

## Research Report

# The Impact of Robo-Advice on Fund Savings Plan Choices

IN THE CURRENT REGIME OF LOW INTEREST RATES, TAKING SOUND SAVINGS DECISIONS POSES A SIGNIFICANT CHALLENGE TO MOST INDIVIDUALS. FUND SAVINGS PLANS ALLOW TO ACCUMULATE PRIVATE SAVINGS VIA AUTOMATED RECURRING INVESTMENTS IN SELECTED FUNDS. LOW FEES AND SMALL MINIMUM INVESTMENT AMOUNTS MAKE THEM A SUITABLE SAVINGS VEHICLE ALSO FOR LOW NET-WORTH INDIVIDUALS. WHILE TRADITIONAL FINANCIAL ADVISORS ONLY RELUCTANTLY PROVIDE ADVICE ON SMALL-SCALE INVESTMENTS, THE RECENT SURGE OF ROBO-ADVISORS ENABLES ACCESS TO ADVICE ON SAVINGS PLAN CHOICES FOR INVESTORS FROM ALL WEALTH BANDS. IN THIS REPORT, WE PRESENT EMPIRICAL RESULTS ON THE IMPACT OF INTRODUCING AN AUTOMATED INVESTMENT TOOL AT A LARGE GERMAN ONLINE BANK ON PRIVATE INVESTORS' SAVINGS DECISIONS.

Konstantin Bräuer

### Introduction

During the past years, households have been confronted with exceptionally low interest rates making savings decisions increasingly difficult. At the same time, declining levels of pension benefits have shifted the responsibility to provide for one's old age towards the individual. Households are thus more than ever required to make adequate savings decisions. In this context, fund savings plans (SPs) have increasingly been promoted by the media, government institutions and, more recently, by robo-advisors as a powerful tool to help individuals build up savings.

Robo-advisors offer automated and low-cost investment advice and asset management services available at substantially lower investment requirements compared to traditional advisory services. These online tools promise to provide unbiased advice primarily by recommending investments in low-cost passively managed exchange-traded funds (ETFs) thereby overcoming problems of traditional personal advice, such as distorted incentives that push clients towards high-cost products and harm performance (e.g., Hackethal et al., 2012; Mullainathan et al., 2012). First empirical studies, however, emphasize im-

portant limitations of the robo-advisors' matching algorithms. In particular, several tools match clients to risky portfolios based on only a handful of questions about a client's risk preferences while others elicit risk preferences more comprehensively but only offer a few portfolios to match with (Tertilt and Scholz, 2017). Despite their simplicity and associated concerns about suitability, robo-advisors have seen a tremendous growth in assets under management (AuM). For instance, Oliver Wyman (2017) predicts AuM of German robo-advisors to increase by 165% p.a. from about EUR 0.8 billion in 2017 to EUR 35 billion in 2021. Currently, robo-advisors are continuously becoming more sophisticated aiming at offering a more individualized advice process and eventually holistic financial planning services.

Motivated by these trends, we investigate the effect of robo-advice on SP choices of individual investors using data from an online bank that provides an automated investment solution to its clients.

### Data

We obtain data from a large German online bank that provides a wide range of retail banking products, such as checking and savings accounts as well as brokerage services. In 2014, the bank introduced an automated investment solution (robo-advisor) that offers a guided process for investments in funds through lump sum investments and SPs.

To set up an SP, the robo-advisor requires an investor to make several decisions. Specifically,

the investor has to decide on the recurring investment amount (contribution rate), the intended investment horizon in years, the desired risk-level ("low", "medium", "high"), and the fund type (passive ETFs or actively managed mutual funds or a blend of both). Based on these entries, the robo-advisor proposes a specific asset allocation and provides one fund recommendation within each recommended asset class and region (e.g., European equities). The investor is free to change these default fund recommendations by choosing alternative funds from an interactive list consisting of a broad universe of ETFs and active mutual funds.

### Who Uses Robo-Advice Savings Plans?

We compare investment choices of investors who set up SPs with guidance of the robo-advisor (robo-advice SP users) to choices of investors who do not make use of the tool when setting up an SP (self-directed SP users). The average contribution rate per SP amounts to EUR 341.3 for robo-advice SP users and to EUR 276.47 for self-directed SP users, or 5.3% and 4.1% when stated relative to investors' total assets deposited at the bank. Around 80% of SPs in the sample see contributions at a monthly frequency.

We find that robo-advice SP users have both substantially lower total assets under management (EUR 22,018 vs. EUR 35,844 on average) and lower portfolio assets (EUR 13,490 vs. EUR 25,491 on average) while there is no significant difference in income between both groups. Moreover, robo-advice SP users on average trade less than non-users and have a shorter relationship with

their bank. Overall, descriptive statistics indicate that among SP investors there is selection of younger, less experienced, and less wealthy individuals into the observed robo-advisor.

### How Does the Tool Shape Savings Plans of First-Time Users?

In a first step of our analyses, we construct a sample of investors who set up their first SP at the bank after introduction of the robo-advisor tool during July 2014 – December 2015 and never invested through an SP before. Specifically, we compare investors who set up their first SP with the help of the robo-advisor (treatment group) to self-directed investors who set up their first SP in the same time period but do not use the tool (control group).

To account for self-selection, we use a matching methodology that performs a nearest-neighbor propensity score matching but restricts the matching to groups that are similar with respect to specific ranges of demographic and account characteristics. Figure 1 presents differences in

means between treatment and control group investors and shows that both groups differ substantially along several SP characteristics.

For example, the average share of passive funds (passive share) amounts to 89.4% for robo-advice SPs and 69.8% for self-directed SPs. As a result, the average total expense ratio (TER) of robo-advice SPs is 35 basis points (bps) lower than the average TER of self-directed SPs. While this difference potentially reflects a selection mechanism of investors preferring ETFs selecting into robo-advice it is, however, not solely driven by a higher share of passive funds in robo-advice SPs. Robo-advice SPs also contain less costly funds than self-directed SPs both within the group of active and passive fund choices. In particular, the majority of robo-advice users (87.4%) adheres to the tool's default fund recommendations and, importantly, these funds are by and large less costly than funds selected by self-directed investors. Robo-advice users can be expected to significantly benefit from this cost advantage (e.g., French, 2008).

Additionally, robo-advice SPs on average have an equity (bond) share of 50.4% (48.6%) while self-directed SPs have an average equity (bond) share of 80.9% (11.4%). Only 5.5% of robo-advice SPs are allocated to equity funds only. On the contrary, 65.9% of self-directed SPs are equity-only portfolios. Hence, SP portfolios set up with the help of the tool exhibit substantially different risk-return characteristics. Finally, our results indicate that robo-advice SP portfolios are also more diversified. In particular, they have a smaller allocation to home equity (i.e., German equities) and exhibit a lower return loss measured as the vertical distance to the capital market line in a mean-variance diagram (Calvet et al., 2007). Thus, results suggest that robo-advice users benefit from the tool's recommendations since portfolio underdiversification has been shown to significantly impair risk-adjusted returns (e.g., Goetzmann and Kumar, 2008).

All the aforementioned unconditional differences in means are confirmed in a regression setting when controlling for various observable investor characteristics pointing towards highly statistically and economically significant effects of using the tool on diversification and cost properties of SPs.

### How Does the Tool Change Investors' Savings Plan Choices?

To further validate and isolate the treatment effect of the tool, we conduct a differences-in-differences analysis using monthly data of SP users. The sample consists of investors who use SPs during January 2013 – June 2014 (pre-

treatment period) and then set up a new SP during July 2014 – December 2015 (post-treatment period) with the help of the tool (treatment group) or self-directed (control group), respectively. Figure 2 depicts a monthly time-series of four key portfolio measures and suggests that using the robo-advisor significantly changes investors' SP choices. We test for the significance of the illustrated treatment effect and find that our previous results for first-time SP users also hold in a within-subject setting that controls for observable investor characteristics as well as unobservable investor and time fixed-effects. Specifically, our estimates indicate that setting up a new SP with guidance of the robo-advisor significantly decreases (increases) the equity (bond) share by 14% (23%), increases the passive share by 28%, and decreases the average TER of SP funds by 45.2 bps relative to the effects when setting up a new SP in the post-treatment period without guidance of the tool. Most importantly, also in a within-subject setting we find that the robo-advisor significantly alters the risk-return (i.e., diversification) characteristics of users' SPs. That is, we observe a decrease in the annualized return loss of 31 bps through tool usage. More precisely, setting up an SP with guidance of the tool slightly decreases expected returns, which shifts overall SP portfolios away from the efficient frontier, but substantially decreases total and idiosyncratic volatility, which shifts them disproportionately closer to the efficient frontier, as compared to when setting up a new SP without using the tool. This results both from less aggressive asset allocations and a selection of more diver-

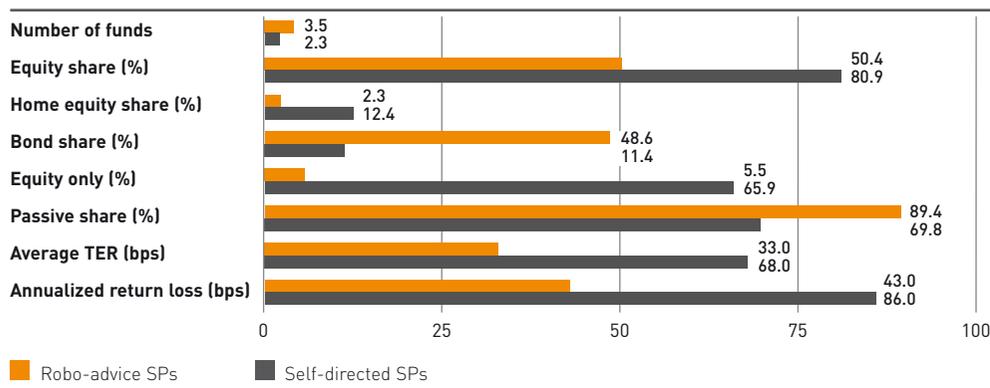


Figure 1: Savings Plan Characteristics by Type of Savings Plan

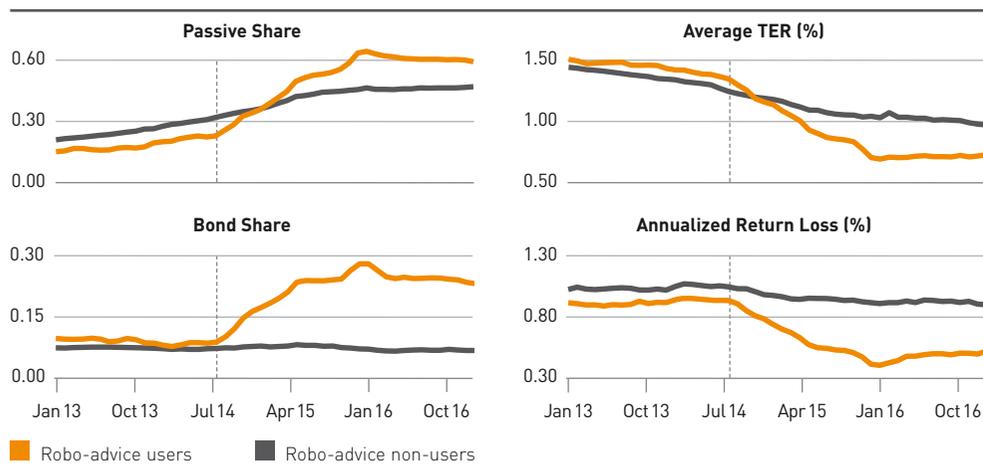


Figure 2: Savings Plan Characteristics Over Time and the Impact of Robo-Advice

sified funds. Figure 3 illustrates these differences by depicting the position of SPs in a mean-variance diagram as well as corresponding 90% confidence ellipses for our before/after and user/non-user observations. For example, 90% of robo-advice users' SPs are

located within the orange ellipse in the left panel of Figure 3 after investors have used the tool. It becomes apparent that after using the robo-advisor, users' SPs are located significantly closer to the efficient frontier (the capital market line) and become substantially more

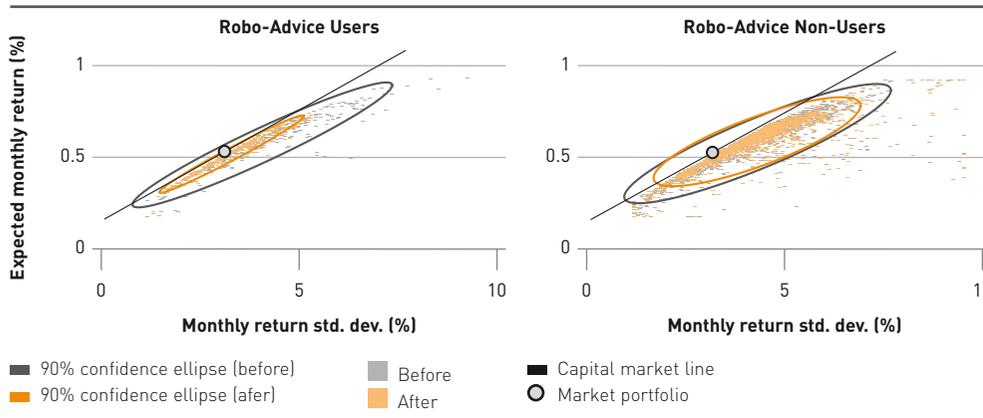


Figure 3: Savings Plan Efficiency and the Impact of Robo-Advice

similar to each other, i.e., the robo-advisor leads to more homogenous portfolios. This results primarily from the high rate of adherence to the tool's default fund recommendations, which leads to similar fund choices among robo-advice users.

As shown in Figure 2, also for control group investors we find an increase (decrease) in the passive share (average TER) but the magnitudes of the effects are much smaller. Thus, also control group investors change their SP choices in the post-treatment period when setting up a new SP. As illustrated in Figure 2 and 3, however, self-directed investors' diversification choices are largely unchanged.

### Conclusion

Our results suggest that investors can benefit from automated investment tools in building up well-diversified and low-cost (SP) portfolios. On the other hand, we find that investors substantially alter their asset allocation choices when using the tool even though recommendations are based on only a few input parameters rather than a more comprehensive individual risk profile. These findings raise concerns about the suitability of digital advice that focuses on simplicity by offering generic advice and only little individualization. Moreover, the large fraction of users adhering to default fund recommendations points out the importance of appropriate default (fund) settings in automated investment solutions. As a next step, we will further elaborate on the causal effect of the tool on investor choices.

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