real Estate | Financial             | Other Developing Countries | 10.178    | EUR               | 3%          |
| INSHARX.MSCI EMERGING MARKETS                                 | USD      | Equities    | Global equity indices | Other Emerging Countries   | 131.543   | EUR               | 18%         |
| Schwab US Global Cities Real Estate A.Asc                     | USD      | Real Estate | Financial             | Other Emerging Countries   | 11.188    | EUR               | 3%          |
| Swissquote Quant Swiss Equities                               | CHF      | Equities    | Global equity indices | Switzerland                | 47.496    | EUR               | 12%         |
| SWISS YIELD ETF   | USD      | Bonds       | Other                 | Switzerland                | 93.221    | EUR               | 4%          |
| USA.SWISS   | CHF      | Real Estate | Financial             | Switzerland                | 12.143    | EUR               | 3%          |
| USA.EIT - FTSE 100  | GBP      | Equities    | Global equity indices | United Kingdom             | 74.999    | EUR               | 12%         |
| BLCF SEPIER B AGG UCITS LUBE                                  | USD      | Commodities | Commodities           | USA                        | 44.479    | EUR               | 12%         |
| BLCF SEPIER B IND UCITS LUBE                                  | USD      | Commodities | Commodities           | USA                        | 18.981    | EUR               | 2%          |
| BLCF SEPIER B METALS  | USD      | Commodities | Commodities           | USA                        | 18.981    | EUR               | 2%          |
| INSHARX S&P 500   | USD      | Equities    | Global equity indices | USA                        | 154.493   | EUR               | 11%         |
| VANGUARD SHORT TERM BOND ETF                                  | USD      | Bonds       | Other                 | USA                        | 31.219    | EUR               | 4%          |
| Vanguard Roman US Real Estate Securities Fund USD Class A.Asc | USD      | Real Estate | Financial             | USA                        | 88.186    | EUR               | 11%         |
| <b>Total</b>  |          |             |                       |                            |           | <b>89'000 EUR</b> | <b>100%</b> |

Table 20: SwissQuote; Aggressive - Portfolio Stefan

| Asset Classes    | Type                                   | Investment  | Weight      | Value              |
|------------------|--|---|-------------|--------------------|
| Cash Equivalents | US 1-3M Treasury Bills                 | SPDR Bloomberg Barclays 1-3 Month T-Bill ETF                    | 50%         | € 25.000,00        |
| Aggregate Bonds  | Global Investment-grade Local Currency | iShares Core Global Aggregate Bond UCITS ETF                    | 20%         | € 10.000,00        |
|                  | Ex-US Investment Grade USD-hedged      | Vanguard Total International Bond ETF                           | 10%         | € 5.000,00         |
| Commodities      | Precious Metals (Gold)                 | SPDR Gold Trust   | 8%          | € 4.000,00         |
| Government Bonds | Ex-US Inflation-linked                 | SPDR FTSE International Government Inflation-Protected Bond ETF | 3%          | € 1.500,00         |
|                  | Emerging Markets                       | iShares J.P. Morgan USD Emerging Markets Bond ETF               | 3%          | € 1.500,00         |
| Corporate Bonds  | Global High Yield USD                  | iShares \$ High Yield Corporate Bond UCITS ETF                  | 5%          | € 2.500,00         |
| Cash             | Cash (SGD)                             | Cash (SGD)  | 1%          | € 500,00           |
| <b>Total</b>     |  |   | <b>100%</b> | <b>€ 50.000,00</b> |

Table 21: StashAway; Conservative - Portfolio Stefan

| Asset Classes    | Type                                   | Investment  | Weight | Value              |
|------------------|--|---|--------|--------------------|
| Cash Equivalents | US 1-3M Treasury Bills                 | SPDR Bloomberg Barclays 1-3 Month T-Bill ETF                    | 21,03% | € 10.515,00        |
| Aggregate Bonds  | Ex-US Investment Grade USD-hedged      | Vanguard Total International Bond ETF                           | 12,70% | € 6.350,00         |
|                  | Global Investment-grade Local Currency | iShares Core Global Aggregate Bond UCITS ETF                    | 8,30%  | € 4.150,00         |
| Global Equities  | All Country World                      | iShares MSCI ACWI UCITS ETF                                     | 8,78%  | € 4.390,00         |
|                  | Emerging Markets                       | SPDR Portfolio Emerging Markets ETF                             | 5,18%  | € 2.590,00         |
|                  | Ex-US Large-cap                        | Vanguard FTSE All World ex-US ETF                               | 4,65%  | € 2.325,00         |
|                  | Japan                                  | iShares MSCI Japan ETF  | 2,25%  | € 1.125,00         |
| US Equities      | Healthcare                             | Health Care Select Sector SPDR Fund                             | 6,45%  | € 3.225,00         |
|                  | Technology                             | Technology Select Sector SPDR Fund                              | 5,18%  | € 2.590,00         |
|                  | Energy                                 | Energy Select Sector SPDR Fund                                  | 2,10%  | € 1.050,00         |
| Commodities      | Precious Metals (Gold)                 | SPDR Gold Trust   | 8,75%  | € 4.375,00         |
| Government Bonds | Ex-US Inflation-linked                 | SPDR FTSE International Government Inflation-Protected Bond ETF | 3,75%  | € 1.875,00         |
|                  | Emerging Markets USD                   | iShares J.P. Morgan USD Emerging Markets Bond ETF               | 2,28%  | € 1.140,00         |
| Corporate Bonds  | Global High Yield USD                  | iShares \$ High Yield Corporate Bond UCITS ETF                  | 6,50%  | € 3.250,00         |
| Cash             | Cash (SGD)                             | Cash (SGD)  | 1%     | € 500,00           |
| <b>Total</b>     |  |   |        | <b>€ 50.000,00</b> |

Table 22: StashAway; Moderate - Portfolio Stefan

| Asset Classes    | Type                                   | Investment  | Weight | Value              |
|------------------|--|---|--------|--------------------|
| Global Equities  | All Country World                      | iShares MSCI ACWI UCITS ETF                                     | 18,47% | € 9.235,00         |
|                  | Emerging Markets                       | SPDR Portfolio Emerging Markets ETF                             | 9,27%  | € 4.635,00         |
|                  | Ex-US Large-cap                        | Vanguard FTSE All World ex-US ETF                               | 8,47%  | € 4.235,00         |
|                  | Japan                                  | iShares MSCI Japan ETF  | 4,00%  | € 2.000,00         |
| US Equities      | Healthcare                             | Health Care Select Sector SPDR Fund                             | 9,40%  | € 4.700,00         |
|                  | Technology                             | Technology Select Sector SPDR Fund                              | 7,60%  | € 3.800,00         |
|                  | Energy                                 | Energy Select Sector SPDR Fund                                  | 3,20%  | € 1.600,00         |
| Aggregate Bonds  | Ex-US Investment Grade USD-hedged      | Vanguard Total International Bond ETF                           | 9,07%  | € 4.535,00         |
|                  | Global Investment-grade Local Currency | iShares Core Global Aggregate Bond UCITS ETF                    | 2,93%  | € 1.465,00         |
| Commodities      | Precious Metals (Gold)                 | SPDR Gold Trust   | 9,33%  | € 4.665,00         |
| Cash Equivalents | US 1-3M Treasury Bills                 | SPDR Bloomberg Barclays 1-3 Month T-Bill ETF                    | 7,59%  | € 3.795,00         |
| Government Bonds | Ex-US Inflation-linked                 | SPDR FTSE International Government Inflation-Protected Bond ETF | 2,67%  | € 1.335,00         |
|                  | Emerging Markets USD                   | iShares J.P. Morgan USD Emerging Markets Bond ETF               | 2,33%  | € 1.165,00         |
| Corporate Bonds  | Global High Yield USD                  | iShares \$ High Yield Corporate Bond UCITS ETF                  | 4,67%  | € 2.335,00         |
| Cash             | Cash (SGD)                             | Cash (SGD)  | 1%     | € 500,00           |
| <b>Total</b>     |  |   |        | <b>€ 50.000,00</b> |

Table 23: StashAway; Aggressive - Portfolio Stefan