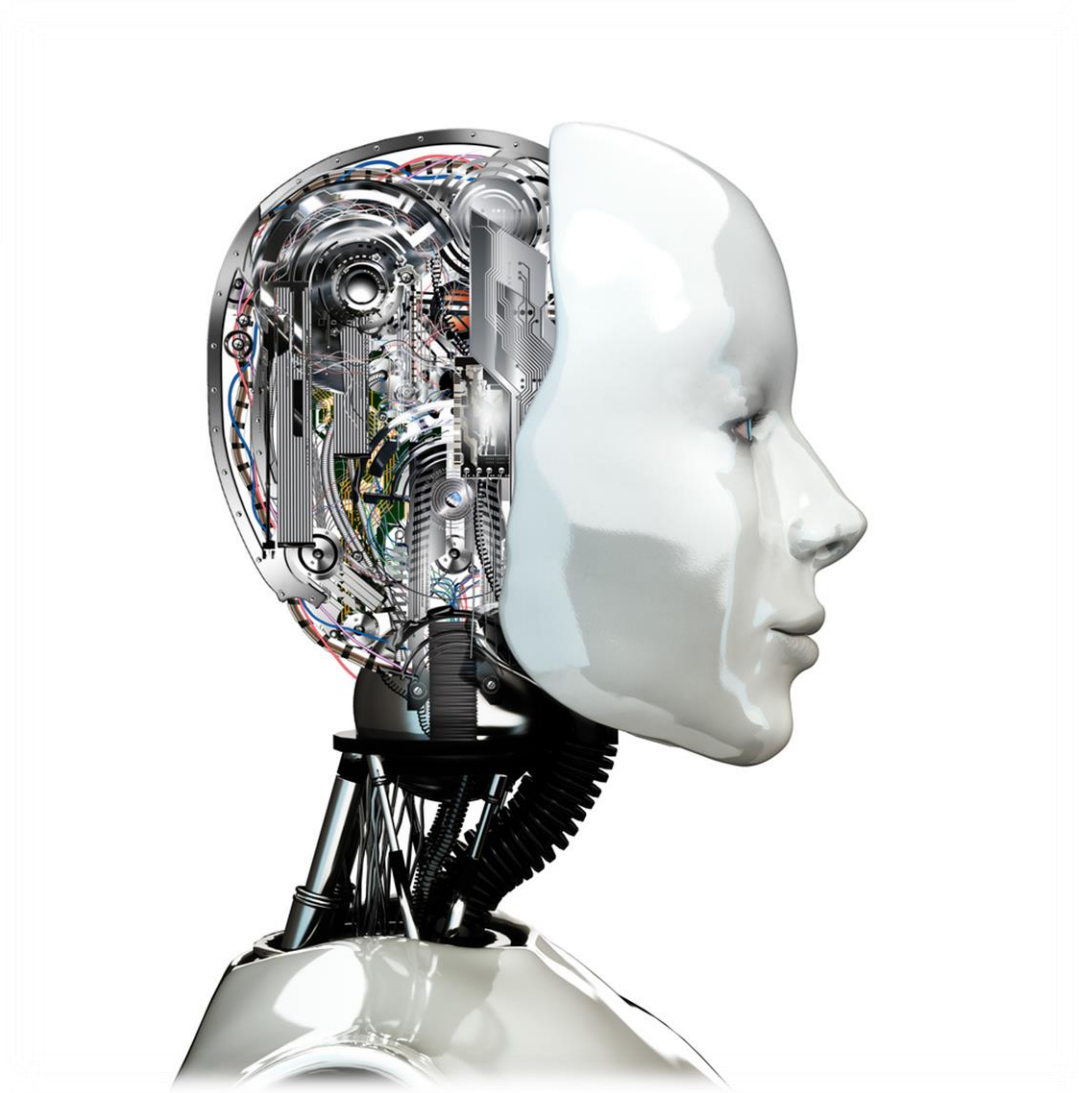
Solactive

ROBO-ADVISORY

A closer look at the engine room



Introduction

"Yet another publication on robo-advisors to add to the stack…!" might be your first thought when coming across this report.

And you are partly right…This is indeed another publication on robo-advisors…BUT with a twist!

As index providers, we cherish rules-based, transparent, quantitative approaches more than anything. For this reason, we take an index perspective on robo-advisors, along the lines of these words. Like robo-advisors, we operate on the passive investing side, develop multi-asset strategies and work with portfolio optimization models. As such, we try to help answer some of the questions associated with robo-advisors, mainly related to transparency, historical performance, and asset allocation by studying a sample of robo-advisors from the U.S. and Germany.

Leveraging on our core expertise in indexing, this report aims to present a practical analysis assessing robo-advisors' portfolios for specific investor types with different risk profiles. To this end, we present the three main characters of our story:

Mr Bart S. is a young man in his twenties starting off his professional career in engineering. Bart is not afraid of risking his money, as according to him, *if you risk nothing, you risk everything*. Needless to say, Bart is performance-oriented and does not mind the ups and downs of the market.

Mrs Lisa S. is a woman in her early forties, married with kids. She is in her mid-career and is at the moment looking to start investing after finishing paying off her mortgage. She has some experience with capital markets but does not have the time to manage her investments. Since a major expense awaits her, she can only afford moderate fluctuations in her portfolio.

Mr Abraham S. is in his late 60s, retired and taking pension income. He aspires to receive regular income streams to cover life expenses, and at the same time preserve his wealth to later pass down to his children. As a retiree, he is highly concerned about potential losses, and thus tends to be more conservative on his investment choices.

In a first step, we study the portfolio allocations for Bart S., Lisa S., and Abraham S. across a sample of U.S. and German robo-advisors. This exercise allows us to see if there are any differences or similarities between U.S. vs. German providers for our three investors. In a second step, we present a simulated sample robo-advisor model that can serve to benchmark the performance of the recommended portfolios. Considering the relatively short history of robo-advisors, this model enables us to evaluate performances across asset classes over a longer period of time and in different market environments.

Customers are increasingly faced with a growing number of robo-advisors, and it is becoming more and more challenging to evaluate and differentiate providers. We hope that this report helps mapping out the increasingly intricated landscape of digital advisors.

Structure

The report is structured as follows:

- The first section describes some of the factors that we have identified as driving the robo-advisory growth trend.
- The second section presents our findings on a sample of U.S. and German robo-advisors regarding asset allocations and portfolio compositions.
- The third section introduces a simulated sample robo-advisory model constructed using indices, as opposed to ETFs, to assess how different portfolios behave over an extended period of time.

The final section draws some conclusions and gives an outlook on the robo-advisory industry commented by Solactive's Head of Research, Timo Pfeiffer.

About Solactive

Solactive AG is an innovative index provider that focuses on the development, calculation and distribution of tailor-made indices over all asset classes. As of October 2017, Solactive AG served approximately 350 clients in Europe, America and Asia, with approximately USD 100 billion invested in products linked to indices calculated by the Company globally, primarily via 250 Exchange Traded Funds from a number of well-known providers. Solactive AG was established in 2007 and is headquartered in Frankfurt.

www.solactive.com

About Solactive Research

The Solactive Research team delivers the full value chain from thought provoking concepts to investible index strategies in today's capital markets. We work proactively with our clients and internal partners to deliver value-add investment ideas and enhance innovation in the index industry.

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Fueling the robo-advisory trend

Robo-advisors are online investment platforms which have emerged as innovative alternatives to traditional financial advisory services. By offering automated investment management and providing access to capital markets in a way that was not available before, these digital advisors are reshaping the boundaries of the financial advisory industry. The benefits for customers include cost-efficiency, diversification of risk, automatic maintenance of portfolio, and on-demand performance review via mobile or other devices. Since human financial advisors are typically not involved, the fees tend to be lower than the ones charged by discretionary investment management services. In our analysis, we have identified four key factors that are strengthening the business case for robo-advisors. These refer to the growing presence of FinTech solutions; the global shift towards passive investing; the changing preferences and expectations of consumers; and the demand for innovative investment solutions giving access to capital markets.

The digitization of financial services

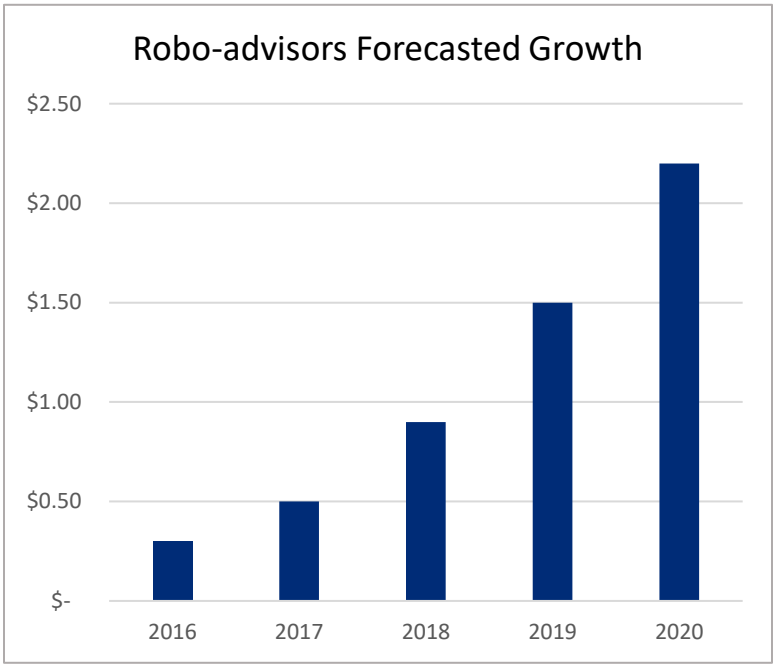
Technology has always acted as a disruptive game changer to traditional ways of conducting business. The computerization of financial services is part of the FinTech evolution, a growing phenomenon in the financial industry. Banking, insurance, payments, and investment management are just a few examples of activities whose traditional modus operandi is being challenged by new FinTech providers. Funding for financial technology startups has grown steadily over the years, with both the number of deals and the amount of VC-backed financing rising globally[1]. Considering the trend in funding activity reported in this segment, it is highly likely that we will see more digitization of financial services – including robo-advisors – in the years to come.

Shift towards passive investing

Over a five-year period, some 80% of large-cap funds underperformed their main benchmarks in the U.S., while in Europe about 70% of large-cap funds underperformed. In addition, there has been growing pressure on pricing. According to a report by Morningstar, U.S. fund fees have been declining steadily since 2000, going from an average expense ratio of around 0.90% to a record low of 0.57% in 2016[2]. Disappointing results of active funds, coupled with growing pressure on fund fees have contributed to the massive rise in AuM of passive funds. Since ETFs constitute the building blocks of robo-portfolios, the proliferation of ETFs proves to be a good match for robo-advisors, and it is thus foreseeable that growth in ETFs will reinforce both the supply of, and the demand for automated advice.

[1]CB Insights (2017). The Global Fintech Report Q3 2017
[2]Morningstar (2017). U.S. Fund Fee Study: Average Fund Fees Paid by Investors Continued to Decline in 2016

Figure 1: Robo-advisors forecasted growth 2016-2020 (in trillions USD)



Source: A.T. Kearney (2015). Robo-Advisory Services Study: *Hype vs. Reality: The Coming Waves of "Robo" Adoption*

Did you know that:

◊ According to consulting firm A.T. Kearney, robo-advisors have the potential to reach USD 2 trillion in assets in the U.S. by 2020 (Exhibit 1).

◊ The U.S. is the market leader, with more than 200 providers[3]. As of January 2017, the largest by AuM were Vanguard Personal Advisor, Schwab Intelligent Portfolios, and Betterment[4].

◊ In Europe, the trend is growing and Germany seems to be the country with the highest concentration of robo-advisors[3,5]. The largest German robo-providers by AuM are Scalable Capital, LIQID and Quirion[5].

Changing preferences and expectations

Instances of financial mismanagement that ultimately led to the 2008 financial crisis have created widespread distrust in banks and other financial institutions, especially among younger generations. The provision of technological solutions offered by new entrants that have little to do with incumbent players thus represents an attractive alternative for a large part of the public. Given the likely affinity between technology and younger generations, it is highly probable that one of the primary sources of demand for automated financial services will come from Millennials. According to Deloitte, global Millennials' net worth is estimated to grow between USD19 trillion and USD24 trillion by 2020[6]. As such, these factors constitute an opportunity for the expansion of the digital advisory trend.

Alternative investment choice

Households in Western Europe prefer safer forms of investment, compared to North America. In 2016, on average 27% of gross financial assets in Western Europe was invested in securities, while the rest went to deposits, insurance and pensions[7]. Considering the low interest rate environment, robo-advisors can provide an innovative alternative to deposit products offering the possibility of earning a higher return on investment. In addition, they give access to capital markets in a way that was not available before, by: 1) offering planned exposure in a less costly way compared to traditional discretionary management services, also requiring lower minimum initial assets; 2) customers not comfortable with managing their own investments can thus delegate this to automated investment solutions.

[3]Burnmark (2017). Digital Wealth
[4]ETF.com (2017). A Tour Of The Top 10 Robos
[5]Techfluence (2017). Map of Robo Advisors in Europe & Germany
[6]Deloitte. Millennials and Wealth Management: Trends and challenges of the new clientele
[7]Allianz (2017). Allianz Global Wealth Report 2017

Automated investment advice and allocation: a sample study across the U.S. and Germany

In order to gain a deeper understanding of robo-advisors' models – from the initial questionnaires to the automatically managed investment plan – we analyze three portfolios corresponding to the risk preferences of Bart S., Lisa S., and Abraham S. (Figure 2). For this, we study a sample of robo-advisors across the U.S. and Germany. The goal is to get into the heart of robo-advisors, understand how they allocate investments among asset classes, and compare and contrast the sampled U.S. and German providers.

The typical robo-advisor follows a standardized investment process composed of four basic steps. The first step is customer profiling through online questionnaires. The questionnaires are used to assess customers' risk preferences. Based on this information, robo-advisors formulate a tailored investment portfolio made of ETFs optimally allocated to better match individual risk preferences. If the customer is satisfied with the suggested portfolio, the robo-advisor continues by executing the recommended trades. Portfolios are then automatically rebalanced to maintain pre-established objectives in line with market movements.

Figure 2. Profile of the conservative, balanced, and growth-oriented investors

	Abraham S.	Lisa S.	Bart S.
Investment goal	Wealth preservation & loss minimization	Moderate wealth creation	Wealth creation & focus on returns
Investment horizon	< 5 years	5 - 10 years	10+ years
Experience	Limited	Moderate	Extensive
Risk Tolerance	Low	Moderate	High
Income	Pension income	High income	Medium income

Findings: What should Bart S., Lisa S., and Abraham S. know before investing

Robo-advisors rely on different optimization approaches to determine the recommended portfolios. For the same risk profile, the sampled robo-advisors recommend different investment portfolios. For instance, in the U.S., the percentage of funds allocated to equity for a more conservative portfolio ranges from 0% to 47%, whereas in Germany, the percentage of funds allocated to equity ranges from 9% to 30%.

U.S. robo portfolios are on average more equity-oriented. Although there is no significant difference between the asset allocations of U.S. and German robo-advisors, the portfolios of the U.S. sample are slightly more aggressive, a trait consistently present in all risk profiles (Figure 3).

Comparison with a static 30/70, 50/50, and 70/30 equity/fixed-income target allocation*

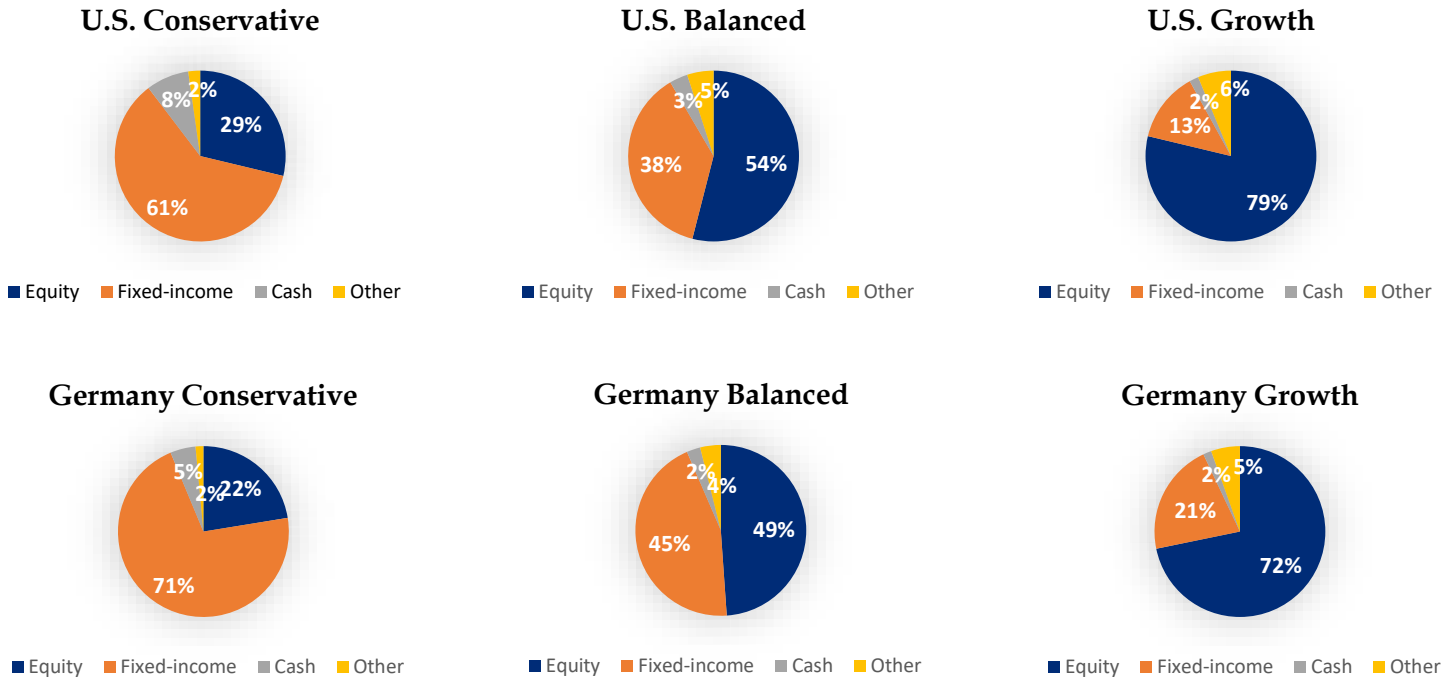
◊ For a conservative investor, German robo-advisors come closer to a target 30/70 equity/fixed-income static allocation. On the fixed-income side, German advisors invest 71% in fixed-income, and 24% in equity*, whereas U.S. robo-advisors invest 31% in equity and 61% in fixed-income.

◊ For a balanced portfolio, German providers come closer to a static 50/50 target allocation strategy, compared to U.S. robo-advisors. However, in both cases, the 50% equity* reference level is exceeded.

◊ For a growth-oriented investor, equity investment exceeds in both cases a static 70/30 equity/fixed-income asset allocation, whereas the allocation to fixed-income is lower. In this case as well, German robo-advisors come closer to a static 70/30 equity/fixed-income target allocation.

*Assuming that commodities and real estate are part of equity.

Figure 3. Average U.S. vs. German robo-portfolio allocations for our three investors



Source: Solactive calculation, October 31 2017

***Other** includes real estate and commodities

There is a difference in the number and type of ETFs composing portfolios. For the sampled U.S. providers, the number of ETFs used in portfolios ranges from 6 to 20, while in Germany it ranges from 3 to 19. Both U.S. and German robo-advisors use an average of 10 ETFs per portfolio. In addition, although the core blocks of robo-portfolios are ETFs, some German and U.S. providers also include mutual funds. Contrarily to ETFs, mutual funds can be managed on a discretionary basis, and generally seek to generate higher expected returns. In the studied sample of robo-advisors, individual mutual funds are employed to target strategies such as value or size.

The majority of robo-advisors use market-cap-weighted broad-market ETFs. In a minority of cases, robo-advisors also include smart beta ETFs, which either implement alternative weighting schemes, or are based on selective rules-based stock picking, as opposed to tracking of broad-market benchmarks. These ETFs attempt to generate excess returns over a market-cap-weighted benchmark by selecting dividend- or value-focused stocks, or applying fundamental weighting schemes.

Robo-advisors invest with a home bias. German robo-advisors mostly employ European ETFs, while U.S. ones use U.S. ETFs. Specifically, in Germany, on average 40% of the ETFs used in portfolios cover the European region. The rest is allocated to Global ETFs, North America, and the Asia-Pacific region. In the U.S., on average 52% of the ETFs used in portfolios cover the U.S., with the rest being allocated to other regions.

Both German and U.S. robo-advisors also invest in alternative asset classes, such as commodities and real estate. Alternative investing typically represents an opportunity to diversify portfolios and buffer against downturns in equity and fixed-income, since commodities and real estate tend to demonstrate low correlation to other asset classes. In our study, despite the fact that the allocation to alternative assets on average never exceeds 6% (Figure 3), 50% of the sampled German robo-advisors and 75% of the sampled U.S. robo-advisors include either commodities or real estate in their portfolio allocations. In addition, 50% of both German and U.S. robo-advisors also invest in cash for risk management purposes.

The funds employed by the sampled U.S. robo-advisors are on average cheaper than the ones used by German robo-advisors. For the sampled U.S. robo-advisors, the expense ratio of the composing funds ranges from a minimum of 0.03% to a maximum of 0.59%, with an average of 0.18%. For the sampled German robo-advisors, the expense ratio ranges from 0.07% to 0.60%, with an average of 0.29%. These findings are also consistent with the higher annual fees charged by the sampled German robo-advisors (on average 0.67% of AuM), compared to their U.S. counterparts (on average 0.25% of AuM)[8]. This can be partly explained by the fact that the ETF market in the U.S. is more developed than the one in Europe, with far more products available to invest. Also, the robo-advisory market is at a later stage of development in the U.S., compared to Europe. Investors have therefore access to cheaper ETFs and robo-advisors.

[8]Assuming an investment of USD/EUR12,000

A simulated sample model

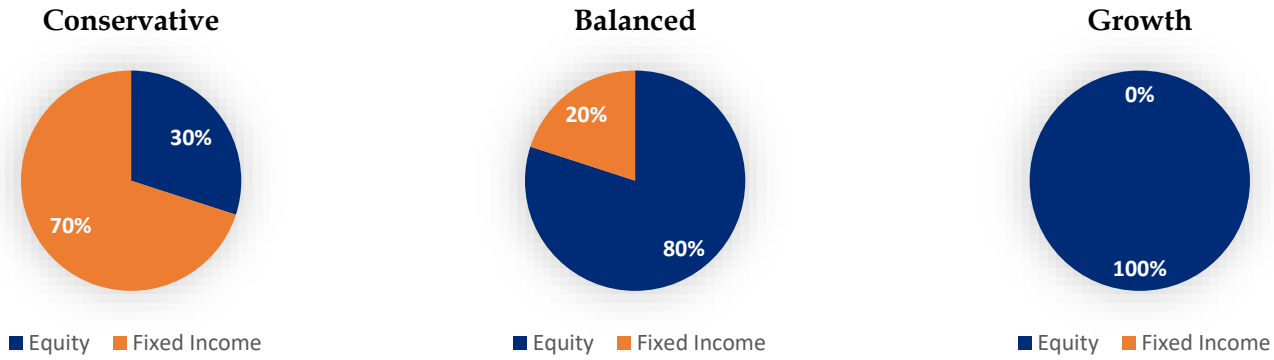
In an attempt to shed some light onto the long-term performance of robo-advisors, this section presents a simulated sample robo-advisor model that transparently looks at asset allocations and historical performance of three portfolios: a growth-oriented for Bart S., a balanced for Lisa S., and a conservative for Abraham S.

As a contribution to research in the field of robo-advisors, this section presents three sample multi-asset class portfolios corresponding to the risk preferences of Abraham S., Lisa S., and Bart S. Each portfolio targets different volatility levels (Figure 4), different dynamic asset allocations (Figure 5), and is based on a mean-variance optimization approach. As can be seen in Figure 5, the conservative portfolio has the lowest equity allocation, whereas the growth-oriented one has the highest, reflecting the fact that equity exposure increases with investors' risk appetite. Rather than using ETFs, the portfolios are made up of broad-market indices tracking the performance of various sub-asset classes. The advantage of using indices, rather than ETFs, is that they allow us to have a longer historical performance, and thus analyze the different portfolios over a longer period of time, including their behavior during business cycles (minus set fees).

Figure 4. Target volatility for our three investors

Risk Profile	Conservative	Balanced	Growth
Target Volatility	5%	7.5%	10%

Figure 5. Current dynamic asset allocations for our three investors as determined by the model



Source: Solactive calculation, October 31 2017

Figure 6 summarizes the annual backtest performance of the simulated sample model for our three investors. All calculations are already taking into account a hypothetical charge of about 60 basis points (approximating the upper ceiling in expense ratios analysed in the previous section). As expected, the return per annum, volatility, and maximum drawdown for the growth-oriented portfolio (Bart S.) are higher than for the conservative portfolio (Abraham S). This is to be anticipated, as the growth-oriented portfolio has the largest equity exposure, therefore the highest risk.

Figure 6. Simulated performance of the sample model (1999 – 2017)

Risk Profile	Conservative	Balanced	Growth
Return p.a.	6.9%	8.3%	8.6%
Volatility	4.8%	8.0%	10.4%
Sharpe Ratio	1.43	1.02	0.83
Max Drawdown	19.3%	31.7%	38.9%

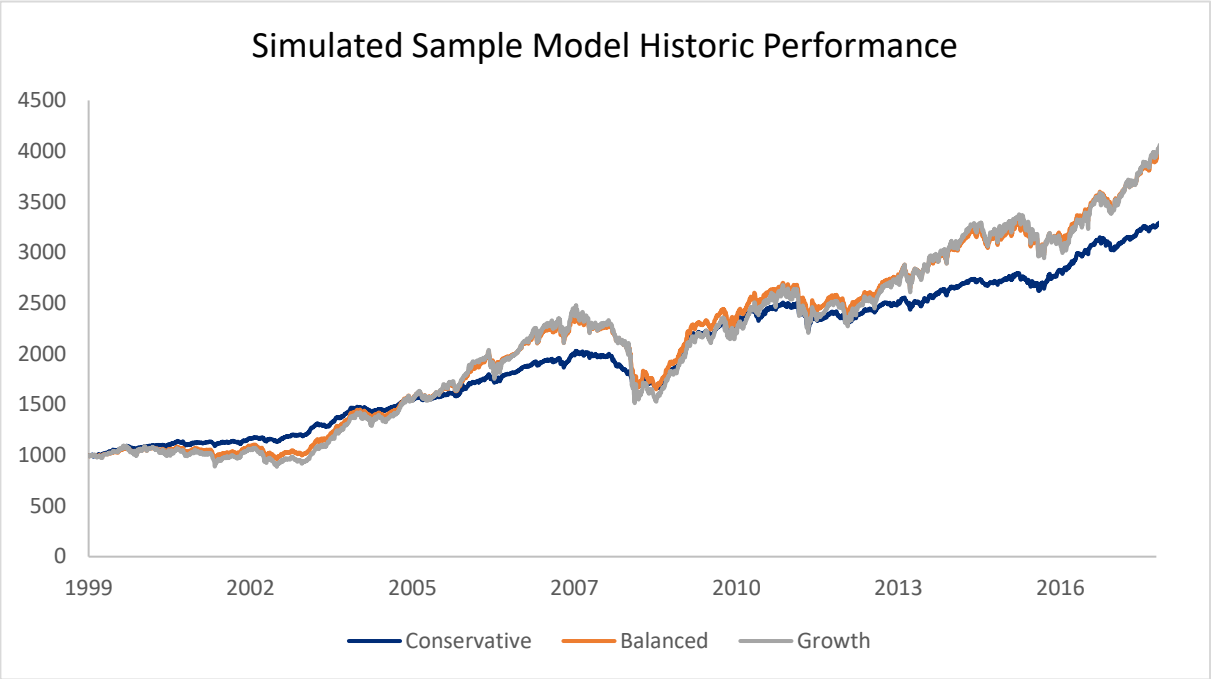
Source: Solactive calculation, October 31 2017

The simulated performance of the sample model for all three investors is illustrated in Figures 7 and 8. As can be seen in the graphs, no investor is immune to potential losses as a result of adverse market movements, especially over short periods of time. Even in the case of a conservative portfolio strategy, which is consistent with lower levels of risk, investors are still exposed to losses. This is particularly evident in 2008 when the financial crisis kicked off. In that year, the three portfolios, reported annual losses ranging from -11.7% (conservative) to -28.6% (growth). A similar scenario is seen in 2011 during the outset of the European debt crisis. There too, the three sample portfolios report losses, although less pronounced. This analysis can give an idea of robo-advisors' performance through time. Despite the hype around this new trend, investors have to keep in mind that robo-advisors are not wizard tools, and losses can still occur. The real test for them will indeed be during market downturns, and it is thus important that investors such as Bart S., Lisa S., or Abraham S. are aware of the risks involved.

Simulated Sample Model: Where are Bart S., Lisa S., and Abraham S. investing their money?

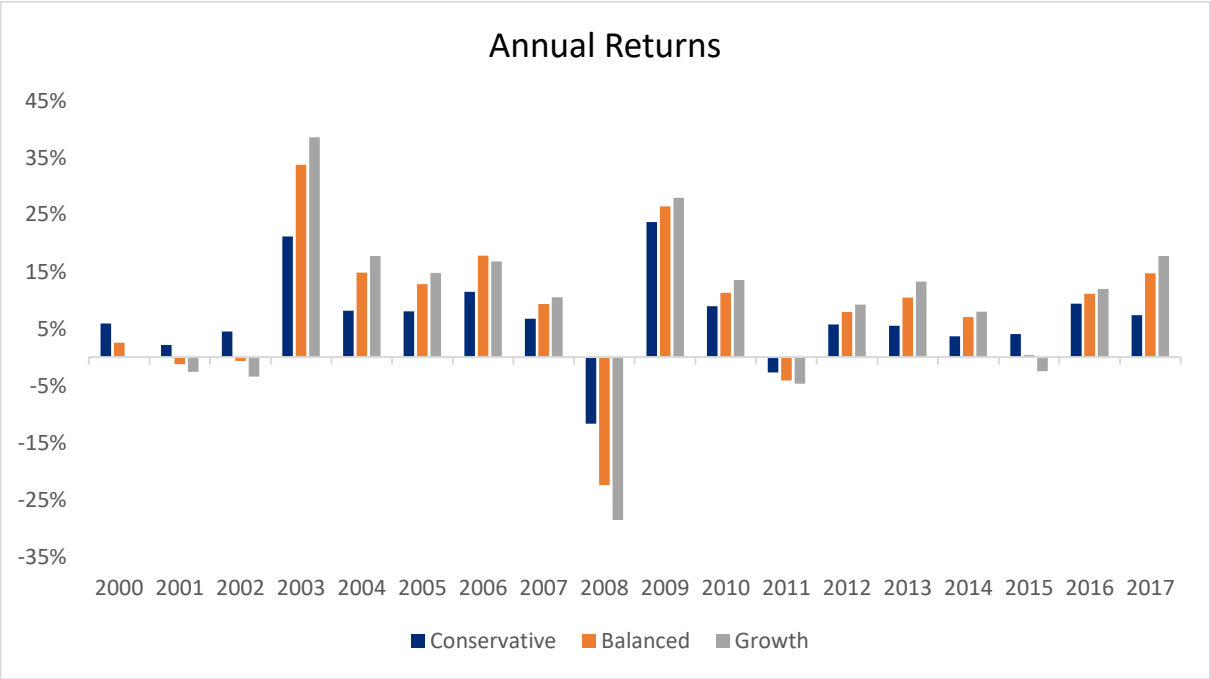
- ◊ US Large Cap
- ◊ Europe Large Cap
- ◊ Emerging Markets Equity
- ◊ US REITs
- ◊ Eurozone Sovereign Bonds
- ◊ Emerging Markets Local Debt
- ◊ US Mid Cap
- ◊ Europe Mid Cap
- ◊ Precious Metals
- ◊ Europe REITs
- ◊ Eurozone High Yield Bonds
- ◊ US Small Cap
- ◊ Asia Pacific Equity
- ◊ Oil & Gas
- ◊ US Treasury
- ◊ US Investment Grade Corporate Bonds

Figure 7. Simulated performance of the sample model (1999 – 2017)



Source: Solactive calculation, October 31 2017

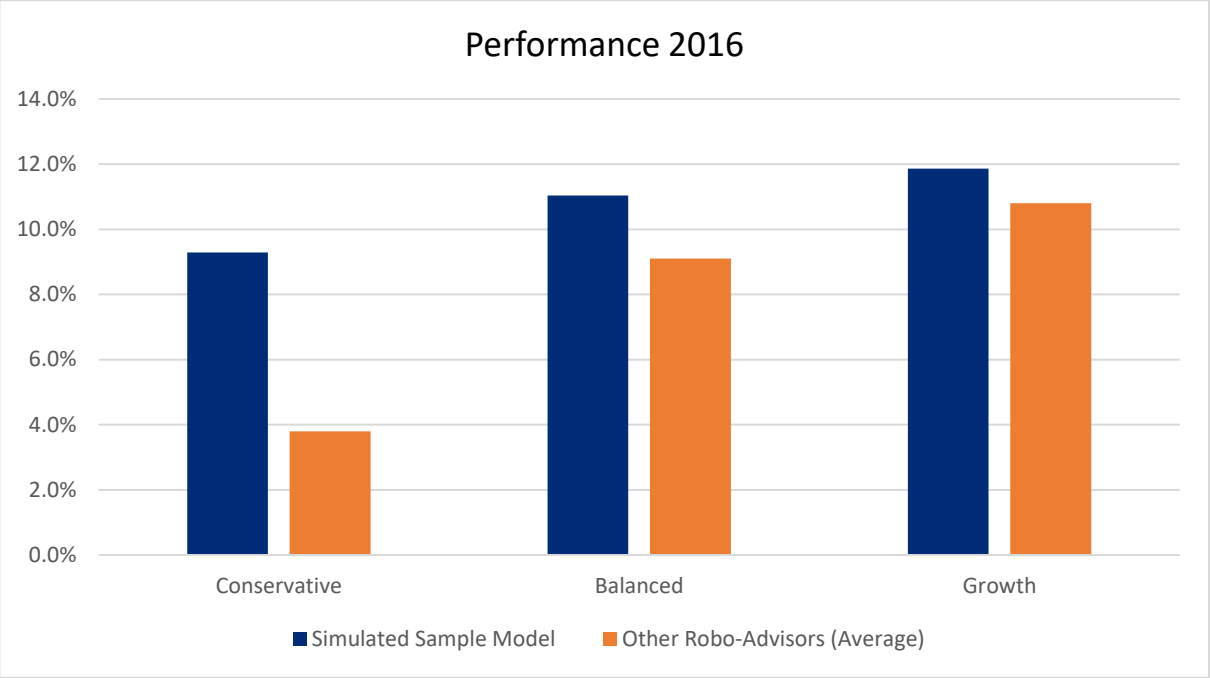
Figure 8. Annual returns of the simulated sample model (2000 - 2017)



Source: Solactive calculation, October 31 2017

Figure 9 shows the annual return comparison between a number of existing approaches of robo-portfolios (average) and the simulated sample model. As displayed by the bar chart, the performance of the simulated sample model is in line with, or exceeds, leading robo-advisor strategies for the three risk profiles.

Figure 9. Annual returns comparison between the simulated sample model and other robo-advisors



Source: Solactive calculation, October 31 2017

Looking ahead

By Timo Pfeiffer

Hot and Cool

Robo-advisors are about the hottest thing in the exciting and growing FinTech scene that has emerged around established financial institutions, such as banks, asset managers or insurance companies in recent years. They are set to challenge incumbent players by building new financial services, or migrating traditional ones into the digital age. As such, robo-advisors have kick-started a process of "creative destruction", driving and fostering innovation in the financial sector.

Timo Pfeiffer

The benefits that robo-advisors bring to investors have many different angles. To name a few: ease of access to discretionary management services; inclusion of more retail investors and capital in financial markets; portfolio diversification with modern investment tools; and an attractive price tag for the services. Most of those characteristics have been discussed and analyzed in similar reports and forums. This is why this publication takes a different approach, with the main focus on transparency of portfolios, models and investment tools.

Most robo-advisors – especially in Germany - have a relatively short history of typically about two years. This has been a period characterized by historically low yields, rising equity markets, and tightening spreads, all on the back of an easing regime by the largest central banks around the globe. And consequently, positive returns for pretty much all multi-asset mandates and portfolios. The real test for robo-advisors and their investors will come when the heat increases and markets enter more shaky territories. Particularly those robo-advisors with frequent and proactive reallocation models will keep benefiting investors under this scenario, while clearly this wouldn't prevent potential losses, or limit potential drops in performance to any guaranteed maximum. Our extended simulations demonstrate the possibility of such outcome, for example around the start of the 2008 financial crisis. No surprise.

This is certainly an area where robo-advisors can – and should – add more transparency and educational effort for their clients. Patience in terms of an extended investment horizon and the acknowledgement that a "digital" manager can't solve it all, will be the main ingredients for turbulent periods – stay cool!

It's not all about fees

Less than 0.06% a year. This is the price of the "Cheapest ETF Portfolio" as compiled and published by ETF.com for the U.S. market[9].

[9]ETF.com (2017). World's Cheapest ETF Portfolio Gets Cheaper

Costs are clearly an important aspect when selecting ETFs for a portfolio. The pressure on fees seen in the U.S. is also hitting the European ETF and mutual fund market, and consequently is also putting pressure on robo-advisors. This trend will keep benefiting investors via robo-portfolios. However, pricing should not become the sole argument - neither for robo-advisors in their positioning, nor for informed investors when making their investment choice. Pricing clearly has a lower relevance compared to the quality of the allocation model, or the overall ETF selection. No surprise there, that an index provider makes the case for additional indices to be used in robo-portfolios. Broader diversification, efficient rebalancing methods, smart beta, factor investing, thematic exposure are just a few examples to name here.

And, of course, Environmental, Social, and Governance (ESG)

No doubt that ESG and impact investing are also driving and reshaping the offerings of robo-advisors. Some first players in the U.S., as well as in Europe, have already introduced portfolios with ESG characteristics.

The integration of social and environmental criteria costitutes a step towards tailored investment in robo-portfolios, as it enables customers to integrate such values into their investment strategies.

ESG investing and its different sub-segments are just one very good example of thematic investments mentioned above. Again, this is nothing specific to just robo-advisors, but is an industrywide trend observed throughout the investment community. We certainly expect to see more ESG in the future.

All Robo? All digital?

Despite posing a challenge to traditional players, robo-advisors can't and won't be the only approach to investing. However, they for sure are a good, complementary service to traditional offerings. Think about it this way: even about 20 years after the first parcel being shipped by Amazon, there are still book shops on the streets – I guess better ones by now. To the same extent, there will still be personal banking and investment services in 20 years' time. Banks can implement hybrid models, especially around individual investment goals, such as retirement planning, or dynamics around life events. This is an aspect for which pure online profiling faces limitations as of today.

I do hope this report triggers thoughts and discussions with stakeholders and interested parties operating in this growing segment – from retail investors, via competing banks and asset managers, to robo-advisors themselves. I am personally looking forward to engage.

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