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Jill E. Fisch, Marion Labouré, and John A. Turner

December 2018

PRC WP2018-12

Pension Research Council Working Paper

Pension Research Council

The Wharton School, University of Pennsylvania

3620 Locust Walk, 3000 SH-DH

Philadelphia, PA 19104-6302

Tel.: 215.573.3414 Fax: 215.573.3418

Email: prc@wharton.upenn.edu

<http://www.pensionresearchcouncil.org>

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Abstract

This volume examines how technology is transforming financial applications, and how FinTech promises a similar revolution in the retirement planning processes. Robo-advisors and mobile savings apps are a few harbingers of innovations to come. Nevertheless, these changes will bring with them new ethical and regulatory considerations, design challenges related to promoting adoption by an older population less trusting of technology, and concerns over data security and privacy. Our contributors take stock of the disruptive impact of financial technology on retirement planning, saving, investment, and decumulation; and it also highlights issues that regulators, plan sponsors, academics, and policymakers must consider as retirement practices evolve at a rapid pace.

Keywords: Robo-advisors, insurance, FinTech, retirement, investments

Jill E. Fisch

University of Pennsylvania Law School

Marion Labouré

Harvard University

John A. Turner

Pension Policy Center

In the past ten years, the market for financial advice has changed dramatically with the emergence of robo-advisors, defined as in Chapter 1 as automated online services that use computer algorithms to provide financial advice and manage customers' investment portfolios. This chapter describes the growth of the robo-advisor industry and the services that robo-advisors offer. It compares the services, quality, and cost of advice provided by robo-advisors to those of traditional human financial advisors. It also considers the potential for conflicts of interest to affect the provision of financial advice by both robo- and human advisors.

Susan Axelrod, the Executive Vice President for Regulatory Affairs at the Financial Industry Regulatory Authority (FINRA), has raised several questions concerning robo-advisors, which she equates to digital services or digital investment advice: 'We need to ask ourselves: what role will financial professionals play in tandem with digital services in providing investment advice? To what degree will investors rely primarily on digital investment advice? How well can software know a client? Can the skill, knowledge and service provided by well-trained and ethical financial professionals be incorporated in software? Can that software provide sound personal advice, especially for clients with more complex advice needs?' (Axelrod 2017: np). This chapter provides a start at answering these questions.

Background on Financial Robo-advisors

Many people find investing to be a difficult challenge, marked by complexity on both the demand and supply sides of the market for financial assets. Financial markets have become more complex as more types of investments have become available, particularly in the retail environment. In addition to understanding the growing array of financial products, investors

must evaluate risk, the effects of compounding, the tax implications of investment alternatives, and how to stage withdrawals from their investment portfolio over their lifetime.

Some people may face additional challenges in making good investment decisions. Young people may have limited experience with financial markets, and some older people suffer from decreased cognition which makes financial decision-making more difficult (Agarwal et al. 2009). A substantial fraction of the population, both in the United States and elsewhere, lacks basic financial literacy (Lusardi and Mitchell 2014), which can deter people from even trying to save, invest, and plan for retirement. Investors with low financial literacy are particularly likely to make poor financial decisions (Fisch et al. 2016).

What do robo-advisors do? Since computers are good at both routine and highly complex tasks, computers can make it easier for clients to manage their investments. Robo-advisors are intended to interact with clients digitally, both to gather client information and to manage the client's investments inexpensively. A client generally creates an account online by responding to a series of questions that may include risk preferences, assets, income, debt and investment goals. The robo-advisor uses computer algorithms to offer investment selections deemed appropriate in terms of asset allocation and diversification based on the information supplied by the client. These selections most typically include low cost mutual funds and exchange traded funds (ETFs). Robos invest the client's portfolio in accordance with the recommended asset allocation which can typically be modified by the client. Robos also manage their clients' portfolios on an ongoing basis, providing services that include automatically rebalancing the portfolio periodically to maintain the desired asset allocation, and reinvesting dividends, redemptions, and interest payments. Some robos also harvest tax losses in taxable portfolios (Berger 2015).

Robo-advisors can differ along several dimensions (Berger 2015). Some require clients to transfer their assets to the robo-advisor's custodian, while others allow clients to keep their investments at external brokerage houses. Most robo-advisors offer advice concerning taxable accounts and IRA retirement accounts, although some do not offer advice concerning complex account structures such as SEP-IRA accounts for the self-employed. Some robos manage other specialized accounts such as 529 college savings accounts.

Robos also offer different types of investments: most limit investors to specific ETFs or mutual funds selected by that advisor, while others offer more flexibility, such as allowing customers to invest in individual stocks. Another difference among robo-advisors is the range of advice that they offer. Many robos limit themselves to portfolio management and do not address, for example, retirement planning, estate planning, or insurance issues. In some cases, a robo will only provide advice with respect to the assets that it is managing; in other cases, the advisor, when preparing an investment plan, has the capacity to consider assets not under its management, such as an employer-sponsored 401k plan.

In addition to asset allocation and diversification, robo-advisors generally rebalance clients' portfolios. For example, Wealthfront (2017b) rebalances its customers' portfolios in taxable accounts by reinvesting dividends and new contributions in underweighted asset classes, so that no tax liability is generated by selling assets to rebalance. That firm argues that rebalancing in this way is one of the advantages it offers over many human advisors. It should be noted that robo-advisors are not necessary for rebalancing, since this service is also provided by target date funds, balanced funds, and managed accounts, among others.

Some robo-advisors offer tax loss harvesting which involves selling investments that have lost value to offset the taxes on investments with realized capital gains. Tax loss harvesting

is relevant for taxable accounts but not for tax-preferenced accounts such as retirement accounts. In addition, Betterment offers customers real time tax information through a 'Tax Impact Preview' calculator (Khentov 2014). When clients decide to sell an asset, Betterment calculates the likely tax liability that these sales could generate. This feature can mitigate clients' tendency to sell in response to a market downturn.

One type of robo-advisor that has received little attention to date is online advice programs offered to pension participants through their 401k plans. Firms such as Financial Engines have long operated in this space (Toonkel and Randall 2015). For instance, Reuter and Richardson (2017) investigated the use of online advice by participants in plans where TIAA was the sole record keeper. They reported that about 6.5 percent of participants studied sought asset allocation advice using an online TIAA tool in 2012 and 2013.

Robo-advisory firms tend to describe what they do as providing investors with asset allocations appropriate to their needs and offering financial advice at a lower cost than traditional human advisors. They market their ability to serve clients who previously received no financial advice because they lacked sufficient investible assets. The advantages in terms of cost and access raise the question as to why more assets are not currently managed by robo-advisors. One reason is that any innovation takes time to become widely accepted. Nevertheless, human advisors may still offer services that robos cannot, leading to the emergence of a hybrid model in which some firms pair robo advice with access to a human advisor.

How are robo-advisors regulated? The Securities and Exchange Commission (SEC) oversees the enforcement of the federal securities law and, as a result, has the job of protecting US investors in the securities markets (SEC 2017). One way it does so is to regulate the services provided by human and robo-advisors, both of which must register under the Investment

Advisers Act of 1940 as Registered Investment Advisers (RIAs). RIAs are subject to the substantive obligations imposed by that statute and have a fiduciary duty to provide advice in the best interest of their clients (Lazaroff 2016). In addition, if robo-advisors hold customer assets, they must register with the SEC and FINRA as broker-dealers. Currently Betterment holds customers' assets and is a registered broker-dealer, while Wealthfront is not.

The scope of protection afforded by the RIA's fiduciary duty has been the subject of extensive debate. Some commentators argue that the fiduciary concept is weak or vague and operates with a lack of predictability for both advisors and customers (Jordan 2012). The precise requirements imposed by the fiduciary relationship can be modified by contract (Klass and Perelman 2019). In addition, many aspects of the fiduciary obligation may be undermined by disclosure and client consent. Under US law, financial advisors are permitted to have a conflict of interest so long as they disclose the conflict to their clients. Nevertheless, disclosure of conflicts of interest may be ineffective in protecting the interests of clients, both because of clients' actions and because of advisors' actions. In one experiment, Cain et al. (2005) found that people generally did not take into account the biases caused by conflicts of interest as much as they should. Some people may believe that disclosure reveals an advisor to be trustworthy, so disclosure may enhance trust in the advisor. Others may feel that it would be insulting to an advisor to question whether the advisor was acting in their best interests.

One potential advantage of robo-advisors is that the quality of their advice may be easier to review, than it is for human financial advisors. While it would be impossible to monitor all private conversations that financial advisors have with their clients, it is conceptually feasible to evaluate computer models' advice (GAO 2011). This greater transparency may lead robo-advisors to adhere more closely than some human advisors to regulatory requirements.

These regulatory requirements continue to evolve. In 2016, the US Department of Labor (2016) outlined a new Fiduciary Rule seeking to impose a fiduciary duty on all financial professionals, including robo-advisors, who provide advice regarding retirement plan investing (U.S. Dept. of Labor 2016). That rule was subsequently invalidated by a federal court.¹ In 2018, the SEC issued for comment its own proposed fiduciary rule – Regulation Best Interest (SEC 2018).

In 2017, the SEC’s Division of Investment Management released regulatory compliance guidance for robo-advisors (SEC 2017). The guidance observed that the unique business model of the robo-advisor raises concerns and emphasized the obligation of robo-advisors to address these concerns. These concerns included the need for adequate disclosure about the robo-advisor and the services it provides, the need to ensure that the robo-advisor is providing suitable advice to its customers, and the need to adopt and implement appropriate compliance programs tailored to the automated nature of the robo’s services.

Evolution of the robo-advisor industry. The first consumer-facing robo-advisors, Wealthfront and Betterment, began operations in 2008,² yet neither company offered financial advice to retail investors until 2010. Wealthfront began as a mutual fund company, KaChing, and it originally used human advisors, not robots, in furtherance of a business model providing high-quality asset management at a lower cost and without the substantial minimum investments required by other professional advisors (Ha 2010). The original objective of Wealthfront’s founders, Andy Rachleff and Dan Carroll, was to provide financial advice to the tech community (Taulli 2012). Wealthfront’s founders shifted the company’s focus when they realized the potential that computer software offered for making investment advice accessible to more people at lower cost (Wealthfront 2017a).

Betterment's co-founder Jon Stein sought to automate the process of selecting and managing investments (Betterment 2017b). The firm offers financial advice at a lower cost than traditional financial advisors, yet the key element of the Betterment strategy is to make investing simple for its clients.

In recent years, additional firms have started to offer robo-advisory services. A BlackRock (2016) study noted 22 new robo-advisory firms launched in the US in 2014 and 44 in 2015. The first robo-advisors were stand-alone firms, but many existing financial firms including banks, broker-dealers, technology firms, and asset managers, have now entered the market.

Assets managed by robo-advisors have continued to grow, with robos managing \$200 billion in assets worldwide in 2017 (Eule 2018). They are likely to continue to grow in the coming years, although estimates of that growth vary considerably, from \$0.82 trillion in 2020 of global assets under management (Statista 2017), to \$2.2 trillion (Regan 2015) and \$8.1 trillion (Kocianski 2016). As of early 2018, the largest US (and worldwide) robo-advisors in terms of assets managed were Vanguard (\$101 billion) and Charles Schwab (\$27 billion). Betterment had \$13 billion in assets under management, and Wealthfront had \$10 billion. Other robo-advisors included Rebalance IRA, Acorns, and SigFig, and the market continues to expand, as is outlined in Table 1. Notably, although robo-advisors are growing rapidly, they still control only a small fraction of the \$80 trillion of global assets under management (Kelly 2017).

Table 1 here.

Who uses robo-advisors?

Despite their appeal, only 5 percent of US investors invest with robos, while 55 percent have not heard about them at all (Wells Fargo 2016). Figure 1 traces the evidence. Part of the reason for the lack of familiarity with robo-advisors stems from the broader reality that only

about one-third of Americans currently seeks financial advice of any sort (Collins 2012). Researchers have documented widespread evidence of low financial literacy in the population (Lusardi and Mitchell 2014) for which financial advice could be an effective substitute (Fisch et al. 2016). Nonetheless, financial advice is not widely used perhaps because consumers view it as too expensive or because they lack sufficient few assets to make it worthwhile to work with a financial advisor.

Figure 1 here.

At the same time, over half of Americans (56%) who hold financial assets outside of pension plans do consult with a financial advisor (FINRA 2016a). The most important reasons people give for using a financial advisor are to improve investment performance and to help avoid losses (FINRA 2016a: 7). Nearly two-thirds also feel it is important to learn about investment opportunities, and over half feel it is important to have access to investments they otherwise would not be able to buy. Most investors who use an advisor (80%) have a specific person with whom they work. Seventy-three percent have communicated with their advisor by telephone or email at least two to three times in the past year, and 80 percent have met in person with their advisor (FINRA 2016a). When people must devote time and money to acquire financial knowledge, which can reduce opportunities to invest in one's own job, outsourcing financial management can make sense (Kim et al. 2016).

To date, the evidence shows that younger people, in their 20s and 30s, are more likely to use robo-advisors than are older people. For example, a FINRA (2016a) study found that 38 percent of Americans between 18 and 34 with investments outside a pension had used a robo-advisor, versus four percent of those over 55. The average age of Betterment's clients is 36, a number that will rise as young robo users age (Wang and Padley 2017). The age tilt may be due

to the fact that the young are often more comfortable with technology than are older individuals (Polyak 2015). Additionally, younger peoples' smaller asset base makes them less suitable clients for traditional financial advisors (Stein 2016).

Robos versus Human Advisors

Over 70 percent of US investors currently believe that human advisors are better than robo-advisors, according to a recent Gallup (2016) survey. That is, investors see human advisors as better serving their interests, making good investment recommendations, taking clients' entire financial picture into account, advising clients on risks they are taking, making people feel confident about their investment, and helping clients understand their investments (see Figure 2).

Figure 2 here.

Several features of robo-advisors distinguish them from human advisors:

Fees and costs. Human financial advisors generally charge fees of 1-2 percent of assets under management, with larger portfolios paying the lower fees in the US (Ludwig 2017). By contrast, robo-advisors typically charge substantially less, with fees ranging from 0 to 50 basis points. Betterment, for example, initially charged 15 basis points for accounts with more than \$100,000 and 35 basis points for the smallest accounts, but it has since moved to charging 25 basis points for all accounts (and for accounts that exceed \$2 million, fees are capped). For an account of about \$50,000, a traditional financial advisor would charge 100 basis points or \$500 a year, versus Betterment which charges \$125 per year. With \$12 billion assets under management at year-end 2017, Betterment's fee structure generated annual revenue of \$30 million.

Other comparisons include Wealthfront, which, as of the time this chapter is written, requires a minimum account balance of \$500 and charges 25 basis points, while accounts of

\$10,000 or under are managed for free. T. Rowe Price and Schwab currently charge no fee for their robo-advisors but are compensated via fees on investment products sold to their clients. Ellevest (2018), a robo-advisor that markets to female clients, charges a fee of 25 basis points for its basic digital service and 50 basis points for its premium service.

Robo-advisors can charge lower fees than human advisors because they have the advantage of economies of scale: that is, a single computer algorithm is used to service many clients. By contrast, a human advisor might have 75 or at most 100 clients (Kitces 2017d); if that advisor had one support staff person, this would entail at most 50 clients per employee. Betterment, by contrast, has over 300,000 clients and 200 employees, so its client-to-staff ratio is 1,500 (Kitces 2017d). Over time as robos acquire more clients with more assets, these fees should fall even further, making financial advice accessible to a larger market of people who are unwilling or unable to pay the fees associated with human financial advisors.

Another factor differentiating robo from human advisors is that the former generally use passive index-fund approaches to investing (Lam 2016). By contrast, human advisors tend to recommend higher-fee actively-managed approaches (Kramer 2016). As a result, robo-advisors not only have lower advisory fees, but they also spend less on trades and charge lower investment management fees. For example, Betterment clients pay 9-12 basis points on investments plus 25 bps for an advisory fee (Betterment 2017a). There are, however, robo-advisors that take an active approach to investing which costs more (Napach 2017).

In addition, human advisors may require clients to have minimum investable assets of \$100,000 or more (Ludwig 2017), whereas robo-advisors are willing to take customers with much lower balances. Wealthfront, for example, requires a minimum balance of only \$500, and Betterment requires no minimum balance. Accordingly, robo-advisors may offer an opportunity

to democratize finance and disrupt the wealth management sector through their low-cost, accessible business models (Braunstein and Laboure, 2018).

Convenience of access. The absence of a human component means that robo-advisors are available to their clients anytime and anywhere, providing a greater level of convenience for clients than previously available. This is particularly appealing to the younger more tech-savvy generation.

Limitations of Robo-advisors

Warm body effect. When comparing robo to human advisors, it can be difficult to measure objectively some of the potential value of working with humans. For instance, human advisors can help their clients overcome limited financial literacy, understand and adjust their levels of risk aversion, and tolerate market volatility. Whether robo-advisors can provide these services to the same degree is unclear but is the subject of on-going research. For instance, Betterment has found that it helps to contact its actively-engaged clients during market downturns. By contrast, contacting clients who are not actively-engaged may backfire because some do not pay attention to stock market fluctuations (Egan 2017).

There is also evidence that people are more likely to seek investment advice from a person than from a company that provides only online advice. For instance, a recent Retirement Confidence Survey showed that 64 percent of pension participants said they would prefer advice from an independent financial advisor, versus only 28 percent favoring financial advice from an online source (Greenwald et al. 2017).

Quality of advice. Several challenges arise when comparing and evaluating the quality of financial advice provided by robos versus human advisors. One has to do with the advisor's

recommended asset allocation. Historically, equity investments have outperformed fixed income, particularly during the rise of the robo-advisory industry. Accordingly, an advisor's performance will be heavily influenced by the degree to which that advisor's recommended portfolio has been concentrated in equities over the past decade. For example, FINRA (2016b) compared the advice of seven robo-advisors for a hypothetical 27-year old, finding that the robos' portfolio allocations to equities varied from 51 to 90 percent.

Market competition may lead robo-advisors to over-concentrate in equities so as to report higher returns and attract more clients, but such a strategy would operate to the detriment of customers in a market downturn. Of course, without additional information on the clients' risk preferences, it is difficult to judge the appropriateness of the portfolio that an advisor recommends. In 2017, the rates of return earned by robo-advisors Betterment (16%), Vanguard (16%), Schwab (15%) and Personal Capital (14%) outperformed the weighted average return of a 60/40 equity/fixed income mix. Robo-advisors' two-year performance for 2016-2017 – a period of strong equity market performance – was even better (Eule 2018). Not surprisingly, most advisors that performed better than the benchmark had a higher allocation to equity. For instance, Betterment, Schwab and Personal Capital had, respectively, 87, 93, and 94 percent of their portfolios allocated to equity vs. 13, 0, and 2 percent to fixed income in Q1 2018 (see Figure 3). It is difficult to evaluate these allocations without more information about the advisors' customers.

Figure 3 here

These differences in asset allocation can be overcome by evaluating returns on a risk-adjusted basis, but this gives rise to another question: that is, do robo-advisors actually tailor recommended portfolios' risk profiles appropriately for their customers' needs? Stein (2016)

found that robo-advisors gave different advice even when their questionnaires were answered in a standardized way. Rappaport and Turner (2010) found a similar result for online retirement planning software. Of course, asset allocation differences resulting from product differentiation are to be expected, but robo-advisors do not appear to brand themselves based on differences in their approach to investment risk.

Another concern is that standard questionnaires seeking to elicit risk preferences may not be very accurate. Kitces (2017a) has noted that a wealthy person with a capacity for bearing risk but who is deeply risk averse would be placed in a moderately risky portfolio because of his or her wealth, in effect overlooking the client's unwillingness to bear risk. He contends that risk bearing and risk tolerance scores should not be added together, but instead they should be treated as separate constraints. Thus, a person with a high capacity for bearing risk but a low risk tolerance would be put in a low-risk portfolio; and a person with a low capacity for bearing risk but a high-risk tolerance would also be put in a low-risk portfolio.

Robo-advisors' approach to risk aversion can also be compared to target date funds. An advantage robo-advisors have over target date funds is that they help clients pick investments appropriate for their levels of risk tolerance, not just their ages (Fisch and Turner 2018). On the other hand,, Porter (2018: n.p.) argued: 'robo-advisers do provide value, but they provide the most value to clients with large taxable accounts and complex goals that are not suited to a simple target date fund. People who are simply saving for retirement or who don't have huge balances in taxable accounts will find that the benefits are offset by the fees.'

Scope of advice. Robos differ according to the share of the client's assets over which the robo has purview (Weisser 2016). In some cases, the robo-advisor may know only one of the client's accounts, and it may also not consider the client's spouse's assets. Naturally, similar limitations

will be relevant to human financial advisors, but human advisors may be more sensitive to signals that prompt them to inquire about other client assets.

A related issue is the extent to which robo-advisors deal with complexity and variation in their customers' needs. FINRA (2016b: 8) raised the regulatory question: 'What information is necessary to build a customer profile with sufficient information to make a sound investment recommendation?' It concluded that most robo-advisors have between five and eight investor profiles, though some advisors have considerably more. It found that 'client-facing digital advice tools rely on a discrete set of . . . between four and twelve questions, generally falling into five broad categories: personal information, financial information, investment objective, time horizon and risk tolerance.' (FINRA 2016b: 9).

Human advisors can offer customers a more personalized approach if they are not limited to standardized formats for gathering customer information. Even when human advisors start with a standard form, face-to-face discussion can enable the advisor to evaluate the intensity of the customer's preferences and to adjust accordingly. How often this happens in practice is unclear. For instance, one Canadian study found that financial advisors tended to ignore differences in risk preferences across their clients and instead recommended the same portfolio for all (Foerster et al. 2017). That study also reported that an advisor's own portfolio was a good predictor of his or her clients' portfolios.

Regulatory requirements are unclear as to the level of personalization required of a broker or financial advisor. Brokers are subject to FINRA's suitability requirement which provides that when making a recommendation, a broker-dealer must use reasonable diligence to obtain and analyze a customer's investment profile. This profile includes, but is not limited to, 'the customer's age, other investments, financial situation and needs, tax status, investment

objectives, investment experience, investment time horizon, liquidity needs, risk tolerance, and any other information the customer may disclose to the member or associated person in connection with such recommendation.’ (FINRA 2016b: 8, quoting FINRA Rule 2111, Suitability). The suitability rule also notes that ‘the level of importance of each factor may vary depending on the facts and circumstances of the particular case.’ FINRA’s rules do not apply, however, to financial advisors that are not broker-dealers and are regulated solely by the SEC.

It is also worth noting that human advisors’ ability to tailor their advice to a specific customer may not always be an advantage. Tailored advice is problematic if human advisors are subject to bias based on the customer’s age, race, gender, or other observables. A possible advantage of robo-advisors is that they may be less subject to this potential for bias.

Financial advisors help customers deal with complexity in the investing process by providing customers with advice on how to invest their money to meet their financial goals and providing ongoing portfolio management (Glassman 2017). In doing so, advisors face a trade-off between customizing client services and the number of clients they can serve. A financial advisor will generally consider a customer’s existing wealth and income, financial goals, risk tolerance and tax status in developing and implementing an investment strategy. Because of the cost of financial advisors, they tend to focus on clients in the top 20 percent of the income distribution (Kitces 2017d).

Financial advisors can also provide financial planning for a broader range of topics than robo-advisors usually do. For example, some advisors counsel on insurance and estate planning (Kitces 2017b), recommend actively-traded mutual funds, and provide access to a broader range of products such as commodities, options, and alternative investments. Thus, they may be better for sophisticated, higher-net worth customers for whom those investments are more likely to be

appropriate. Nevertheless, problems have been identified with human financial advice on these topics, such as recommending costly or unnecessary insurance products or recommending that clients rollover assets from a relatively low-fee 401k plan to a higher-fee IRA (Turner and Klein 2014).

There is no firm consensus regarding the effectiveness of financial advisors. Some studies suggest advisors can improve portfolio performance, but other research warns of potential negative consequences related to the relationship. On the downside, advisors may cater to uninformed clients while sometimes recommending unsuitable products (Anagol et al. 2017). In addition, client's behavioral biases and misconceptions are not always effectively addressed by advisors (Bergstresser et al. 2009; Mullainathan et al. 2012) and broker-sold funds tend not to outperform benchmarks (Bergstresser et al. 2009, Chalmers and Reuter 2015). On the upside, clients can improve their portfolio's efficiency by following unbiased computer-generated advice (Bhattacharya et al. 2012), and individuals who have participated in consultations with a financial planner tend to have higher net worth and retirement wealth (Finke 2013).

Conflicts of interest. One potential difference between robo-advisors and human advisors is the possibility for conflicts of interest to affect the quality of financial advice. Some human financial advisors have been criticized for providing investment advice and recommending products that generated conflicts of interest (Council of Economic Advisers 2015). Robo-advisors may be less vulnerable to the potential for conflicts of interest to the extent that they are independent and do not sponsor or sell the investments that they recommend. Additionally, robo-advisors tend to charge a flat fee based on assets under management rather than a fee that varies depending on the investment choices made by the client or its advisor. In addition, because robo-advisors compete based on fees, their fees are generally more transparent than for human financial advisors.

These differences depend on the structure and business model of the advisor in question. As Klass and Perelman (2016: 11) explained, '[d]igital advisory offerings are typically comprised of ETFs that, in comparison to mutual funds, offer little room for revenue streams and payment shares that would otherwise create a conflict of interest for investment advisors (e.g., 12b-1 fees, subtransfer agent fees). The absence of such compensation factors means that comparatively fewer conflicts of interest are present even where digital advisors are affiliated with some of the ETFs that they recommend, and independent digital advisors reduce such conflicts even further.'

Similarly, as FINRA (2016b: 6) noted, '[f]irm vs. client conflicts, however, may remain present for both financial professional- and client-facing digital advice tools, for example if a firm offers products or services from an affiliate or receives payments or other benefits from providers of the products or services.' Lam (2016) argued that Schwab Intelligent Portfolios held an unusually large amount in cash at Schwab Bank, allowing the firm to profit from the difference between the rate of return the bank pays and the rate of return it receives on lending. He also noted that Schwab Intelligent Portfolios charged higher expense ratios for its ETFs than did the largest robos, Betterment and Wealthfront.

It is worth noting that robos can also face conflicts of interest. When they offer different levels of service with different fees, they confront a conflict if they recommend the service generating the highest revenues to the firm. In addition, pension rollovers generate a conflict of interest for robos because encouraging rollovers also boosts their fees. The total fees Betterment charges are roughly 35 basis points (25 bps for advisory fee and 10 bps for asset management fee). By comparison, in a study of fees in 401k plans, 10 percent of the 525 plans surveyed had an 'all-in' fee of 28 basis points, while 10 percent had an 'all-in' fee of 138 basis points (Deloitte

2011). Thus, the fees Betterment charged were lower than the fees of many 401k plans, but most 401k participants are in large plans that tend to charge lower fees.

Trends in Robo-advisors

This section considers several trends in robo-advisors in the United States. The first is a move to human-robo hybrids; the second is a move to greater product or service diversification in other aspects; and the third is toward vertical integration. These all provide a way for incumbents in the market to compete against the pure robo-advisors, as well as to gain distribution channels. A fourth trend is the use of robo-advisors by human advisors.

The move to hybrids. Some financial advisory companies have begun to combine features of robo-advisors and traditional human advisors, creating a type of hybrid. Hybrids charge lower fees than traditional advisors by automating part of the investment process, but they still offer the possibility of talking with a financial advisor.

The stand-alone robo-advisor movement is also slowly declining in relative importance, as robo-advisors are acquired by other financial firms such as custodian and broker-dealer companies. Some of the traditional financial management companies such as Vanguard and Schwab have incorporated robo-advisors into their business model, Schwab being the first to use the hybrid approach. This development, while increasing competition, has also given added credibility to the use of robo-advisors. Vanguard's Personal Advisor Services charged 30 basis points and required an account minimum of \$50,000 in 2018. Schwab Intelligent Advisory charged 28 basis points with an account minimum of \$25,000 and offers 'unlimited' contact with a Certified Financial Planner 24/7. Schwab Intelligent Advisory combined Schwab Intelligent Portfolios plus the availability of human advisors. It provided comprehensive financial planning

services, not just portfolio management, which it implemented with the Schwab robo model (Kitces 2016). Both the Schwab and Vanguard services involved contact with human advisors, so neither was a pure robo-advisor.

In 2017, T. Rowe Price began offering a robo-advisor, ActivePlus Portfolios, reflecting its emphasis on active portfolio management. Advisors could only select T. Rowe Price funds. There was no extra investment management fee. The robo-advisor service was available to clients with at least \$50,000 in the portfolios managed by this program (Kitces 2017c). The program only managed IRA money, so presumably there were no tax consequences associated with trading. The fact that it only managed money invested in an IRA with a minimum of \$50,000 made the service unavailable to most young people. The program offered a call-in center where participants could talk to advisors, as well as online access to client managers. A website allowed a client to see how the allocation of a portfolio between stocks and fixed income would vary based on the personal information provided (T. Rowe Price 2017). For example, the program recommended that a person age 25 with medium risk tolerance invest in a portfolio of 88.5 percent stocks and 11.5 percent bonds, while a person with the same risk tolerance who was age 67 was advised to invest in a portfolio with 58.5 stocks and 41.5 percent fixed income.

Wells Fargo began offering a robo-advisor service in 2017, requiring a minimum investment of \$10,000. It was a hybrid service, offering the possibility of speaking to an advisor. It offered seven different portfolios, with a fee of 50 basis points including the expense ratio for the investments and the advice fee (Saacks 2017).

The hybrid business model has spread to the original robo-advisor space. In 2017, Betterment opened a call center and began offering three levels of service. Betterment Digital was the classic robo advice offering with no account minimums, costing 25 basis points (the

same fee charged by Wealthfront). Betterment Premium required a \$100,000 minimum balance and cost 40 basis points for unlimited access to a ‘team of CFP professionals and licensed financial experts.’ (Benke 2017: np). Customers looking for even more hands-on advice could use a dedicated financial advisor assisted by Betterment for Advisors (Neal 2017). These changes were designed to attract wealthier clients than those typically using the basic robo-advisor approach. In 2016 and 2017, about one-third of the assets Betterment managed were owned by investors age 50 or older, who typically had larger portfolios than did younger investors (Weisser 2016; Kitces 2017d).

Greater product diversification. With the growing number of entrants into the robo-advisor market, there has also been a move toward greater product diversification. This is a common pattern in product development as markets mature. It means that robo-advisors need to differentiate themselves with respect to the services they provide instead of competing primarily on fees.

Some robo-advisors offer specialized services to attract a demographic or interest group. For example, because the financial advice industry is supposedly male-oriented in the services it provides, some robo-advisors instead focused on attracting female clients. SheCapital was founded in 2015 to target the specific needs of women investors (Malito 2015), but the firm went out of business after a year because of its inability to attract a sufficient number of clients (Malito 2016). In 2016, Ellevest started as a robo-advisor catering to women. The premise was that because women have longer life expectancies than men, they need to have different portfolios from men the same age (Weisser 2016). Ellevest clientele are well educated— more than 40 percent have a master’s degree or doctorate (Ellevest 2017).

True Link focused on older investors and retirees (True Link 2017), while United Income was also oriented toward people near or in retirement. Several robo-advisors, including OpenInvest and Earthfolio, offered investors the opportunity to combine socially responsible investing with a robo platform (Skinner 2017b). The fees of these specialized firms were higher than those of the original robo-advisors.

The original robo-advisors have also expanded the range of products and services that they offer over time. In 2017, Betterment began offering three new options: a fund that took socially responsible investing criteria into account, a low-risk alternative to its standard fund, and a high-risk alternative, which is its Goldman Sachs Smart Beta portfolio. The high-risk fund invests based on factors such as the momentum or the quality of a stock. The same year, Betterment also began offering a program for charitable giving (Betterment 2017c). The client specifies the amount of the desired donation, and Betterment picks the asset that has the most unrealized capital gains to donate to that charity. In this way, the client gets to contribute and deduct the full value of the security, rather than first selling the security, paying tax on the capital gains, and then contributing the after-tax amount.

Robo-advisors are also expanding their operations into a broader range of financial services. For example, Betterment offers Betterment for Business, providing record keeping and asset management services for 401k plans. It also offers Betterment for Advisors, providing asset management services for financial advisors.

Vertical integration - robo-advisors as distribution channels. From the perspective of the financial services industry, robo-advisors function as distribution channels for financial products. Some providers of financial products have also purchased or started robo-advisors as a way to

distribute their products (Kitces 2017d). Such vertical integration is one way for incumbent financial service providers to compete with the start-up robo-advisors.

Schwab started Schwab Intelligent Portfolios, in which the portfolios primarily consist of its own proprietary products. BlackRock purchased FutureAdvisor as a platform to distribute its ETFs. Similarly, Invesco purchased Jemstep to distribute its ETFs. Wisdom Tree invested heavily in AdvsorEngine to distribute its ETFs. Northwestern Mutual purchased LearnVest, and Interactive brokers Online purchased Covestor (Hooper and Andress 2016). By contrast, the CEO of Betterment, Jon Stein, has indicated that he would prefer an IPO for Betterment rather than being bought by a large investment management company because this would preserve its independence relating to its choice of investments (Wang and Padley 2017).

The use of robo-advisors by human advisors. A further trend is the use of robo-advisors by human advisors. Human advisors can become more efficient by using robo-advisors to help them advise their clients and manage client investments. For example, Riskalyze only deals with registered financial advisors. Its technology helps advisors determine the risk tolerance of their clients and use that information to construct portfolios that are appropriate for the clients. By analyzing the risk of the prospects' investment holdings, the software allows financial advisors to show prospects whether their investment portfolios have the appropriate amount of risk (Riskalyze 2018). Raymond James Financial announced in 2017 that its 7,100 advisors would have access to a robo-advisor platform that they could use as a tool for advising clients (Skinner 2017a).

Robo-advisors Internationally

Although robo-advisors began in the United States, the concept has spread to other countries. In Europe, robo-advisors are a relatively new concept. The number of robo advisors in Europe has increased significantly since 2014, and the amount of money robo-advisors manage has also grown rapidly (Table 2). Most European robo advisors operate at the national level (rather than internationally) due to legislative and regulatory constraints. However, some such as Quirion operate in several countries. In June 2017, BlackRock took a stake in the Anglo-German digital investment manager Scalable Capital. Robo-advisors now operate in Canada (12), France (17), the United Kingdom (20), Switzerland (12), Germany (31), Italy (5), China (20), Japan (14), Singapore (8), India (19), and Australia (8). By contrast, there are 200 robo-advisors in the United States. However, robo-advisors are rare in South America (3) (Burnmark 2017).

Table 2 here

Although it is difficult to generalize about the European market, robo-advisors there tend to charge higher fees than US robo-advisors, from 40 to 100 basis points (e.g., Nutmeg, Quirion, Marie Quantier). The higher fees may be due to the fact that robo-advisors are a relatively new phenomenon in Europe. In addition, European financial and banking legislation differs across countries, resulting in many different national markets for robo-advisors rather than a single centralized European market. Also, European citizens may tend to be more risk-averse than Americans, resulting in more saving and safer investments (Laidi 2010). These factors may have led European robo-advisors to grow slowly, reducing their ability to benefit from economies of scale.

Conclusion

Whether robo-advisors will be better generally for investors than human advisors in the long run remains to be seen. Because of their relatively low fees and low minimum account balances, robo-advisors can provide financial advice to people who cannot afford it from traditional financial advisors and for whom many financial advisors would not be willing to provide their services. For this group, robo-advisors are clearly a better option than human financial advisors. A robo-advisor can steer young people who are just starting out away from poor decisions such as inappropriate asset allocations or the selection of overly-costly investments.

In addition, robo-advisors may be less likely to have conflicts of interest related to the products they sell. This, however, may be undercut by the growing trend toward robo-advisors being integrated into traditional full-service banks, brokerages, and asset management firms.

In the future, robo-advisors can be expected to increase the sophistication with which they identify individual differences in risk preference, as well as other aspects of the advice and financial management provided. To assess the relative merits of robo-advisors versus financial advisors fully, more information on and experience with robo-advisors is needed. It is likely that their importance will grow over time as more new cohorts of investors use them and as the asset balances of their current users increase, as they age.

The intangible component of human contact is one service that robo-advisors are unable to provide. The real or perceived value of this human contact appears to be an important difference between robo-advisors and traditional financial advisors, and it likely explains the current trend toward hybrid advisors that involve a robo-advisor working in partnership with a traditional advisor. Such hybrids charge lower fees than traditional advisors, but they still offer

the possibility of talking with a financial advisor and may constitute the future of the financial advisory industry.

References

- Agarwal, S., J. Driscoll, X. Gabaix, and D. Laibson (2009). 'The Age of Reason: Financial Decisions over the Lifecycle with Implications for Regulation,' *Brookings Papers on Economic Activity* 2:51-117.
- Anagol, S., S. Cole, and S. Sarkar (2017). 'Understanding the Advice of Commissions-Motivated Agents: Evidence from the Indian Life Insurance Market,' *Review of Economics and Statistics* 99(1).
- Axelrod, S. F. (2017). 'Remarks at IRI Government, Legal and Regulatory Conference.' June 12: <http://www.finra.org/newsroom/speeches/061217-remarks-iri-government-legal-and-regulatory-conference>
- Backend Benchmarking (2018). "The Robo Report Second Quarter 2018: Bringing Transparency To Robo Investing." Edition 8: <https://storage.googleapis.com/gcs-wp.theroboreport.com/gZhdpxRTPEhtB8Wj/2Q%202018%20Robo%20Report.pdf>
- Benke, A. (2017). 'Your Money, Your Way: The Betterment Service Plans,' *Betterment*. January 31: <https://www.betterment.com/resources/your-money-your-way-the-betterment-advice-plans/>.
- Berger, R. (2015). '7 Robo Advisers that Make Investing Effortless,' *Forbes*. February 5: <http://www.forbes.com/sites/robertberger/2015/02/05/7-robo-advisors-that-make-investing-effortless/#75eaae1f7e48>
- Bergstresser D., J. Chalmers, and P. Tufano (2009). 'Assessing the Costs and Benefits of Brokers in the Mutual Fund Industry,' *Review of Financial Studies* 22(10): 4129–4156.
- Betterment (2017a). 'How is a Betterment IRA Better than a Typical 401(k)?' *Betterment*. <https://www.betterment.com/401k-and-ira->

rollover/?gclid=CjwKEAjwja_JBRD8idHpxaz0t3wSJAB4rXW55KvrzvjpgmvpQLWhL_4Hzz2De3RXD-tAsyx88We8XiBoC_zzw_wcB

Betterment (2017b). 'The History of Betterment: How We Started a Company That Changed an Industry,' *Betterment*. July 20: <https://www.betterment.com/resources/inside-betterment/our-story/the-history-of-betterment/>

Betterment (2017c). 'Introducing Charitable Giving by Betterment,' *Betterment*. November 15: <https://www.betterment.com/resources/charitable-stock-donation/>

Bhattacharya, U., A. Hackethal, S. Kaelser, B. Loos, and S. Meyer (2012). 'Is Unbiased Financial Advice to Retail Investors Sufficient? Answers from a Large Field Study,' *Review of Financial Studies* 25(4): 975–1032.

BlackRock (2016). 'Digital Investment Advice: Robo Advisers Come of Age,' *Viewpoint*, September. <https://www.blackrock.com/corporate/en-mx/literature/whitepaper/viewpoint-digital-investment-advice-september-2016.pdf>

Braunstein J., M. Laboure (2017). 'Democratising Finance: The Digital Wealth Management Revolution,' *VoxEU*, November 11: <https://voxeu.org/article/digital-wealth-management-revolution>

Cain, D.M., G. Loewenstein, and D.A. Moore (2005). 'The Dirt on Coming Clean: Perverse Effects of Disclosing Conflicts of Interest,' *The Journal of Legal Studies*, 34(1): 1-25. <http://www.journals.uchicago.edu/doi/abs/10.1086/426699>

Chalmers J. and J. Reuter (2015). 'Is Conflicted Investment Advice Better than No Advice?' NBER Working Paper No. 18158. Cambridge, MA: National Bureau of Economic Research.

- Collins, J. M. (2012). 'Financial Advice: A Substitute for Financial Literacy?' *Financial Services Review*, 21: 307–322.
- Council of Economic Advisers (CEA) (2015). *The Effects of Conflicted Investment Advice on Retirement Savings*, February. Washington, DC: CEA. http://www.whitehouse.gov/sites/default/files/docs/cea_coi_report_final.pdf
- Deloitte Consulting (2011). *Inside the Structure of the Defined Contribution/401(k) Plan Fees: A Study Assessing the Mechanics of the 'All-In' Fee*, Study Conducted for the Investment Company Institute. November. http://www.ici.org/pdf/rpt_11_dc_401k_fee_study.pdf
- Deschenes, S.L. and P.B. Hammond (2019). 'Matching FinTech (Robo) Advice to Participant Needs: Lessons and Challenges,' in J. Agnew and O.S. Mitchell, eds., *The Disruptive Impact of FinTech on Retirement Systems*. Oxford, UK: Oxford University Press, pp. xxx-xxx.
- Egan, D. (2017). 'Our Evidence-Based Approach to Improving Investor Behavior.' October 12. Betterment. <https://www.betterment.com/resources/investment-strategy/behavioral-finance-investing-strategy/behavioral-testing/>.
- Ellevest (2017). 'We've Rounded Up the Biggest Ellevest Trends,' email to the authors dated September 2.
- Ellevest (2018). 'Simple, Flexible Pricing.' <https://www.ellevest.com/pricing>
- Eule, A. (2018). 'As Robo-Advisors Cross \$200 Billion in Assets, Schwab Leads in Performance,' *Barron's*. Feb. 3. <https://www.barrons.com/articles/as-robot-advisors-cross-200-billion-in-assets-schwab-leads-in-performance-1517509393>.
- Financial Industry Regulatory Authority (FINRA) (2016a). *Investors in the United States: 2016*. December. FINRA Report. Washington, D.C.: FINRA. http://gflec.org/wp-content/uploads/2017/02/NFCS_2015_Inv_Survey_Full_Report.pdf?x28148

- FINRA (2016b). *Report on Digital Investment Advice*, March. Washington, D.C.: FINRA.
<https://www.finra.org/sites/default/files/digital-investment-advice-report.pdf>
- Finke, M (2013). 'Financial Advice: Does it Make a Difference?' in O.S. Mitchell and K. Smetters, eds., *The Market for Retirement Financial Advice*. Oxford University Press: Oxford, UK, 229–248.
- Fisch, J.E., T. Wilkinson-Ryan, and K. Firth (2016). 'The Knowledge Gap in Workplace Retirement Investing and the Role of Professional Advisors,' *Duke Law Review* 66: 633-672. <http://dlj.law.duke.edu/article/the-knowledge-gap-in-workplace-retirement-investing-and-the-role-of-professional-advisors-fisch-vol66-iss3/>
- Fisch, J.E. and J.A. Turner (2018). 'Making A Complex Investment Problem Less Difficult: Robo Target Date Funds,' *Journal of Retirement*, 5(4): 40-45.
- Foerster, S., J.T. Linnainmaa, B.T. Melzer, and A. Previtro (2017). 'Retail Financial Advice: Does One Size Fit All?' *Journal of Finance*, 72: 1441-1482.
- Gallup (2016). 'Robo-Advice Still a Novelty for U.S. Investors,' *Gallup*, July 27.
<http://www.gallup.com/poll/193997/robo-advice-novelty-investors.aspx>
- Glassman, B. (2017). 'What Does a Financial Advisor Do?' *Forbes*. February 8:
<https://www.forbes.com/sites/advisor/2017/02/08/what-does-a-financial-advisor-do/#16bc5cb55499>
- Greenwald, L., L. Copeland, and J. VanDerhei (2017). *The 2017 Retirement Confidence Survey: Many Workers Lack Retirement Confidence and Feel Stressed about Retirement Preparations*, *EBRI Issue Brief* No. 431. March 21:
https://www.ebri.org/pdf/briefspdf/EBRI_IB_431_RCS.21Mar17.pdf

- Ha, A. (2010). 'Investing Site KaChing Gets Classier as Wealthfront,' *Venturebeat*, Oct. 19:
<https://venturebeat.com/2010/10/19/kaching-wealthfront/>,
- Hooper, T. and M. Address (2016). 'Robo-Advisory Space Poised for Further Consolidation—
Sources,' *Mergermarket*, January 19.
- Jordan, R. (2012). 'Thinking Before Rulemaking: Why the SEC Should Think Twice Before
Imposing a Uniform Fiduciary Standard on Broker-Dealers and Investment Advisers,'
Louisville Law Review 50: 491-526.
- Kelly, J. (2017). 'Global Assets Under Management Hit All-Time High above \$80 Trillion,'
Reuters Oct. 30: <https://www.reuters.com/article/us-global-funds-aum/global-assets-under-management-hit-all-time-high-above-80-trillion-idUSKBN1CZ11B>.
- Khentov, B. (2014). 'Avoid Surprises with Tax Impact Preview,' *Betterment*. October 29:
<https://www.betterment.com/resources/tax-impact-helps-you-get-the-full-picture/>
- Kim, H.K., R. Maurer, and O.S. Mitchell (2016). 'Time is Money: Rational Life Cycle Inertia
and the Delegation of Investment Management,' *Journal of Financial Economics*, 121(2):
427-447.
- Kitces, M. (2016). 'Is Schwab Intelligent Advisory a Threat to Independent Financial Advisors?'
The Nerd's Eye View, December 22: <https://www.youtube.com/watch?v=I8ERYe7JQt0>
- Kitces, M. (2017a). 'Adopting a Two-Dimensional Risk-Tolerance Assessment Process,' *The
Nerd's Eye View*, January 25: <https://bit.ly/2zAKB46>.
- Kitces, M. (2017b). 'Advisor #Fintech as a Distribution Channel for Insurance and Investment
Products,' *The Nerd's Eye View*, December 7: <https://bit.ly/2L5uu00>.
- Kitces, M. (2017c). 'The Latest in Financial Advisor #FinTech (March 2017): Takeaways from
the T3 Advisor Tech Conference,' *The Nerd's Eye View*, March 6: <https://bit.ly/2uoCZff>.

Kitces, M. (2017d). 'What Robo Advisers Can Teach Human Advisers About Evidence-Based Behavioral Finance with Dan Egan,' *The Nerd's Eye View*, December 19:

<https://bit.ly/2L4X5FM>.

Klass, J. L. and E. Perelman (2019). 'The Transformation of Investment Advice: Digital Investment Advisers as Fiduciaries' in J. Agnew and O.S. Mitchell, eds., *The Disruptive Impact of FinTech on Retirement Systems*. Oxford, U.K: Oxford University Press: pp. xxx-xxx.

Klass, J. L. and E. Perelman (2016). *The Evolution of Advice: Digital Investment Advisers as Fiduciaries*. Morgan Lewis. New York, NY: Morgan Lewis.

<https://www.morganlewis.com/~media/files/publication/report/im-the-evolution-of-advice-digital-investment-advisers-as-fiduciaries-october-2016.ashx?la=en>

Kocianski, S. (2016). 'The Robo Advising Report,' *BusinessInsider*, June 9.

<http://www.businessinsider.com/the-robo-advising-report-market-forecasts-key-growth-drivers-and-how-automated-asset-management-will-change-the-advisory-industry-2016-6>

Kramer, L. (2016). 'Can Robo Advisers Replace Human Financial Advisers?' *Wall Street Journal*, Feb. 28. <https://www.wsj.com/articles/can-robo-advisers-replace-human-financial-advisers-1456715553>

Laidi, Z. (2010). *Europe as a Risk Averse Power: A Hypothesis*. Garnet Policy Brief. Princeton, NJ: Princeton University.

Lam, J.W. (2016). 'Robo-Advisers: A Portfolio Management Perspective,' Unpublished Senior Thesis, Yale College, April 4.

http://economics.yale.edu/sites/default/files/files/Undergraduate/Nominated%20Senior%20Essays/2015-16/Jonathan_Lam_Senior%20Essay%20Revised.pdf

- Lazaroff, P. (2016). "The Difference Between Fiduciary and Suitability Standards." *Forbes*, April 6. <http://www.forbes.com/sites/peterlazaroff/2016/04/06/the-difference-between-fiduciary-and-suitability-standards/#4d42e9a735bf>
- Ludwig, L. (2017). 'The Rise of the Robo-Advisors – Should You Use One?' *InvestorJunkie*. <https://investorjunkie.com/35919/robo-advisors/>.
- Lusardi, A. and O.S. Mitchell (2014). 'The Economic Importance of Financial Literacy: Theory and Evidence,' *Journal of Economic Literature* 52(1): 5-44. <http://www.aeaweb.org/articles.php?doi=10.1257/jel.52.1.5>
- Malito, A. (2015). 'Newest Robo-Adviser Targets Female Investors,' *InvestmentNews*. August 27: <http://www.investmentnews.com/article/20150827/FREE/150829930/newest-robo-adviser-targets-female-investors>.
- Malito, A. (2016). 'Women-Focused Robo-Adviser SheCapital Shuts Down.' *InvestmentNews*, July 19. <http://www.investmentnews.com/article20160719/FREE/160719922/women-focused-robo-adviser-shecapital-shuts-down>
- Mullainathan S., M. Noeth, and A. Schoar (2012). 'The Market for Financial Advice: An Audit Study,' NBER Working Paper 17929. Cambridge, MA: National Bureau of Economic Research.
- Napach, B. (2017). 'T. Rowe Price Launches Robo Platform with Only Actively-Managed Funds,' *ThinkAdvisor*, Mar. 16. <https://www.thinkadvisor.com/2017/03/16/t-rowe-price-launches-robo-platform-with-only-acti/?slreturn=20180415200353>.
- Neal, R. (2017). 'Betterment Pivots Toward a Human-Robo Hybrid.' *Wealthmanagement.com*, January 31: http://www.wealthmanagement.com/technology/betterment-pivots-toward-human-robo-hybrid_

- Polyak, I. (2015). 'Millennials and Robo-Advisers: A Match Made in Heaven?' *CNBC*, June 22:
<https://www.cnbc.com/2015/06/21/millennials-and-robo-advisors-a-match-made-in-heaven.html>.
- Porter, T. (2018). 'Why Robo-Advisory Services May Not be Worth the Investment,'
MyBanktracker, February 20: <https://www.mybanktracker.com/news/why-robo-advisors-may-not-be-worth-cost>.
- Rappaport, A.M. and J.A. Turner (2010). 'How Does Retirement Planning Software Handle Postretirement Realities?' in R. L. Clark and O.S. Mitchell, eds., *Reorienting Retirement Risk Management*. Oxford, UK: Oxford University Press, pp. 66-85.
- Regan, M.P. (2015). 'Robo Advisers to Run \$2 Trillion by 2020 if This Model is Right,'
Bloomberg, June 18. <https://www.bloomberg.com/news/articles/2015-06-18/robo-advisers-to-run-2-trillion-by-2020-if-this-model-is-right>.
- Reuter J. and D. Richardson (2017). 'New Evidence on the Demand for Advice within Retirement Plans,' *Trends and Issues*, TIAA Institute. April: <https://bit.ly/2ucC5TV>.
- Riskalyze (2018). 'Risk Number.' <https://kb.riskalyze.com/category/24-risk-questionnaire>
- Robo Advisors Europe (2019). <http://robo-advisors.eu/>.
- Saacks, B. (2017). 'Wells Readies Robo Rollout (with Human Touch),' *Ignites*, March 29.
<http://bit.ly/2JBfmL4>.
- Skinner, L. (2017a). 'Raymond James to Deliver Robo Service for Advisers by Year End,'
Investment News, January 30.
<http://www.investmentnews.com/article/20170130/FREE/170139992/raymond-james-to-deliver-robo-service-for-advisers-by-year-end>

Skinner, L. (2017b). 'Robos Jumping into Socially Responsible Investing Space,'

InvestmentNews. January 11:

<http://www.investmentnews.com/article/20170111/FREE/170119974/robos-jumping-into-socially-responsible-investing-space>

Statista (2017). 'Forecast of Assets Under Management of Robo-Advisors in the United States from 2016 to 2020 (in Billion U.S. dollars).' (Updated 2018.)

<https://www.statista.com/statistics/520623/projected-assets-under-management-us-robo-advisors/>

Stein, J.D. (2016). 'Test Driving Robo-Advisors: Their Recommended Portfolios and ETFs,'

Seeking Alpha, June 13. <http://seekingalpha.com/article/3981595-test-driving-robo-advisors-recommended-portfolios-etfs>

Taulli, T. (2012). 'Interview: Wealthfront CEO and Founder Andy Rachleff,' *Investor Place*.

February 7: <http://investorplace.com/ipo-playbook/interview-wealthfront-ceo-and-founder-andy-rachleff/#.WZRqJoeWwck>

Toonkel, J. and D. Randall (2015). 'Original Robo-adviser Financial Engines Seeks Life Beyond

401(k)s,' *Reuters*. May 26: [https://www.reuters.com/article/us-financialengines-future-insight/original-robo-adviser-financial-engines-seeks-life-beyond-401s-](https://www.reuters.com/article/us-financialengines-future-insight/original-robo-adviser-financial-engines-seeks-life-beyond-401s-idUSKBN0OC0BE20150527)

[idUSKBN0OC0BE20150527](https://www.reuters.com/article/us-financialengines-future-insight/original-robo-adviser-financial-engines-seeks-life-beyond-401s-idUSKBN0OC0BE20150527)

Turner, J.A., and B. W. Klein (2014). 'Retirement Savings Flows and Financial Advice: Should

You Roll Over Your 401(k) Plan?' *Benefits Quarterly* 30: 42-54.

T. Rowe Price (2017). 'Enjoy the Convenience of Online Investing—Powered by Our Experts.'

https://www3.troweprice.com/usis/personal-investing/products-and-services/activeplus-portfolios.html?v_linkcomp=aalink&v_link=ActivePlus%20Portfolios&v_linkplmt=TN

True Link (2017). 'Financial Services Built for You.' <https://www.truelinkfinancial.com/>

US Department of Labor (2018). *Field Assistance Bulletin No. 2018-02*. Washington, D.C.: US DOL. <https://www.dol.gov/agencies/ebsa/employers-and-advisers/guidance/field-assistance-bulletins/2018-02>

US Department of Labor (2016). *Definition of the Term 'Fiduciary'; Conflict of Interest Rule-- Retirement Investment Advice (Final Fiduciary Definition)*. Washington, D.C.: 81 Fed. Reg. 20,946.

US Government Accountability Office (GAO) (2011). *Improved Regulation Could Better Protect Participants from Conflicts of Interest*. GAO-11-119. Washington, D.C.: USGAO. <http://www.gao.gov/products/GAO-11-119>

US Securities and Exchange Commission (SEC) (2018). *Regulation Best Interest*. Washington, D.C.: US SEC. <https://www.sec.gov/rules/proposed/2018/34-83062.pdf>.

US Securities and Exchange Commission (SEC) (2017). *Robo-Advisers, IM Guidance Update*. Washington, D.C.: US SEC. <https://www.sec.gov/investment/im-guidance-2017-02.pdf>.

Wang, Y. and K. Padley (2017). 'Betterment Still Plans IPO But Not This Year, CEO Says,' *Mergermarket*, April 10.

Wealthfront (2017a). 'Here's How It All Started.' <https://www.wealthfront.com/origin>.

Wealthfront (2017b). 'How Does Tax-loss Harvesting Relate to Rebalancing?' <https://support.wealthfront.com/hc/en-us/articles/209348586-How-does-tax-loss-harvesting-relate-to-rebalancing->

Weisser, C. (2016). 'The Rise of the Robo-Adviser,' *Consumer Reports*. July 28: <https://www.consumerreports.org/personal-investing/rise-of-the-robo-adviser/>

Wells Fargo (2016). “Wells Fargo/Gallup Survey: Investors Curious about Digital Investing, More Optimistic about Economy Prior to Brexit.” July 19.

<https://newsroom.wf.com/press-release/innovation-and-technology/wells-fargogallup-survey-investors-curious-about-digital>

Endnotes

¹ Chamber of Commerce v. US Dept. of Labor, 885 F.3d 360 (5th Cir. 2018). Following the ruling, the US Department of Labor (2018) announced that it did not intend to enforce the rule, pending further review.

² The precursors to robo-advisors such as Mpower and Financial Engines were automated services that employers provided to employees in their defined contribution plans, but these firms offered services directly to retail investors (Deschenes and Hammond 2019).

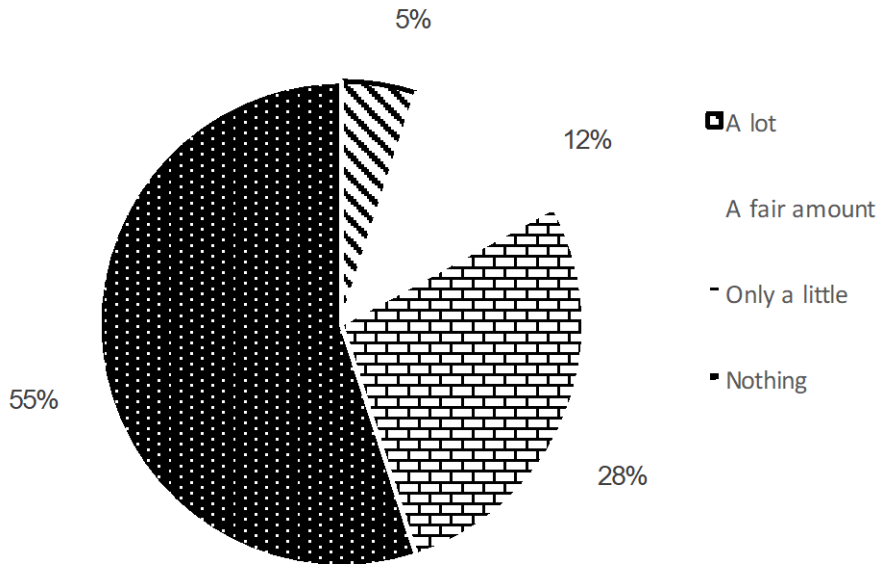


Figure 2.1. U.S. investors' familiarity with robo-advisers

Note: Participants were asked: 'How much have you heard or read about robo-advisers before now? Robo-advisers are digital advisory services that use computer algorithms to select stocks and other investments for people based on the information people provide about their risk tolerance and goals.'

Source: Gallup (2016).

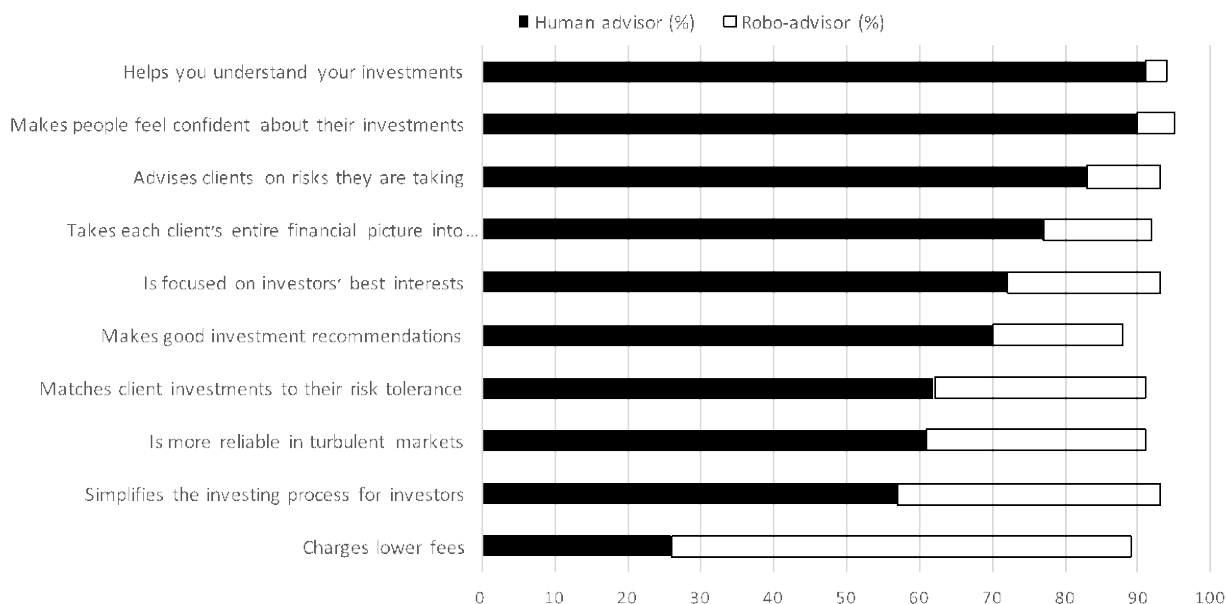


Figure 2.2. U.S. investors' perceptions of human vs. robo-advice

Note: Investors were asked whether each statement applies more to robo-advisors or more to human advisors. Results for the Wells Fargo/Gallup Investor and Retirement Optimism Index survey are based on questions asked May 13-22, 2016, on the Gallup Daily tracking survey, of a random sample of 1,019 U.S. adults having investable assets of \$10,000 or more.

Source: Gallup (2016).

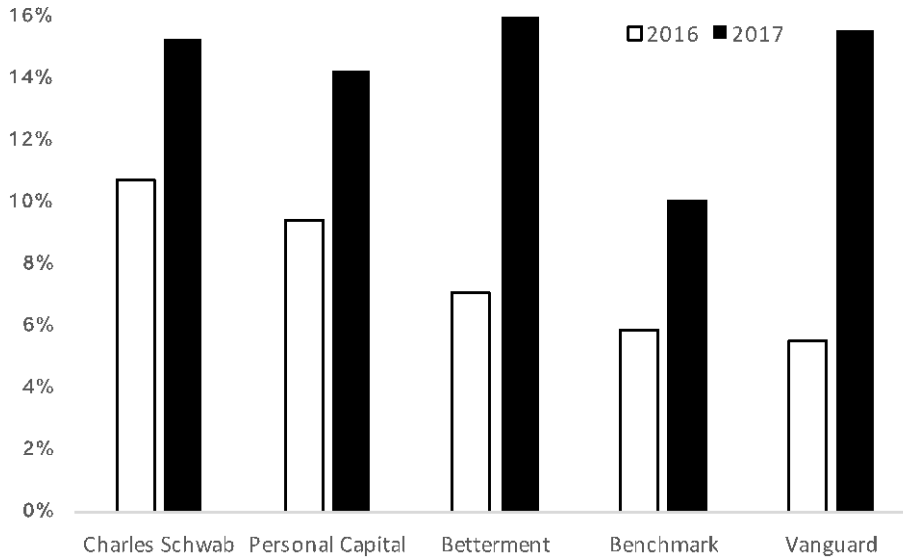


Figure 2.3. 2016-7 Returns of Selected Robo Advisers vs. Benchmark

Note: Benchmark is calculated based on a 60 percent fixed income indices (US 10-Year Bond Yield) and 40 percent Equity (S&P 500) weighted average return.

Source: Backend Benchmarking (2018).

Table 2.1. Selected top U.S. robo-adviser by assets under management, first quarter 2018

Robo Adviser	\$AuM (billion)	Advisory Fee as % of AuM (excludes fee for investment in funds)	Minimum Assets
Vanguard Personal Advisor Services	\$101	0.30%	\$50,000
Charles Schwab	\$27	0 (fees for Schwab ETFs)	\$5,000
Betterment	\$13	Digital – 0.25%/year Premium – 0.40%/year	\$0
Wealthfront	\$10	0.25% (free for accounts of \$10,000 or less)	\$500

Source: Backend Benchmarking (2018).

Table 2.2. Selected Features of European Robo Advisers, 2018

Robo-Adviser	Available countries	Advisory Fee as % of AuM (does not include fee for investments in funds)	Account minimum	Investment Instruments
Nutmeg	United Kingdom	0.75% - 0.25% asset management fee on invested money 0.20% fund management fee on invested money (min £100/months for accounts below £5,000)	£500	ETFs
Quirion	Germany Switzerland	0.48% for asset management fee 0.39% fund management fee on invested money	€10,000	ETFs
Marie Quantier	France	5% on profits made Trading commissions from interactive brokers apply with a minimum of USD 10 per month	€5,000	ETFs
Ginmon	Germany	0.39% for asset management fee 10% on profits made 0.37% fund management fee	€5,000 or €1,000 with a reinvestment of €50 per month	ETFs
Wealth Horizon	United Kingdom	0.25% on invested money 0.75% for asset management fee on invested money 0.18% for fund management fee on invested money	£1,000	ETFs
Wealthify	United Kingdom	0.7% (under £10,000) to 0.5% (over £250,000) for asset management fee on invested money	£250	ETFs

Note: ETF refers to Exchange Traded Fund

Source: Authors' collection of data from robo-adviser websites (Robo Advisors Europe 2018).