Robo Advisers vs. Humans:

Which Make the Better Financial Advisers?

Jill E. Fisch

University of Pennsylvania Law School – Institute for Law and Economics

John A. Turner

Pension Policy Center

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In some areas where problems are complex and decisions may be affected by human emotions or cognitive biases, computers may make better decisions than people. Complexity can have two dimensions. A problem can be complex for each individual person (the intensive margin), and it can be complex because of differences across individuals (the extensive margin). When problems are complex at the intensive margin, people tend to seek the advice of experts. When problems are complex at both margins, the situation may be challenging even for experts. Computers may be better than humans in dealing with complexity, especially when both aspects occur at the same time, which is arguably the case for financial advice. Robo advisers are computer algorithms that provide advice on investment portfolios, and their fees are considerably lower than the fees of traditional financial advisers. This paper evaluates the cost and quality of robo advice compared to traditional advice. This paper uses the framework of complexity in financial advice to analyze whether traditional financial advisers or robo advisers do better in dealing with complexity in providing advice. It also assesses the extent that robo advisers are affected by the conflicts of interest that cause problems with the advice provided by traditional financial advisers. It argues that market competition relating to fees seems to reduce the effects of conflicts of interest for robo advisers, while that has not occurred for traditional advisers. Robo advisers can efficiently provide advice to people who would benefit from advice but who do not have sufficient assets to be attractive clients to financial advisers.

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In some areas where problems are complex and decisions may be affected by human emotions or cognitive biases, computers may make better decisions than people. While individuals are known to have behavioral biases that affect their investment decisions, such as becoming discouraged or fearful during a market downturn and selling stocks, their financial advisers have also been shown to have biases, some of them arising from conflicts of interest and some of them also arising from emotion or cognitive biases. A recent development in the market for financial advice is robo advisers, where computer algorithms advise clients as to their portfolios, based on information obtained through online questionnaires, and then manage the portfolios.

This paper compares the quality and cost of advice concerning investment portfolios provided by robo advisers versus human advisers. It argues that robo advisers should not be analyzed in isolation, but instead should be analyzed in comparison to financial advisers. It notes that robo advisers are able to expand the market for advice to people who are excluded from the market for financial advice because financial advisers want clients with relatively high amounts invested.

This paper first considers the issue of complexity in financial advice. It uses this framework to compare how well robo advisers and traditional financial advisers deal with this complexity. It surveys the literature concerning the quality of advice provided by financial advisers. It then provides background on the robo adviser industry. It discusses the quality of advice provided by robo advisers and compares that to the quality provided by financial advisers.

It discusses the effects of conflicts of interest on robo advisers compared to traditional financial advisers.

Complexity in Financial Advice

In some areas where problems are complex and decisions may be affected by human emotions or cognitive biases, computers may make better decisions than people. Complexity can have two basic dimensions. A problem can be complex for each individual person (the intensive margin), and it can be complex because of differences across individuals (the extensive margin). When problems are complex at the intensive margin, it is difficult for people to make decisions, and they tend to turn to experts for advice. When problems are complex on both margins, even experts may be challenged.

In addition, complexity can be a factor on both the demand and supply sides of the market for advice. Arguably, financial markets have become more complex, with more different types of investments available.

Computers may be better than humans in dealing with complexity, especially when both aspects of complexity occur at the same time. That is arguably the case for financial advice. Financial advice is complex for an individual in part because of changes over time as people age in the ability and willingness to bear risk, and in part because of the inherent complexity of structuring a well-diversified portfolio. Providing financial advice is a complex problem across individuals because of differences in whether a person participates in a defined benefit plan or in any pension plan, whether a person is married and has a spouse that works, and numerous other factors.

The number of steps involved in providing financial advice is an aspect of its complexity. The digital advice chain can be described as the following: customer profiling, asset allocation,

portfolio selection, executing trades, asset rebalancing, tax-loss harvesting, and portfolio analysis. The advice chain for traditional financial advisers could involve all the same elements, but typically does not involve asset rebalancing and tax-loss harvesting. Tax loss harvesting is the practice of strategically selling a security at a loss. By realizing a loss, investors are able to offset taxes on both realized capital gains and income. The sold security is replaced by a similar one, maintaining the optimal asset allocation (Betterment 2017). Tax loss harvesting is not an issue for investments in pension funds because of their tax preferenced status. In taxable accounts, it works better for investors who are buying and selling individual stocks than for investors who are investing in index funds.

The complexity C of the portfolio decision function from the perspective of a financial adviser begins with complexity in customer profiling. This complexity can be viewed as being affected by factors at both the intensive I and extensive E margins.

$$C = C(I,E)$$

Complexity can be measured by the dimensions of the problem, or the number of arguments in the portfolio decision complexity function. An individual making his or her own portfolio decisions is not concerned about the extensive margin, and only needs to understand his or her own situation as it relates to the portfolio decision. For example, an individual who is married and expects to remain married does not need to understand the implication for the portfolio decision of not being married, but a financial adviser would need to understand the implications of both situations when advising different clients.

The intensive factors include economic e and demographic d factors relating to the individuals willingness and ability to bear risk.

$$I = I(e,d) \qquad (1)$$

The extensive factors in customer profiling include individual economic and demographic factors that vary across individuals, which would include some but not all of the factors affecting complexity at the intensive margin.

$$E = E(e,d) \qquad (2)$$

For example, the availability for most people of Social Security benefits at age 62 could be a factor at the intensive margin, but not at the extensive margin since it is the same for everyone.

As well as there being complexity for financial advisers in customer profiling, complexity enters at other stages of the advice change, such as in the asset allocation and portfolio selection decisions. For the asset allocation decision A, the adviser takes into account the customer profiling in determing asset allocation, but also takes into account macroeconomic factors m, and market factors k.

$$A - A(I, m, k) \qquad (3)$$

This paper uses the framework of complexity in financial advice, focusing on complexity in customer profiling and how that maps into the asset allocation and portfolio selection decisions, to analyze whether traditional financial advisers or robo advisers do a better job in dealing with complexity in when providing advice.

Problems with Traditional Financial Advice

This section surveys the growing literature on problems with traditional financial advice relating to investments. Financial advisers may advise on other issues besides financial market investments, such as insurance or estate planning, or the amount the person needs to be saving for retirement. This paper does not consider those types of advice. It does not consider issues relating to the decumulation phase for people in pensions and saving for retirement.

Since the fees are lower for robo advisers than for financial advisers, financial advisers have a hurdle to overcome in terms of producing a net rate of return that is competitive with that of robo advisers. In part because of the growth of defined contribution pension plans, and the decline of defined benefit pension plans, the financial advice industry is a large industry. Thus, whether computers or humans provide better financial advice is a question with important implications.

More than half of individuals (56 percent) in the United States who have financial investments outside of pension plans consult with a financial adviser (FINRA 2016a). 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).

Financial advisers are generally regulated by a fiduciary standard to prevent them from taking advantage of the asymmetry between their financial knowledge and the lack of knowledge of their clients. Studies have documented the low level of financial literacy in the United States (Lusardi and Mitchell 2014).

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). RIAs have a fiduciary duty to provide advice that is in the best interest of their clients (Lazaroff 2016).

In the United States, financial advisers are permitted under SEC rules 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 that might be the case.

In addition, disclosure can increase the bias in advice because the adviser feels that after disclosure it is morally acceptable to provide biased advice. Thus, as a result disclosure may fail to solve the problems created by conflicts of advice and may sometimes make those problems even worse. The conclusion from the literature of the effects of disclosure of conflicts of interest is that eliminating the conflicts is a much more effective policy than disclosing them (Loewenstein et al. 2011).

Several studies find that financial advisers undermine the effect of disclosures through their verbal interactions with clients. When clients discover adverse information in disclosures, one study shows that advisers are often able to explain away that information (Choplin, Stark and Ahmad 2011). Another study shows that advisers are able to distract clients from important information in disclosures by talking about less important things (LeBouef, Choplin and Stark 2015).

The Council of Economic Advisers (CEA 2015) has quantified the cost of pension mis-selling by financial advisers in the United States, where pension participants in low-fee employer provided plans are advised to roll over into higher-fee individual account plans (Individual Retirement Accounts (IRAs)). It finds that conflicted advice costs participants in IRAs $17 billion a year. That amount includes not only excess fees but also lower investment returns compared to what investors would have received in net rates of return had they not been advised to roll their funds over to an IRA. A large amount of this loss, and the underlying reason for why it is occurring, relates to the higher fees earned by financial advisers.

Bad outcomes as a result of bad financial advice generally require a combination of three factors operating simultaneously. First, the pension participant has a low level of financial literacy—in particular, not understanding the importance of the difference in fees between different financial products. Second, the financial adviser has a conflict of interest in that the advice that yields him the most income is not the best advice for the pension participant. Third, the regulatory protections are weak or the enforcement of regulations is weak. All three factors are present in the U.S. market for financial advice.

The complexities in the current definitions of when an adviser is a fiduciary combined with the lack of uniform terminology, the variety of services an adviser may provide, and the many different professional designations have raised concerns that investors can be confused about the standard of care owed to them by their adviser. A study by the Government Accountability Office (US GAO 2011), an independent, government investigative agency that reports to Congress, of financial planners observed that when one individual or firm provides a variety of services, the standard of care may vary with the services. This is known as a "hat switching" problem (Turner and Muir 2013).

With "hat switching," an adviser sometimes acts as a Registered Investment Adviser (RIA) with a fiduciary duty, and sometimes acts as a broker-dealer, with a suitability duty, which is generally considered to be a lower standard. Broker-dealers are regulated by the Financial Industry Regulatory Authority (FINRA). Under the suitability standard, advice, rather than being in the best interest of the client, must merely be suitable for the client, given the client's age, income and assets, risk preferences, and other factors (Lazaroff 2016). For this and other reasons, it may be difficult for clients to determine what standard of regulatory protection, if any, applies to the advice they are receiving (Hung et al. 2008). For example, if the financial planner is purchasing securities for the client, the planner is wearing its broker-dealer "hat" and owes only a duty of suitability. When the planner provides advice under the Advisers Act definition of investment advice, the planner is wearing its Advisers Act "hat" and must act in the client's best interest (US GAO 2011).

Hauptman and Roper (2017) find that financial professionals employed by broker-dealers often advertise that they are "trusted advisers," but when taken to court argue instead they argue that they are sales people and thus do not have a fiduciary duty.

Fisch et al. (2016) find that while financial advisers do far better than their clients on a financial literacy exam, many financial advisers did not get a perfect score, with some doing substantially worse than others. Relating to the issue of fees, the study of 60 financial advisers finds that when given a selection of investment choices for constructing portfolio that included a high-fee and a low-fee index fund, 58 percent of the advisers invested in the high-fee fund. In addition, 37 percent of the financial advisers invested in a "closet" index fund that had basically the same portfolio as the index funds but purported to be actively managed and that charged higher fees. Also, 32 percent of financial advisers answered incorrectly in response to the

following statement, “Index fund performance can vary substantially depending on the expertise of the fund managers” (Fisch et al. 2016).

Mullainathan et al. (2012) in an audit study in the United States document a number of problems with the financial advice that financial advisers provide their clients (Mullainathan et al. 2012). They define “good advice” to include low cost. That study finds that advisers push for actively managed portfolios with high fees, even if clients start with well-diversified portfolios with low fees. That study finds that financial advisers tend to profit from investor errors. For example, some investors sell during downturns and buy during upturns, known as “chasing returns.” Counter to the supposition that advisers would attempt to prevent such behavior, they find that some advisers support that strategy, presumably because it increases their sales commissions, even though it results in worse outcomes for their clients. The study also finds that not all advisers are systematic in their advice, for example, being statistically less likely to ask women their age than men.

Because of conflicts of interest, recipients of advice may actually have worse outcomes than those not receiving advice. A study in Germany of bank customers who used a financial adviser compensated through commissions finds that the portfolios of those customers who used a financial adviser had lower rates of return net of costs (Hackenthal et al. 2011). Similarly, a U.S. study finds that mutual funds recommended by financial advisers underperformed other mutual funds on a risk-adjusted basis, taking into account fees (Bergstresser et al. 2009).

According to a survey by the Investor Protection Trust, about 20 percent of adults aged 65 or older in the United States report having ‘been taken advantage of financially in terms of an inappropriate investment, unreasonably high fees for financial services, or outright fraud’ (Infogroup/ORC 2010).

Christoffersen et al. (2013) find that load payments and revenue sharing arrangements bias the recommendations of financial advisers, leading to higher fees for the advisers and higher fees paid by the clients. Linnainmaa et al. (2015) find evidence of investment advisers engaging in active portfolio management and chasing returns, leading to worse outcomes for themselves and their clients. They characterize this as misguided beliefs of the investment advisers. They suggest that adverse selection affects who chooses to become a financial adviser, with people believing in active management, market timing and frequent trading being more likely than others to enter the profession.

Turner, Klein and Stein (2016) compare three choice models: rational economics, behavioral economics, and financial illiteracy with conflicted advice. They argue that financial illiteracy with conflicted advice best explains the situation of pension participants in low-fee 401(k)-type plans being advised to roll over to higher-fee Individual Retirement Accounts. In a small empirical study of advice concerning rollovers from a very low-fee 401(k)-type plan (fees of 3 basis points) to an IRA, they find that an adviser with a fiduciary duty was less likely to recommend rolling over from a very low fee plan, but that some still did make that recommendation, providing evidence as to the weakness of the fiduciary standard in the United States when it comes to protecting pension participants.

What are Robo Advisers

Attitudes toward technology are changing, especially among young people. With computers playing an increasingly important role in people's lives, people are becoming more comfortable interacting with computers in dealing with a wide range of economic activities, including personal finances. For example, it is common for people to be able to view their defined contribution pension account online, and to be able to change its asset allocation.

One of the biggest recent developments in investing is the growth of robo advisers. Robo advisers first were available in 2008, but didn't take off until 2011 (Wikipedia 2017). As well as being available in the United States, they are also available in Canada, the United Kingdom and other countries. The word "robo" is short for robot. Robo advisers use computer programs available on websites (not robots) to obtain information on clients and then to recommend and manage investment portfolios for them.

In an attempt to reduce the cost of financial advice, which often is 1 percent of assets under management (AUM), but can be as high as 2 percent, financial companies have looked to computer technology for lower cost options. FinTech is the term that has been coined for financial technology. Robo advisers are one aspect of FinTech.

The clients enter information online in response to a questionnaire, which is an information entry mechanism that is lower cost than having the adviser gather and enter the information. While robo advisers can be used by financial professionals to assist in their preparing advice for their clients, this paper focuses on robo advisers used directly by retail investors.

To our knowledge, the only previous academic investigations of robo advisers are Fein (2015) and Lam (2016). Fein (2015) judges robo advisers against an ideal standard, while Lam (2016), in the spirit of the current paper, compares them to traditional financial advisers.

A recent survey (FINRA 2016a) finds that 38 percent of individuals ages 18 to 34 in the United States 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. They are comfortable with technology and they have smaller amounts of investments that would not make them clients for many traditional

financial advisers (Stein 2016). Young people starting out with little saved will not be able to afford a financial adviser, and most financial advisers won't want them as clients because of the low fees generated by charging based on assets under management. For these people, robo advisers provide a good alternative. Once getting started with robo advisers, they may continue with them, partly out of inertia, and partly out of a familiarity with that approach.

Because of the use of computer technology and algorithms, rather than expensive human interactions, robo advisers charge considerably lower fees than do traditional financial advisers. The lower fees may make financial advice accessible to a larger market of people who would not be willing to pay the usual fee, averaging about 1 percent of assets per year, charged by traditional financial advisers. In addition to lower fees, robo advisers have lower minimum asset requirements than do traditional financial advisers. While some financial advisers require a minimum level of investible assets of $50,000, Wealthfront (a robo adviser) has a minimum of $500 and Betterment (a robo adviser) has no minimum, making robo advisers particularly well suited for young people just starting to save.

The amount of money managed by robo advisers has grown rapidly. In April 2014, they managed an estimated $11.5 billion, which had grown to $15.7 billion by July 2014 (Kane 2014). At least one estimate predicts that that rapid growth will continue and that robo advisers will be managing $2.2 trillion by 2020 (Regan 2015), though others estimate considerably smaller amounts.

Various types of businesses provide robo advisers, including banks, broker-dealers, technology firms, and asset managers (BlackRock 2016). As of February 2016, the largest robo advisers in the United States in terms of assets managed were Vanguard ($31.0 billion), Charles

Schwab ($5.3 billion), Betterment ($3.0 billion) and Wealthfront ($2.4 billion) (BlackRock 2016) (see Table 1).

Table 1. Robo Adviser Assets and Fees, 2016-17

Robo Adviser	Assets (billion)	Advisory Fee (bps) (does not include fee for investments)	Asset Minimum
Vanguard	$31.0	30	$50,000
Charles Schwab	$5.3	0 (fees for Schwab ETFs)	$5,000
Betterment	$3.0	25	$0
Wealthfront	$2.4	25 (free for accounts of $10,000 or less)	$500

Sources: Blackrock (2016), websites of the robo advisers

Comparing Robo Advisers to the Alternatives

While robo advisers clearly are an alternative to human advisers, the role of robo advisers can perhaps be better understood by comparing them to other substitutes or alternatives. Robo advisers can be viewed as a substitute or partial substitute for financial education. Instead of trying to help their workers make good decisions about their 401(k) plan by providing financial education, employers can help them by providing robo advisers to assist them in making pension decisions.

Target date funds are designed to help workers make good pension decisions. A robo adviser can go a step further because target date funds place everyone with the same retirement

date in the same fund. A robo adviser can provide advice so that a person with greater risk tolerance would be placed in a risker fund, which would be a fund with a later target date.

Different Management Structures

Key differences among robo advisers include the following (Berger 2015):

- **Custody**: Some services require participants to transfer their money to their custodian, while others allow participants to keep their investments at well-known brokerages;
- **Account Types**: While all offer taxable accounts and IRA retirement accounts, they don't all offer SEP IRA accounts for the self-employed;
- **Investments**: Some limit investors to the ETFs selected by the service, while others offer more flexibility;
- **Taxes**: Some services offer sophisticated tax loss harvesting features, while others do not; and
- **Stocks**: Some services allow participants to invest in individual stocks, although most do not.

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. Also, robo advisers differ as to whether they manage the client's money or simply advise as to how it should be managed.

Fees

The cost of robo advisers ranges from free to 50 basis points or more. 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. Thus, Wealthfront provides a simple, transparent fee structure.

The widespread assumption is that robo advisers would force human advisers to lower their fees in order to compete, but instead Betterment has raised its fees and offered more human interaction.

What Do Robo Advisers Do?

While financial advisers may use computer programs to assist them in recommending and managing portfolios, robo advisers go a step further, with no human intervention. Robo advisers have automated the process of matching investor goals and risk tolerance to appropriate asset allocation models.

Robo advisers, also called digital advisers, use computer algorithms to help investors manage their risk preferences, diversification, tax planning and other issues in meeting their investment goals. They construct a portfolio, typically of low-cost ETFs, they reinvest dividends, they rebalance the portfolio, and they harvest tax losses (Berger 2015).

Robo advisers tend to provide advice on goal-based investing—saving for purchasing a house, saving for college education, and saving for retirement. With this type of focused saving, the adviser does not need to know all the assets of the individual, but only the assets relevant to the particular goal. Thus, this focus means that the information about the individual the adviser needs to collect is limited to the information relevant to the goal of their saving (Klass and Perelman 2016).

In the United States, robo advisers must be Registered Investment Advisers (RIAs), which are regulated by the Securities and Exchange Commission (SEC). Robo advisers in the

United States must register under the Investment Advisers Act of 1940 and thus have a fiduciary duty to their clients.

Robo advisers offer several financial advantages compared to traditional investment advisers. Robo advisers tend to invest passively, compared to financial advisers, who tend to recommend active investments. Most robo advisers use passive, index-fund approaches, while some use active investment management approaches (Lam 2016). Thus, robo advisers have not only less expensive advisory fees, they also spend less on trades, and less on mutual fund fees. Robo advisers offer tax loss harvesting, which is not available to most investors, but only for high net-worth investors. Tax loss harvesting is relevant for taxable accounts but not for tax preferenced pension accounts. Robo advisers tend to provide different advice for taxable and tax-preferenced accounts, which is not always the case for financial advisers. 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.

Robo advisers generally automatically rebalance the client's portfolio, which is often not done by financial advisers. Wealthfront does this by reinvesting dividends and new contributions in underweighted asset classes, so that no tax liability is generated by selling assets to rebalance. Robo advisers are more convenient to use because they can be accessed at any time from any place. Robo advisers are more likely than financial advisers to use target date fund approaches where the client's portfolio becomes more conservative as the client approaches retirement. Robo advisers are less likely to be affected by behavioral biases than financial advisers. The advice of robo advisers is generally more transparent than the advice of financial advisers. With

robo advisers, the advice is not just from one person, but rather reflects the collective wisdom of the company.

An issue is whether robo advisers do less well than financial advisers in preventing clients from selling low and buying high. Some evidence, including a study discussed earlier concerning financial advisers (Mullainathan et al 2012), suggests that they do. A further issue is concern about cyber security, but so far, at least, that has not arisen as an actual problem for robo advisers.

An established investor who wishes to start using either a robo adviser or a traditional financial adviser would generally be expected to sell at least some of their holdings to conform with the plan of the advisor. Doing so, however, would result in a tax liability for realized capital gains. Wealthfront has a program to manage such sales over time to minimize the tax liability.

Complexity in Investor Profiling

Robo advisers use quantifiable factors such as an investor's wealth, income, tax situation and investment goals to provide portfolio recommendations that are keyed to that investor's individual needs. Robo advisers minimize the cost of this personalization by having their clients enter the information online and then provide an algorithmically designed portfolio.

A key issue with robo advisers is how well they are able to deal with the complexity that arises due to differences across individuals. FINRA (2016b) finds that most robo advisers have between five and eight investor profiles, though some advisers have considerably more. FINRA (2016b) 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."

By comparison, a study using Canadian data 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.

FINRA (2016b) notes that "When making a recommendation, FINRA Rule 2111 (Suitability) requires a broker-dealer to 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." 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." Thus, these are aspects of information about a client that a financial adviser and a robo adviser should obtain. However, these specific rules do not apply to financial advisers regulated by the SEC. For that reason, Fein (2015) argues that the fiduciary standard is weak, and it is difficult to determine in practice whether the suitability standard or the fiduciary standard provides greater protection to investors. Though both financial advisers and robo advisers are generally governed by the fiduciary standard, the study by Mullainathan et al. (2012) indicates that financial advisers are systematically less likely to ask women their age than men, robo advisers do not have such gender biases.

Robo Advice

An issue with robo advice is the extent of the total assets of the client for which the adviser is providing advice. For example, does the adviser know about all the pension accounts

the client may have, and does the adviser take into account the assets of the client's spouse? However, similar issues apply for financial advisers, with a financial adviser for a person where both spouses have their own assets not necessarily knowing about the financial assets of the person's spouse.

Robo advice differs considerably across different advisers. Cerulli compared the advice of seven robo advisers for a hypothetical 27-year old. It found that recommended portfolio allocation to equities varied from 90 percent to 51 percent (FINRA 2016b). 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).

Betterment for Business is one robo adviser that is specifically designed to provide advice to participants in 401(k) plans (Lam 2016). However, Wealthfront also provides advice concerning the investment of IRAs and 401(k) plans.

Quality of Advice

Robo advisers differ in terms of the quality of advice they provide. They differ as to the degree of customization of the advice they provide.

FINRA (2016b) notes, "applying a tax-loss harvesting algorithm to one account of a married client where both spouses have multiple investment accounts may be detrimental. Without a full view of the couple's portfolio, the algorithm may generate unusable realized losses."

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).

Robo advisers generally determine the investor's time horizon, with the portfolios they manage following a glide path toward a more conservative asset mix, similarly to target date funds. Wealthfront allows investors to specify different time frames for different purposes—retirement, saving for a new home, or saving for a child's education.

Conflicts of Interest

Conflicts of interest have been documented to have an adverse effect on the quality of advice provided by financial advisers. One reason that may occur is that clients of financial advisers tend not to shop around for low-fee financial advice, and thus competition in the market for clients of advice is not based on fees but instead on perceptions as to the quality of the advice.

This section argues that because robo advisers compete based on fees, and because some

of them do not offer investment products, they are less likely than financial advisers to be affected by conflicts of interest that would result in them charging higher fees. This section addresses the effects of conflicts of interest on robo advisers.

One reason why robo advisers have fewer conflicts of interest than traditional advisers relates to the way they are marketed. Traditional advisers generally have a financial incentive to attract clients. While robo advisers have the same incentive, their actions are completely transparent, while those of traditional advisers generally are directly between the adviser and the client, with little to no outside monitoring.

Klass and Perelman (2016) writes, "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."

The presence of conflicts of interest may also be reduced by the greater degree of transparency of robo advisers relative to traditional financial advisers. One element of transparency is greater transparency in fees, which can be easily found online. Typically, it is more difficult to find the fees of financial advisers. Transparency extends beyond that, however, with robo advisers providing a lot of information online concerning their approach.

Conflicts of interest may, however, affect the quality of advice provided by some robo advisers. FINRA (2016b) notes that "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.

Many robo advisers permit clients to select a portfolio that differs from the one recommended by the robo adviser. This raises the question of whether robo advisers will advise their clients against what appear to be bad choices, based on the information the client has provided the client.

New Developments--Hybrids

Some companies combine features of robo advisers and traditional human advisers, and thus are hybrids. In addition, some of the major traditional financial management companies such as Vanguard and Schwab, have incorporated robo advisers into their business model as one type of service they offer. Vanguard's Personal Advisor Services charges 30 basis points and an account minimum of $50,000, while Schwab Intelligent Advisory charges 28 basis points with an account minimum of $25,000. It offers 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 Shwab robo model (Kitces 2016).

In 2017, Betterment opened a call center and announced that it would offer 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.

For some people, the hybrids may be the best alternative. They charge lower fees than traditional advisers, but they still offer the possibility of talking with a financial adviser.

The robo adviser industry continues to evolve. Robo advisers can be distribution channels for proprietary ETFs of the adviser. The stand-alone robo adviser movement is slowly ending, as robo advisers are being acquired by other financial advice and management companies such as custodian and broker-dealer companies. 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).

A recent development is the increase in the number of companies providing software that focuses on identifying a person's level of risk tolerance (Kitces 2017b). Thus, it is likely that robo advisers will become more sophisticated at identifying individual risk preference. The two leading companies in 2017 in terms of market share are FinaMetrica and Riskalyze.

Summary: Comparison of Financial Advisers and Robo Advisers

Financial advisers have substantially higher fees than robo advisers. It is sometimes argued that the higher fees are justified by collateral advantages they offer in that to some extent financial advisers provide advice on a broader range of topics, such as insurance or estate

planning. With the rise of federal estate tax thresholds, financial advisers have focused less on estate planning (Kitces 2017b). However, financial advisers also have collateral disadvantages, such as being 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. Thus, for clients for whom they provide advice that is at least equally valuable to that provided by financial advisers, robo advisers would be preferable because of their lower fees.

To some extent, robo advisers and financial advisers are targeting different markets. For young people, who are the main clients of robo advisers, robo advisers seem to be superior to financial advisers. Robo advisers will provide advice to clients with small account balances, which often financial advisers will not do.

Robo advisers, however, have advantages for all investors, except perhaps very high-end investors who engage in more sophisticated investment strategies than do typical investors. Robo advisers are more convenient than financial advisers since robo advisers can be interacted with at any time and from any place. Robo advisers are less likely to be biased due to conflicts of interest than are financial advisers. Thus, they are not likely to engage in excess trading, as some financial advisers do. Robo advisers generally do a better job of providing individualized advice than do financial advisers, who tend to ignore individual differences. They are less likely to have gender biases. They are more likely to provide recommendations that are personalized to the individual's risk tolerance than are financial advisers. They are more likely to distinguish in their

advice between taxable and tax-preferenced accounts. They are more likely to adjust the client's portfolio risk as retirement approaches than are financial advisers.

Conclusions

This paper uses the framework of complexity in financial advice and the issue of differential effects of conflicts of interest to analyze whether traditional financial advisers or robo advisers do a better job in dealing with complexity in determining advice. While some analysts have criticized robo advisers, this paper argues that the correct analytic approach is to compare robo advisers to traditional advisers. This paper compares the cost and quality of advice provided by robo advisers to that provided by financial advisers. Of course, there is variation in both cost and quality among both robo advisers and financial advisers. This paper compares the range of costs of the two sources of advice and discusses the strengths and weaknesses of both approaches. The paper surveys the growing literature as to problems with traditional financial advice, including problems caused by conflicts of interest, by adviser emotion, and by adviser biases, including gender biases. It compares that analysis with an analysis of robo advisers.

Because of their relatively low fees and low minimum account balances robo advisers are able to provide financial advice to people who couldn't afford it and for whom financial advisers would not be willing to provide their services. For this group, robo advisers are clearly better than financial advisers.

In terms of complexity, this paper argues that robo advisers do a better job of taking into account individual differences in risk preference and the ability to bear risk than do financial advisers. It argues that robo advisers are more likely to take into account differences between taxable and tax preferenced accounts. Robo advisers are more likely to take into account the time horizon of the individual. Robo advisers are more likely to engage in tax harvesting and are more

likely to rebalance the individual's portfolio. Robo advisers are more likely to provide well diversified portfolios.

In addition, perhaps because of greater competition based on fees, robo advisers are less likely to engage in costly behavior motivated by conflicts of interest. Some advisers engage in excessive trading because that generates fees. Some advisers do not put their clients in low-fee investment options. Some advisers charge relatively high advisory fees. Some advisers recommend rollovers of low-fee 401(k) plans to higher-fee IRAs. However, robo advisers are to some extent affected by the incentives that create conflicts of interest for traditional financial advisers, and at least one robo adviser has recommended rollovers to higher-fee IRAs.

Also, robo advisers are less likely to be affected by biases, such as gender biases, or possibly by other demographically based biases, that are known to affect the way that humans interact. They are less likely to have idiosyncratic biases that individual financial advisers may have.

Robo advisers have lower fees than do financial advisers. They are more likely to invest in low-fee index funds, and thus invest in lower-fee investments with lower trading costs.

For some people, the hybrids involving a robo adviser working in partnership with a traditional adviser may be the best alternative. They charge lower fees than traditional advisers, but they still offer the possibility of talking with a financial adviser.

Some critics may argue that the decision as to whether robo advisers are better than human advisers is one that should be left to individuals making decisions in the market. While the decision is up to the individuals, behavioral economics has demonstrated that individuals make systematic mistakes, so that the observation of choices made in the market does not necessarily equate with which adviser would be best for individuals with different circumstances.

The robo advisers are relatively new, and it is to be expected that they will make improvements over time 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. More research on both robo advisers and financial advisers will possibly shed light on their relative merits. 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.

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