

The Economics of Complex Decision Making: The Emergence of the Robo Adviser

Jill E. Fisch¹

University of Pennsylvania Law School – Institute for Law and Economics

Marion Laboure
Harvard University

John A. Turner
Pension Policy Center

August 2017

Abstract

Robo advisers are online services that use computer algorithms to provide financial advice and manage customers' investment portfolios. This chapter describes the development of the robo adviser industry in the United States and elsewhere and compares robo advisers to traditional human financial advisers. Robo advisers emerged in response to investors' need for financial advice and the high cost of obtaining that advice from human advisers. Pure robo advisers, with no direct human contact, are generally substantially less expensive than human advisers, and the use of computer algorithms allows for an increasing degree of personalization of this advice. At the same time, it is unclear that robo advisers provide customers with all the services offered by human advising and that, in particular, investors value human contact. In response to this issue, one of the recent developments is hybrid robo and human services that combine cost saving from a robo adviser with some human contact.

Key words: robo advisers, financial advice, fintech.

¹ We have received helpful comments and assistance from Olivia Mitchell, and from participants at the Behavioural Finance Working Group Conference at Queen Mary University in London and the International Pension Workshop at Dauphine University in Paris.

Introduction

The market for financial advice has changed dramatically in the past ten years with the emergence of robo advisers. Robo advisers are automated on-line services that use computer algorithms to provide financial advice and manage customers' investment portfolios. Two firms pioneered the use of robo advisers— Betterment and Wealthfront— and their approach has spread to a variety of financial services firms.

This paper describes the growth of the robo adviser industry and the services that robo advisers offer. It compares the services, quality and cost of advice provided by robo advisers to that offered by traditional human financial advisers. It also considers the potential for conflicts of interest to affect the provision of financial advice by both robo and human advisers.

Susan Axelrod (2017), the Executive Vice President for Regulatory Affairs at the Financial Industry Regulatory Authority (FINRA), has raised the following questions concerning robo advisers. '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?' This chapter offers a start at answering these questions.

Background on Financial Robo Advisers

What Do Financial Robo Advisers Do? Many people presumably find investing to be a complex problem. Complexity is a factor on both the demand and supply sides of the market for financial

assets. Financial markets have become more complex, with more types of investments available. Investing is complex because, in addition to understanding the financial markets and the array of available products, investor must evaluate risk, the effects of compounding, tax implications of investment alternatives and more. Some people may face additional challenges in making good investment decisions. Young people may have limited experience with the financial markets. Older people may have decreased cognition or a diminished ability to bear risk. In addition, a substantial fraction of the population, both in the United States and elsewhere, lacks basic financial literacy (Lusardi and Mitchell 2012). Investors with low financial literacy are particularly likely to make poor financial decisions (Fisch et al. 2016).

Financial advisers 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 (Glassman 2017). They may also provide ongoing portfolio management. These services assist customers with the complexity of investment decisions. In many cases, these services are customized to the needs of the customer. A financial adviser will consider a customer's existing wealth and income, financial goals, risk tolerance and tax status in developing and implementing an investment strategy.

Robo advisers provide financial advice to customers without human intervention. Robo advisers interact with their customers over the internet, obtaining customer information and then using computer algorithms to match that information to appropriate asset allocation models. The algorithms enable robo advisers to provide their customers with a portfolio that presumably meets their needs in terms of asset allocation and diversification. Robo advisers typically also manage that portfolio.

Financial robo advisers use quantifiable factors such as an investor's wealth, income, tax situation, investment goals, and risk tolerance to analyze a customer's financial status and to provide portfolio recommendations that are tailored to that customer's individual needs. They construct a portfolio that typically consists of low-cost ETFs or mutual funds. Robo advisers also manage their customers' portfolios on an ongoing basis -- they reinvest dividends, redemptions or interest payments, they rebalance the portfolio, and some harvest tax losses in taxable portfolios (Berger 2015). The primary marketing approach of robo advisers has been that they provide investors with an asset allocation appropriate to their needs and that they offer financial advice at a lower cost than traditional human advisers. An increasing number of robo advisers have entered the industry, and incumbents are starting to respond by offering similar services. Despite the growth in the number of robo advisers, the amount of assets migrating to automated advisory portfolios from human advisors is relatively low. Today, all types of robo advisers manage a combined total of more than \$100 billion in assets (Statista 2017). This represents a small fraction of the \$20 trillion of assets invested in the U.S. financial market. Nonetheless, experts expect the industry's growth to be substantial – fueled by the low cost of robo advisers coupled with the ease with which investors can access their services.

The advantages of robo advisers in terms of cost and access suggest a puzzle as to why more assets are not currently managed by robo advisers. One possible answer is that human advisers provide intangible services that robots cannot. This possibility has led, most recently, to the emergence of a hybrid model in which firms are pairing robo advisory services with access to a human adviser. We document this development and consider its potential implications for the investment advisory industry.

The amount of information obtained by robo advisers varies considerably. Some robo advisers collect a limited amount of customer information such as age, income and wealth. Others ask questions about investment horizon, risk tolerance, living expenses and financial goals.

Robo advisers operate in a variety of ways (Berger 2015). Some services require participants to transfer their money to the robo adviser's custodian, while others allow participants to keep their investments at well-known brokerages. While most robo advisers offer advice concerning taxable accounts and IRA retirement accounts, not all robo advisers offer advice concerning more complex account structures, such as SEP IRA accounts for the self-employed. Robo advisers also vary in the types of investments that they offer. Most limit investors to specific ETFs or mutual funds selected by that adviser; others offer more flexibility such as allowing customers to invest in individual stocks. Another difference among robo advisers is the range of advice that they offer. Many limit themselves to portfolio management, and do not address, for example, retirement planning, estate planning, or insurance issues.

Perhaps most importantly, because robo advisers each use their own algorithms, the investment advice that they provide can vary substantially. Reports have documented significant differences in the equity and fixed income allocations recommended by different robo advisers in response to a set of inputs (Finra 2016b). In practice, this means the choice of a robo adviser will subject an investor to substantial variation in the riskiness of his or her portfolio.

In some cases, the robo adviser will only provide advice with respect to the assets that it is managing; other robo advisers have the capacity to consider assets that are not under their management, such as an employer-sponsored 401(k) plan, in preparing an investment plan. In addition to asset allocation and diversification, robo advisers generally rebalance the client's portfolio, which is not always done by human financial advisers. For example, Wealthfront

rebalances its customers' portfolios by reinvesting dividends and new contributions in underweighted asset classes, so that no tax liability is generated in taxable accounts by selling assets to rebalance (Wealthfront 2017d). Some robo advisers also offer tax loss harvesting. Tax loss harvesting involves selling investments that have had losses to offset the taxes on investments with realized capital gains. Tax loss harvesting is relevant for taxable accounts but not for tax preferred pension accounts.

One type of robo adviser that has not received much attention is online advice programs provided to pension participants through their 401(k) plans. Reuter and Richardson (2017) investigate the use of online advice by participants in plans where TIAA is the sole record keeper. In 2012 and 2013, each year roughly 6.5 percent of participants in their research sample sought asset allocation advice using an online tool made available to TIAA participants. The demand for advice increased fourfold with the introduction of online advice tools.

Robo advisers entered the financial services market at the low-cost end of the fee spectrum, and they market themselves, at least in part, based on their fees. The fees charged by robo advisers vary, but are typically less than 50 basis points. They are almost uniformly calculated as a flat percentage of assets under management, although the percentage charged may vary depending on the size of the account. In addition to the advisory fee, customers of robo advisers pay fees associated with the underlying assets, such as the expense ratios and any applicable sales fees for mutual funds or ETFs. Robo advisers typically minimize these fees by offering their customers low-cost investment options.

How Are Robo Advisers regulated? The Securities and Exchange Commission (SEC) has the job of protecting U.S. investors in financial markets (SEC 2017). One way it does that is to regulate the services provided by Registered Investment Advisers (RIAs). Both human and robo financial

advisers must register under the Investment Advisers Act of 1940 as RIAs. They are subject to the substantive and fiduciary obligations imposed by that statute. RIAs have a fiduciary duty to provide advice that is in the best interest of their clients (Lazaroff 2016). In addition, if robo advisers hold customer assets, they must register with the SEC and FINRA as a broker-dealers. Currently Betterment holds customers assets and is a registered broker-dealer; 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 advisers and customers (Jordan 2012). In addition, many aspects of the fiduciary obligation may be undermined by disclosure and client consent. Under U.S. law, financial advisers are permitted to have a conflict of interest so long as they disclose the conflict to their clients. Studies have documented, however, that disclosure of conflicts of interest is not an effective way of protecting the interests of clients, both because of actions of the clients and because of actions of the advisers. Cain et al. (2005) in an experiment find that people generally do not take into the biases caused by conflicts of interest as much as they should. Some people may feel that the disclosure shows that the adviser is trustworthy, and thus disclosure of conflicts of interest may increase trust in the adviser. Some people may feel that it would be insulting to the adviser to indicate concern that the adviser is not acting in their best interests, even if they are concerned that might be the case.

One potential advantage of robo advisers is that the quality of their advice may be more transparent than for human financial advisers. While it is not possible to monitor the private conversations that financial advisers have with their clients, it is possible to evaluate the advice provided by computer models (GAO 2011). This greater transparency may lead robo advisers to adhere more closely to regulatory requirements than some human advisers.

In 2017, the Department of Labor's Fiduciary Rule went into effect, though its status is uncertain given the change in Administrations. That rule imposes a fiduciary duty on all financial professionals who provide advice about investing in retirement plans (U.S. Dept. of Labor 2016). The rule requires all financial advisers, whether they are broker-dealers or RIAs, to act in the best interest of the client when they provide financial advice about a retirement plan. In addition, the rule prohibits certain forms of compensation, such as commissions, unless the adviser complies with additional regulatory requirements known as the Best Interest Contract Exemption.

On February 23, 2017, the Securities and Exchange Commission Division of Investment Management released new regulatory compliance guidance for robo advisers (SEC 2017). The guidance observed that, in the SEC staff's view, the unique business model of the robo adviser raises concerns, and emphasized the obligation of robo advisers to address these concerns. The concerns identified by the SEC include the need for adequate disclosure about the robo adviser and the services it provides, the need to ensure that the robo adviser 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 adviser's services.

Evolution of the Robo Adviser Industry. The first robo advisers, Wealthfront and Betterment, began operations in 2008, but neither company really began providing financial advice to public investors until 2010. Wealthfront began as a mutual fund company, KaChing, and originally used human advisers, not robots, in furtherance of a business model that would provide 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 identified the potential that

computer software offered for making investment advice accessible to more people at a lower cost (Wealthfront 2017b).

Betterment founder Jon Stein sought to develop a method that automated the process of selecting and managing investments (Betterment 2017c). Although Betterment offers financial advice at a lower cost than traditional financial advisers, the key component of the Betterment strategy is to make investing simple for its clients.

In the past several years, a variety of other firms have begun to offer robo advisory services. A recent BlackRock study describes the launch of 22 new robo advisory firms in the U.S. in 2014 and 44 new firms in 2015. While the first robo advisers were stand-alone firms, with their growing popularity, various types of incumbent financial firms now provide robo advisers, including banks, broker-dealers, technology firms, and asset managers (BlackRock 2016).

The amount of assets managed by robo advisors has continued to grow. At the end of 2014, Corporate Insight reported that U.S. robo advisers managed \$19 billion in assets (Scott-Briggs 2016). That number had grown to \$126 billion in 2016 in the United States (Statista 2017). Robo advisers are expected to grow fast in the coming years, although estimates of that growth vary considerably from \$0.82 trillion in global assets under management (Statista 2017) in 2020, to \$2.2 trillion (KPMG) (Regan 2015) and \$8.1 trillion (BI Intelligence) (Kocianski 2016).

As of early 2017, the largest robo advisers in the United States (and worldwide) in terms of assets managed were Vanguard (\$47.0 billion), Charles Schwab (\$12.3 billion), Betterment (\$6.7 billion) and Wealthfront (\$4.3 billion) (etf.com 2017) (see Table 1). Other robo advisers include Future Advisor, Rebalance IRA, Acorns and SigFig, and new firms continue to enter the market.

Table 1. Selected top U.S. Robo Adviser by Assets Under Management, first quarter 2017

Robo Adviser	Assets Under Management (billion)	Advisory Fee as % of AuM (does not include fee for investments in funds)	Minimum Assets
Vanguard	\$47.0	0.30%	\$50,000
Charles Schwab	\$12.3	0 (fees for Schwab ETFs)	\$5,000
Betterment	\$6.7	0.35% under \$10,000 0.25% under \$100,000 0.15% over \$100,000	\$0
Wealthfront	\$4.3	0.25% (free for accounts of \$10,000 or less)	\$500
Personal Capital	\$2.8	0.89%	\$25,000

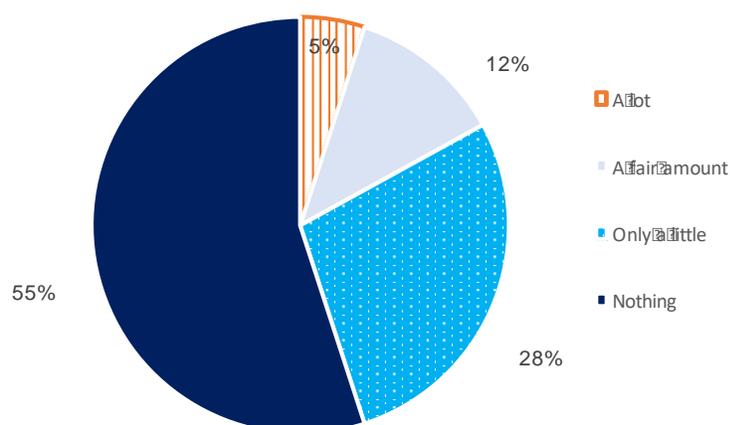
Sources: etf.com (2017), Bringing Transparency to Robo Investing (first quarter 2017), websites of the robo advisers.

Robo advisers have recently expanded the services that they provide to offer additional types of specialization. Shecapital was founded in 2015 to target the specific needs of women investors (Malito 2015). In 2016, Ellevest was started as a robo adviser catering to women. The premise is that because women have longer life expectancies than men, they need to have different portfolios from men the same age (Weisser 2016). True Link targets older investors and retirees (True Link 2017). Several robo advisers, including OpenInvest and Earthfolio, offer investors the opportunity to combine socially responsible investing with a robo platform (Skinner 2017). The fees of these specialized firms are higher than those of the original robo advisers.

Who Uses Robo Advisers? Although robo advisers have received a fair amount of attention in the media, they manage a limited amount of assets. Global assets under management for all types of advisers grew to \$69.1 trillion in 2016 (Global Asset Management 2017).

According to a 2016 Wells Fargo/Gallup study (Wells Fargo 2016), only 5 percent of U.S. investors are very familiar with robo advisers and have already invested with them, while 55 percent have never heard about robo advisers.

Figure 1: U.S. Investors' Familiarity With Robo Advisers



Source: Wells Fargo/Gallup Investor and Retirement Optimism Index survey. 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.

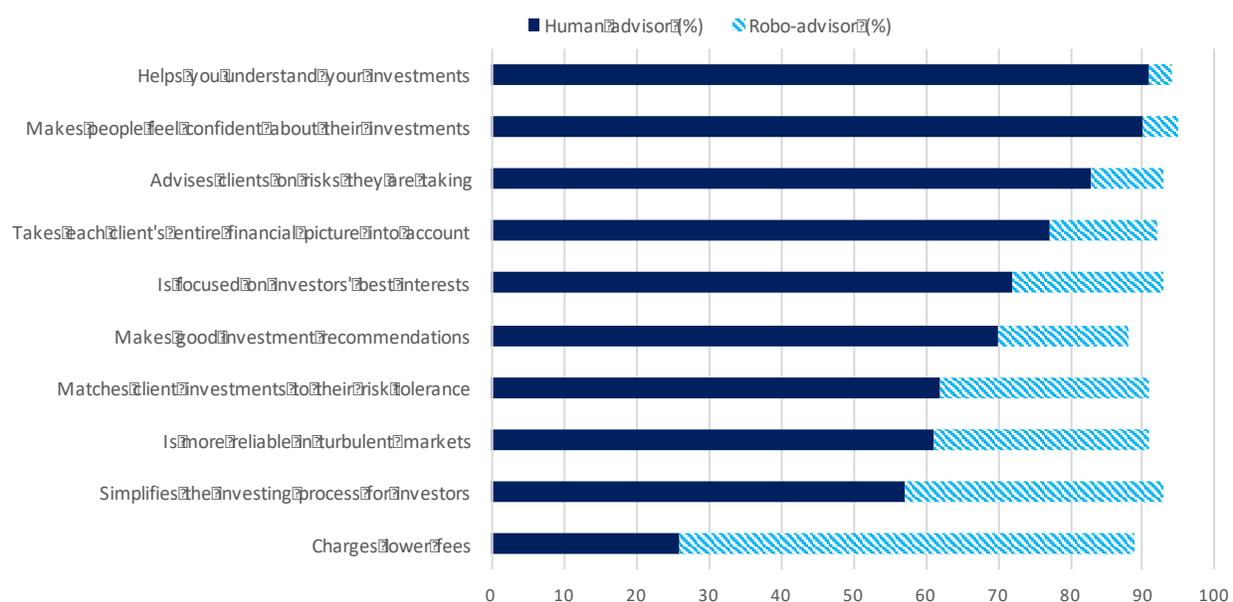
Part of the reason for the lack of familiarity with robo advisers is the relatively limited use of professional financial advisers. Only about a third of the U.S. population seeks financial advice (Collins 2012). Although researchers have documented widespread evidence of low financial literacy (Lusardi and Mitchell 2012), for which financial advice could be an effective substitute (Fisch et al. 2016), financial advice is not available to many people, either because they view it as too expensive or because they have too little assets to make it worthwhile for a financial adviser.

At the same time, more than half of individuals (56 percent) in the U.S. who have financial investments outside of pension plans consult with a financial adviser (FINRA 2016a). Kim et al. (2016) present a model for the demand for financial advice, considering the time cost of acquiring financial knowledge. The most important reasons people give for using a financial adviser are to improve investment performance and to help avoid losses. 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 have. Most of those who use an advisor (80 percent) 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).

According to a Gallup (2016) survey, more than 70 percent of U.S. investors believe that human advisers are better than robo-advisers to serve investors' best interests, make good investment recommendations, take each client's entire financial picture into account, advise clients on risks they are taking, make people feel confident about their investment, and help clients to understand their investments.

Figure 3: U.S. Investors' Perceptions of Human vs. Robo-Advice



Source: Gallup: 'Robo-Advice Still a Novelty for U.S. Investors.' July 27, 2016. Findings came from the Wells Fargo/Gallup Investor and Retirement Optimism Index survey. Based on investors who have heard about robo-advisers. Note: Investors were asked whether each statement applies more to robo-advisers or more to human advisers. 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.

Young people are more likely to use robo advisers than older people. A recent survey (FINRA 2016a) finds that 38 percent of individuals aged 18 to 34 in the U.S. with investments outside of a pension plan have used a robo adviser, compared to 4 percent of individuals ages 55+

with investments outside of a pension plan. Thus, the clients of robo advisers tend to be in their twenties and thirties.

Robo advisers are more popular with young people for several reasons. First, young people tend to be more comfortable with technology. Second, many young people have smaller amounts of assets to invest; as a result, they are often not suitable clients for traditional financial advisers (Stein 2016). Third, many young people lack experience with investing and turn to robo advisers out of a desire not to make financial mistakes. Finally, young people, particularly millennials, often distrust traditional wealth advisers and financial services firms.

Despite evidence showing that most customers of robo advisers are young people, millennials do not prefer robo advisers over face-to-face interactions. In fact, millennials as a group are more likely to seek advice in face to face meetings than either Gen X or baby boomers (Barnett 2015).

Robos versus Human Advisers

Fees and costs. Several features of robo advisers distinguish them from human advisers. The dominant feature is cost. Historically human financial advisers have charged fees ranging from 1-2 percent of assets under management, with larger portfolios tending to be charged lower fees (Ludwig 2017). Robo advisers typically charge fees that are substantially lower than those charged by human advisers. The cost of robo advisers ranges from free to 50 basis points or more in the United States. Betterment, for example, charges fees of 15 basis points for accounts with more than \$100,000, and 35 basis points for the smallest accounts. For an account of \$500,000 the annual cost of a traditional financial adviser charging 100 basis points would be \$5,000, versus the cost

of Betterment, which would be \$750. Wealthfront charges a flat fee of 25 basis points, with accounts of \$10,000 or less managed for free, and with a minimum account balance of \$500.

Robo advisers have the advantage of economies of scale in that one adviser (one computer algorithm) advises many clients. Thus, over time, as the robo advisers acquire more clients and their clients have more assets accumulated, their fees should fall even further. Their fees are lower because of the use of computer technology and algorithms, rather than expensive human interactions. The lower fees may make financial advice accessible to a larger market of people who would not be willing to pay the fees associated with human financial advisers. In addition, robo advice is less labor-intensive. Most robo advisers use passive, index-fund approaches (Lam 2016), while traditional financial advisers are more likely to recommend higher-fee actively managed approaches. Thus, robo advisers have not only less expensive advisory fees, they also spend less on trades, and less on mutual fund fees. For example, the fees on the investment options for Betterment clients range from 9 to 12 basis points (Betterment 2017a).

In addition, human advisers may have minimum assets requirements of \$500,000 or more, making them inaccessible to lower and middle-income customers (Ludwig 2017). In contrast, robo advisers offer far lower minimum account balances – Wealthfront, for example, requires a minimum balance of only \$500, and Betterment does not require any minimum balance. These lower minimums make robo advisers particularly well suited for young people just starting to save.

Convenience of Access. Robo advisers offer their customers convenience. The absence of a human component means that robo advisers are available at any time and from any location. For some customers, the procedure of providing information through a website platform is also more convenient than filling out paper documents or meeting with a human adviser. These features of robo advisers may be particularly appealing to a younger generation that is both comfortable

dealing with technology and prefers the freedom to handle their affairs at a time and location that is convenient for them.

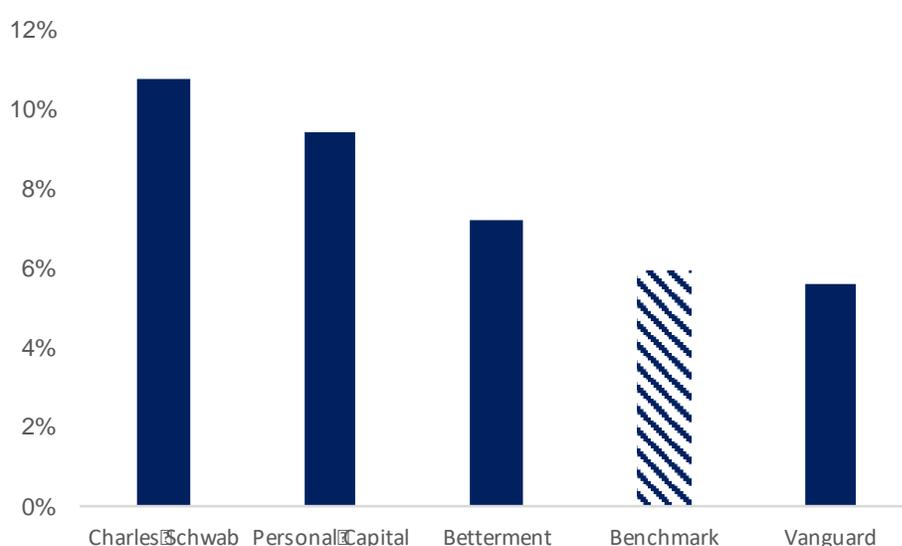
Warm Body Effect. One challenge in comparing robo advisers to humans is that it is difficult to capture objectively the potential value of consulting with a human adviser. Human advisers may be able to help their clients overcome limited financial literacy, understand and adjust their level of risk aversion and tolerate shocks such as market volatility. Whether robo advisers can provide these same services remains unclear. For example, one issue is whether robo advisers do less well than financial advisers in preventing clients from selling low and buying high.

Survey data indicate that people are more likely to seek advice from a person than from a company that provides advice solely online. Data from the EBRI 2017 Retirement Confidence Survey finds that 28 percent of pension participants surveyed indicated that they would obtain financial advice from an online provider, compared to 64 percent who would seek advice from an independent financial adviser (Greenwald et al. 2017).

Quality of Advice. Robo advice differs considerably across advisers, which suggests that the quality of advice may also differ considerably. Two main challenges arise in evaluating the quality of advice. The first is the adviser's choice of asset allocation. Historically, equity investments have outperformed fixed income. This is particularly true during the history of the robo advisory industry. Thus a particular adviser's performance is heavily influenced by the degree to which that adviser's recommended portfolio is concentrated in equities. For example, Cerulli compared the advice of seven robo advisers for a hypothetical 27-year old. It found that portfolio allocation to equities varied from 90 percent to 51 percent (FINRA 2016b). Market competition may lead robo advisers to over-concentrate in equities in order to report higher returns. This strategy may operate to the detriment of their customers in a market downturn. In 2016, the rates of return

earned by robo advisers Schwab (10.75 percent), Personal Capital (9.41 percent) Betterment (7.14 percent) outperformed a weighted average return of a benchmark made of 60 percent equity and 40 percent fixed income. Not surprisingly, most of robo advisers' asset allocations, who have performed better than the benchmark, had a higher weight of equity. For instance, Schwab, Personal Capital, and Betterment had respectively 94 percent, 94 percent and 87 percent of equity vs. 0, 3 percent and 13 percent of fixed income invested in Q1 2017.

Figure 3: 2016 Returns of Selected Robo Advisers vs. Benchmark



Sources: Bringing Transparency to Robo Investing (first quarter 2017), Treasury Direct, Investing. Note: Benchmark is calculated based on a 60% fixed income indices (U.S. 10-Year Bond Yield) and 40% Equity (S&P 500) weighted average return.

Of course, the differences in asset allocation can be overcome by evaluating returns on a risk-adjusted basis. This leads to the second challenge – does the robo adviser tailor the risk profile of its recommendations appropriately for its customer's individualized needs. Stein (2016) finds that robo advisers differ in their advice even when their questionnaires are answered in a standardized way. A similar result has been found for online retirement planning software (Rappaport and Turner 2010).

Kitces (2017a) critiques some robo adviser approaches that attempt to match people to portfolios using questionnaires. He notes that a person who has a lot of wealth, providing a capacity for bearing risk, but a low risk tolerance, in some approaches would be placed in a moderately risky portfolio because of their wealth. He argues that the scores in the areas of risk bearing capacity and risk tolerance should not be added together but should provide constraints. Thus, a person with a low risk tolerance or with a low capacity for bearing risk would be matched to a low-risk portfolio, regardless of whether they also had a high capacity for bearing risk or a high-risk tolerance, respectively. Thus, for example, a person with a high capacity for bearing risk but a low risk tolerance would be put in a low-risk portfolio. Similarly, a person with a low capacity for bearing risk but a high-risk tolerance would be put in a low-risk portfolio.

Porter (2016) argues, ‘Robo-advisors 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.’ However, one advantage that robo advisers have over target date funds is that they help the client pick a fund that is appropriate for their level of risk tolerance, not just their age (Fisch and Turner 2017).

Scope of Advice. One issue with robo advice is the extent of the total assets of the client for which the adviser is providing advice. When advising clients on portfolio allocation, not all robo advisers consider the client’s other investments, in particular their 401(k) investments (Weisser 2016). The robo adviser may not know about all the pension accounts the client may have, and may not consider the assets of the client’s spouse. However, similar issues apply for human financial advisers. For instance, when both spouses have their own assets, a human adviser will not necessarily know about the financial assets of the person’s spouse.

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

Human advisers may offer their customers a more personalized approach to the extent that they are not limited to standardized formats for collecting customer information. Of course, this depends critically on the degree to which human advisers collect information and tailor their advice as opposed to providing all their customers with a single standard. One Canadian study, for example, finds that financial advisers tend to ignore differences in risk preferences among their clients and to advise the same portfolio for all their clients (Foerster et al. 2016). That study finds that an adviser's own portfolio is a good predictor of the portfolio of his or her clients.

Regulatory requirements are somewhat vague as to the level of personalization required of a broker or financial adviser. 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, which 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) FINRA Rule 2111. 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 advisers that are not broker-dealers and that are regulated solely by the SEC.

The ability of human advisers to tailor their advice to a specific customer may not be an unqualified advantage. Human advisers may also be subject to potential bias based on the customer’s age, race or gender. One possible advantage of robo advisers is that they do not appear to be subject to this potential for bias.

Human advisers may also provide financial planning advice on a broader range of topics than robo advisers. For example, some human financial advisers provide advice on topics that include insurance or estate planning. The value of these services depends on investor needs. With the rise of federal estate tax thresholds, for example, human financial advisers have focused less on estate planning (Kitces 2017b). In addition, commentators have identified problems associated with human financial advice on these topics. Human advisers may disserve their clients by recommending costly or unnecessary insurance products. Human adviser may also be more likely to recommend a rollover from a relatively low-fee 401(k) plan to a higher-fee IRA.

In addition to charging higher advisory fees, financial advisers are more likely to recommend actively traded mutual funds, which thus also have higher management fees than the funds recommended by robo advisers, and have higher trading costs. In an efficient market such as that for large cap U.S. stocks, active management is unlikely to yield superior results, but it may yield superior results in less efficient markets, such as those in some foreign countries. Human advisers may also recommend 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.

Conflicts of Interest. One potential difference between robo advisers and human advisers is the possibility for conflicts of interest to affect the quality of financial advice. Human financial advisers have received extensive criticism for providing investment advice and recommending products because of conflicts of interest. (Council of Economic Advisers 2015). In particular, commentators have documented a variety of circumstances in which human adviser recommendations are based on the fee that the recommended investments provide to the adviser rather than the appropriateness of the investment for the customer.

Robo advisers appear less vulnerable to the potential for conflicts of interest for several reasons. First, to the extent that robo advisers are independent and do not sponsor or sell the investments that they recommend, their recommendations do not create a potential conflict. Second, most robo advisers 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 adviser. Third, because robo advisers compete based on fees, their fees are generally more transparent than for human financial advisers.

These differences depend on the structure and business model of the adviser in question. As Klass and Perelman (2016) explain, ‘Digital 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 advisers (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 advisers are affiliated with some of the ETFs that they recommend, and independent digital advisers reduce such conflicts even further.’

Similarly, as FINRA (2016b) notes, ‘Firm 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) argues that Schwab Intelligent Portfolios has a conflict of interest in that it holds an unusually large amount in cash, which it holds at Schwab Bank, where it profits on the difference between the rate of return the bank pays and the rate of return it receives on lending. He also notes that Schwab Intelligent Portfolios has higher expense ratios for the ETFs that it holds than does Betterment and Wealthfront because it holds only Schwab ETFs, which are higher fee ETFs than those held by Betterment and Wealthfront.

Robo Advisers Internationally

Although robo advisers began in the United States, the concept has spread elsewhere. In Europe, robo advisers are a relatively new concept. The number of robo advisors in Europe significantly rose since 2014. The amount of money robo advisers manage has grown rapidly (Table 2). Most of robo advisors operate at the national level (rather than internationally) due to legislative and regulations 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 advisers 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 advisers in the United States. However, robo advisers are rare in South America (3) and Africa (93) (Burnmark 2017).

Table 2. Selected European Robo Adviser, 2017

Robo Adviser	Available countries	Advisory Fee as % of AuM (does not include fee for investments in funds))	Minimum Assets	Investment Instruments
Nutmeg	UK	0.95%	£500	ETFs
Quirion	Germany Switzerland	0.48% – No Coach 0.88% – With Coach	€10,000	ETFs
Marie Quantier	France	€2.90-17.90 per quarter 5% of earnings	€5,000	ETFs
Ginmon	Germany	0.39% 10% of earnings	€1,000	ETFs
Wealth Horizon	United Kingdom	0.25% on initial deposit 0.75% for advisory 0.18% for fund charges	None	ETFs
Wealthify	United Kingdom	0.7% under £10,000 0.6% under £250,000 0.5% over £250,000	£250	ETFs

Sources: investin.com (2017), websites of the robo advisers. AuM stands for assets under management.

While it is difficult to generalize the European market, European robo advisers (e.g. Nutmeg, Quirion, Marie Quantier etc.) tend to charge higher fees than U.S. robo advisers--from 40 basis point to 100 basis points. The higher fees may be due, in part, to the fact that robo advisers are a very recent phenomenon in Europe. In addition, European financial and banking legislation is national, and as a result differs across countries, resulting in a national market for robo advisers rather than a centralized a European market. Also, European citizens may tend to be more risk

adverse than Americans, resulting in more saving and safer investments. These factors may have led European robo advisers to have a lower number of investors to date, reducing their ability to benefit from economies of scale.

Trends in Robo Advisers – the Move to Hybrids

In the past few years, financial advisory companies have begun to combine the features of robo advisers and traditional human advisers, creating a type of hybrid. The key features of the hybrid model is that hybrids charge lower fees than traditional advisers by automating part of the investment process, but still offer the possibility of talking with a financial adviser.

Some of the major traditional financial management companies, such as Vanguard and Schwab, have incorporated robo advisers into their business model, using the hybrid model. Vanguard's Personal Advisor Services charges 30 basis points and requires an account minimum of \$50,000, while Schwab Intelligent Advisory charges 28 basis points with an account minimum of \$25,000. It offers 'unlimited' contact with a Certified Financial Planner 24/7. Both involve contact with human advisers, so neither are pure robo advisers. Schwab Intelligent Advisory combines Schwab Intelligent Portfolios plus the availability of human advisers. It provides comprehensive financial planning services, not just portfolio management, which it implements with the Schwab robo model (Kitces 2016). Raymond James Financial has announced that its 7,100 advisers will have access to a robo adviser platform by the end of 2017. The advisers will use the platform as a tool for advising clients (Skinner 2017).

The stand-alone robo adviser movement is slowly declining in relative importance, as robo advisers are being acquired by other financial advice and management companies such as custodian and broker-dealer companies.

In 2017, T. Rowe Price began offering a robo adviser, ActivePlus Portfolios, reflecting its emphasis on active portfolio management. The adviser only selects T. Rowe Price funds, and it does so at no extra investment management charge. The robo adviser service is available to clients with at least \$50,000 in their T. Rowe Price portfolios that are managed by this program (Kitces 2017c). The program only manages money in IRAs, presumably so that there are no tax consequences associated with its trading. The fact that it only manages money invested in an IRA with a minimum of \$50,000 makes the service unavailable to most young people. The program offers a call-in center where participants can talk to an adviser, as well as online access to client managers. A website allows a client to see how the portfolio split between stocks and fixed income varies with changes in the input (T.Rowe Price 2017). For example, the program would recommend 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 would be advised to invest in a portfolio with 58.5 stocks and 41.5 percent fixed income.

In 2017, Wells Fargo began offering a robo adviser service. Its service requires a minimum investment of \$10,000. It is a hybrid service, offering the possibility of speaking to an adviser. It offers seven different portfolios, with a fee of 50 basis points, which includes the expense ratio for the investments and the fee for advice (Saacks 2017).

Most recently, the hybrid business model has spread to one of the original robo advisers. In 2017, Betterment opened a call center and began offering three levels of service. Betterment Digital is the classic robo advice offering with no account minimums, costing 25 basis points, which is the same fee as charged by Wealthfront. Betterment Plus requires a \$100,000 minimum balance and costs 40 basis points for an annual call from the 'team of CFP professionals and licensed financial experts.' Betterment Premium offers unlimited access to the advisers with an

account minimum of \$250,000 and a cost of 50 basis points. Customers looking for even more hands-on advice can be recommended to a dedicated financial adviser using Betterment for Advisors (Neal 2017). These changes are designed to attract wealthier clients than those typically using the basic robo adviser approach. In 2016, about a third of the assets that Betterment manages were owned by investors age 50 or older, who typically have larger portfolios than younger investors (Weisser 2016).

Conclusion

Robo advisers are computer algorithms that provide advice on investment portfolios and then manage those portfolios. This chapter introduces the concept of the robo adviser, explains how the industry has developed, and highlights key differences between robo and human financial advisers.

Whether robo advisers are better for investors than human advisers remains to be seen. Because of their relatively low fees and low minimum account balances, robo advisers can provide financial advice to people who cannot afford it from traditional financial advisers and for whom many financial advisers would not be willing to provide their services. For this group, robo advisers are clearly a better option than financial advisers. For young people starting out investing, a robo adviser can steer them away from poor investment decisions that would later result in taxes on realized capital gains when they sold those investments and replaced them with better choices.

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

Robo advisers are relatively new, and it is expected that over time they will improve in the sophistication with which they identify individual differences in risk preference, as well as other aspects of the advice they provide. To fully assess the relative merits of robo advisers versus financial advisers, more information on and experience with robo advisers 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 those clients grow older.

The intangible component of human contact is one service that robo advisers are unable to provide. The real or perceived value of this human contact appears to be an important difference between robo advisers and traditional financial advisers and likely explains the current trend toward hybrid advisers that involve a robo adviser working in partnership with a traditional adviser may be the best alternative. These hybrids charge lower fees than traditional advisers, but still offer the possibility of talking with a financial adviser and may constitute the future of the financial advisory industry,

References

- 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>
- Barnett, C. (2015). 'FinTech Trends: Wealth Management and the Rise of Robo Advisers,' *Forbes*, September 1. <https://www.forbes.com/sites/chancebarnett/2015/09/01/fintech-trends-wealth-management-and-the-rise-of-robo-advisors/2/#2207d7633740>

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>

_____ (2017). 'Online Investing Made Easy with Betterment (New Fee Structure + Bonus),'

DoughRoller, February 18. http://www.doughroller.net/investing/betterment-review/?utm_source=getresponse&utm_medium=email&utm_campaign=doughrollernewsletter&utm_content=What+to+do+if+you+get+audited%3B+All+about+Betterment+%28and+their+new+fees%29%3B+Household+debt+is+now+dangerously+high

Betterment (2017a). 'How is a Betterment IRA better than a typical 401(k)?'

https://www.betterment.com/401k-and-ira-rollover/?gclid=CjwKEAajwja_JBRD8idHpxaz0t3wSJAB4rXW55KvrzvjmvpQLWhL_4Hzz2De3RXD-tAsyx88We8XiBoC_zzw_wcB

_____ (2017b). 'What is Tax Loss Harvesting?' [https://www.betterment.com/tax-loss-](https://www.betterment.com/tax-loss-harvesting/)

[harvesting/](https://www.betterment.com/tax-loss-harvesting/)

----- (2017c). 'The History of Betterment: How We Started a Company That Changed an

[Industry' https://www.betterment.com/resources/inside-betterment/our-story/the-history-of-betterment/](https://www.betterment.com/resources/inside-betterment/our-story/the-history-of-betterment/)

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>

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>

- 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.
http://www.whitehouse.gov/sites/default/files/docs/cea_coi_report_final.pdf
- Financial Industry Regulatory Authority (FINRA) (2016a). 'Investors in the United States: 2016. December. http://gflec.org/wp-content/uploads/2017/02/NFCS_2015_Inv_Survey_Full_Report.pdf?x28148
- _____(2016b). 'Report on Digital Investment Advice,' March.
<https://www.finra.org/sites/default/files/digital-investment-advice-report.pdf>
- 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 T. Wilkinson-Ryan (2014). 'Why Do Retail Investors Make Costly Mistakes? An Experiment on Mutual Fund Choice, University of Pennsylvania Law Review, 162: 605-
- Fisch, J.E. and J.A. Turner (2017). 'Robo Target Date Funds: Greater Personalization of Default Investment Options,' Unpublished paper.
- Foerster, S., J.T. Linnainmaa, B.T. Melzer, and A. Previtro (2016). 'Retail Financial Advice: Does One Size Fit All?' *Journal of Finance* (forthcoming).
- 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, Barry (2017). 'What Does A Financial Advisor Do?' *Forbes*

<https://www.forbes.com/sites/advisor/2017/02/08/what-does-a-financial-advisor-do/#16bc5cb55499>

Global Asset Management (2017). 'The Innovator's Advantage', <http://image->

[src.bcg.com/Images/BCG-The-Innovators-Advantage-July-2017_tcm9-163905.pdf](http://image-src.bcg.com/Images/BCG-The-Innovators-Advantage-July-2017_tcm9-163905.pdf),

Government Accountability Office (GAO). 2011. 'Improved Regulation Could Better Protect Participants from Conflicts of Interest.' GAO-11-119.

<http://www.gao.gov/products/GAO-11-119>

Greenwald, Lisa, Copeland and Jack 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 Classiers as Wealthfront,'

<https://venturebeat.com/2010/10/19/kaching-wealthfront/>,

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-

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* 427-447.

Kitces, M. (2016). 'Is Schwab Intelligent Advisory a Threat to Independent Financial Advisors?'

The Nerd's Eye View, December 22.

- _____ (2017a). ‘Adopting a Two-Dimensional Risk-Tolerance Assessment Process,’ *The Nerd’s Eye View*, January 25. https://www.kitces.com/blog/tolerisk-aligning-risk-tolerance-and-risk-capacity-on-two-dimensions/?utm_source=Nerd%E2%80%99s+Eye+View+%7C+Kitces.com&utm_campaign=ec884c7469-NEV_MAILCHIMP_LIST&utm_medium=email&utm_term=0_4c81298299-ec884c7469-57149837
- _____ (2017b). ‘The Latest in Financial Advisor #FinTech (March 2017): Takeaways from the T3 Advisor Tech Conference.’ *The Nerd’s Eye View*, March 6. https://www.kitces.com/blog/latest-financial-advisor-fintech-march-2017-t3-advisor-technology-conference-takeaways/?utm_source=Nerd%E2%80%99s+Eye+View+%7C+Kitces.com&utm_campaign=7517eab51a-NEV_MAILCHIMP_LIST&utm_medium=email&utm_term=0_4c81298299-7517eab51a-57149837
- _____ (2017c). ‘Weekend Reading for Financial Planners (March 18-19).’ https://www.kitces.com/blog/weekend-reading-for-financial-planners-mar-18-19/?utm_source=Nerd%E2%80%99s+Eye+View+%7C+Kitces.com&utm_campaign=f54ca39efc-NEV_MAILCHIMP_LIST&utm_medium=email&utm_term=0_4c81298299-f54ca39efc-57149837
- Klass, J. L. and E. Perelman (2016). ‘The Evolution of Advice: Digital Investment Advisers as Fiduciaries.’ 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.’ *BusinessInside*, 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>

Lam, J.W. (2016). ‘Robo-Advisers: A Portfolio Management Perspective,’ 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

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 (2012). ‘Financial Literacy and Planning: Implications for Retirement Wellbeing,’ *Financial Literacy: Implications for Retirement Security and the Financial Marketplace*, 17-

Malito, A. (2015). ‘Newest Robo-Adviser Targets Female Investors,’ *InvestmentNews*.

<http://www.investmentnews.com/article/20150827/FREE/150829930/newest-robo-adviser-targets-female-investors>

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>

Rappaport, A.M. and J.A. Turner (2010). ‘How Does Retirement Planning Software Handle Postretirement Realities?’ in *Reorienting Retirement Risk Management*, edited by R. L. Clark and O.S. Mitchell, Oxford University Press, Oxford, England, 2010, 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*, April. TIAA Institute.

https://www.tiaainstitute.org/sites/default/files/presentations/2017-04/New%20Evidence%20on%20the%20Demand%20for%20Advice%20within%20Retirement%20Plans_Insights_April%202017.pdf

Saacks, B. (2017). ‘Wells Readies Robo Rollout (with Human Touch).’ *Ignites*, March 29.

http://ignites.com/c/1599943/186013/wells_readies_robo_rollout_with_human_touch?referrer_module=emailMorningNews&module_order=2&chhttps://www.tiaainstitute.org/sites/default/files/presentations/2017-04/New Evidence on the Demand for Advice within Retirement Plans_Insights_April 2017.pdfode=YldsMFkyaGxiRzlBZDJoaGNuUnZiaTUxY0dWdWJpNWxaSFVzSURJM01EQTVoaXdnTVRVMk1UTTRNall6Tnc9PQ

Scott-Briggs, A. (2016). ‘What is a Robo-Adviser, Origin and History.’ *TechBullion*.

<http://www.techbullion.com/robo-advisor-origin-history>

Securities and Exchange Commission (SEC) (2017a). Robo-Advisers, IM Guidance Update

<https://www.sec.gov/investment/im-guidance-2017-02.pdf>.

_____ (2017b). ‘What We Do.’ <http://www.sec.gov/about/whatwedo.shtml>

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>

_____ (2017b). ‘Robos Jumping into Socially Responsible Investing Space.’ *InvestmentNews*.

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

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>

SWF Institute (2015). ‘Everyone Wants a Robo-Advisor, Right?’ August 27.

<http://www.swfinstitute.org/swf-article/everyone-wants-a-robo-advisor-right-8461344/>

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>

Taulli, T. (2012). ‘Interview: Wealthfront CEO and Founder Andy Rachleff’

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

True Link (2017). ‘How It Works: True Link’s Investment Planning Process.’

<https://www.truelinkfinancial.com/how-it-works>

U.S. Dept. of Labor (2016). ‘Definition of the Term ‘Fiduciary’; Conflict of Interest Rule--

Retirement Investment Advice (Final Fiduciary Definition),’ 81 Fed. Reg. 20,946.

Wealthfront (2017a). ‘Let’s Get to Know You.’ <https://www.wealthfront.com/questions>

_____ (2017b). ‘Here's how it all started’, <https://www.wealthfront.com/origin>.

_____ (2017c). '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*, September.