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AUTOMATION

To robo or not to robo: The rise of automated financial advice

THOMAS H. DAVENPORT

AUTOMATION

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ABSTRACT

Many financial firms are now providing online and somewhat automated investing and financial advice to their customers. These “robo-advisors,” some of which include roles for human advisors, are growing rapidly and generally charge lower fees than human advisors. The history, key functions and processes, and likely future directions for automated financial advice are described. Implications for human financial advisors are also discussed.

1. INTRODUCTION

The provision of financial advice to consumers is increasingly being automated. Instead of a conversation with a financial planner, investment advisor, or broker, many consumers are increasingly receiving digitally-based recommendations that are personalized to the individual. In many cases, the recommendations are implemented automatically. These investment recommendations, financial and wealth management plans, and operational financial alerts are now commonly dispensed to middle-net-worth individuals and families, from the millennial generation to baby boomers.

What does this approach mean over the longer term for the financial services industry? What changes may take place as machines grow increasingly more intelligent, and as increasing amounts of online data about personal finance becomes available? What does it all portend for human financial advisors? I will address these and other issues about automated financial advice later in this article.

These systems are often referred to as “robo-advisors,” although the term is often reviled within financial firms. This is sometimes because the firms are employing hybrid human/machine solutions (discussed below), or perhaps the term “robotic” suggests overly structured and simplistic advice. In any case, I will refer to the field as “automated financial advice,” even though in many cases it is only partially automated.

Many firms have adopted some form of this digital, automated, or semi-automated advice for investing or wealth management. Startups like Personal Capital, Betterment, and Wealthfront offer primarily online offerings. “Self-directed” investing firms like Vanguard, Fidelity, and Charles Schwab have had them in place for several years. Brokers including Morgan Stanley and Merrill Lynch have recently announced an advisor-mediated system. Traditional banks like JP Morgan Chase, Wells Fargo, Bank of Montreal, and HSBC have rolled out or announced robo-advisors. And even high-end wealth managers like UBS and Goldman Sachs have some form of automated offering.

However one refers to the concept, automated financial advice is growing rapidly. A Deloitte study [Srinivas and Gordia (2015)] estimates that assets under automated management in the U.S. may grow to U.S.\$5 trillion to U.S.\$7 trillion by the year 2025 from about U.S.\$300 billion today. This would represent between 10% and

15% of retail financial assets under management. At the end of 2016, Fitch Ratings estimated that all robo-advisors managed under U.S.\$100B in assets, and predicts double-digit growth in assets under management over the next several years [Reuters (2017)]. One consulting firm, A.T. Kearney, predicted that assets under “robo-management” would total U.S.\$2.2 trillion by 2021 [Epperson et al (2015)]. The prediction was based on a study of consumers, many of whom expressed interest in automated financial advice.

These predictions suggest that while traditional human advice isn't going away, any firm interested in wealth management cannot afford to ignore automated advice.

“Assets under automated management in the U.S. may grow to U.S.\$5 trillion to U.S.\$7 trillion by the year 2025 from about U.S.\$300 billion today. This would represent between 10% and 15% of retail financial assets under management.”

[Srinivas and Gordia (2015)]

2. THE CONTEXT FOR FINANCIAL ADVICE

A number of trends have converged to make automated investing advice possible. Demographic trends in many wealthy nations suggest aging populations with increasing longevity, which creates anxiety about outliving resources in retirement. In the U.S. and several other countries, the move away from corporate pensions means that employees are responsible for their own investment decisions. As investment options become more numerous and complex, individual investors need more help in making decisions, but many cannot afford to pay a human advisor.

In the investment landscape, an important trend favoring automated advice is the move to passive investing. When clients invest in index funds and ETFs, it is much easier to construct portfolio recommendations. Since 2010, money has flowed strongly into passive investments more than active; in most years active flows were negative or flat. In addition, the majority of active firms have lagged behind their chosen benchmarks in investment performance over the last decade [Ellis (2017)].

Another key trend favoring automated advice is that information about financial markets and products

has exploded. Much of it is available for free or at significantly lower prices than Bloomberg, for example, which charges for a terminal [Weil (2017)]. This makes it both more difficult for any investor to gain an edge in price discovery, and makes the use of computers and algorithms more important to digest all the information.

The great majority – more than 90% – of active trading in stock markets is by institutions and professionals. Individual investors have a number of disadvantages in competition with them, one of which is the extensive use of analytics and algorithms as the basis for trading. Even the most sophisticated asset management in hedge funds is increasingly driven by algorithms. Hedge funds that use algorithms for trading already account for almost a third of the industry's assets, according to Hedge Fund Research, Inc., and quantitative hedge funds have outperformed other types over the last 25 years [Mackintosh (2017)]. Since amateur investors are unlikely to be able to compete effectively with such analytical prowess, they are probably more likely to turn their money over to professional advisors (machine or human-based) or investment firms.

Regulatory factors are also helping to drive automated advice. Fiduciary requirements for retirement-oriented financial advisors are now in place in the U.S., which may lead investment and wealth management firms to put algorithms and automated rules in place to ensure advice in the client's best interest [Fuller and Patrie (2017)]. While there is some doubt that a fully automated system can be classified as a fiduciary, most observers believe that a hybrid human/machine advisor can be [Tergensen (2017)]. In the U.K., automated advice has been given impetus as a means to provide low-cost and customized investment advice by the Financial Conduct Authority's Retail Distribution Review [Europe Economics (2014)]. A review of financial and investment regulation by asset management firm BlackRock suggests that most jurisdictions that have commented on automated or digital advice have been positive or neutral on the concept [Novick et al. (2016)].

3. TECHNOLOGICAL PRECURSORS OF AUTOMATED ADVICE

Several precursor technological components of automated financial advice have been developed over the past couple of decades. William Sharpe, a Nobel Prize winner in economics, developed the first automated financial advisor in 1996 and co-founded the firm Financial Engines [ThinkAdvisor (2015)]. The company

primarily serves workplace retirement programs and employs Monte Carlo simulation to calculate the probability that an investment portfolio will meet financial objectives given many different market outcomes over the next 30 years. Several other firms have adopted the Sharpe simulation approach in their own automated advice systems.

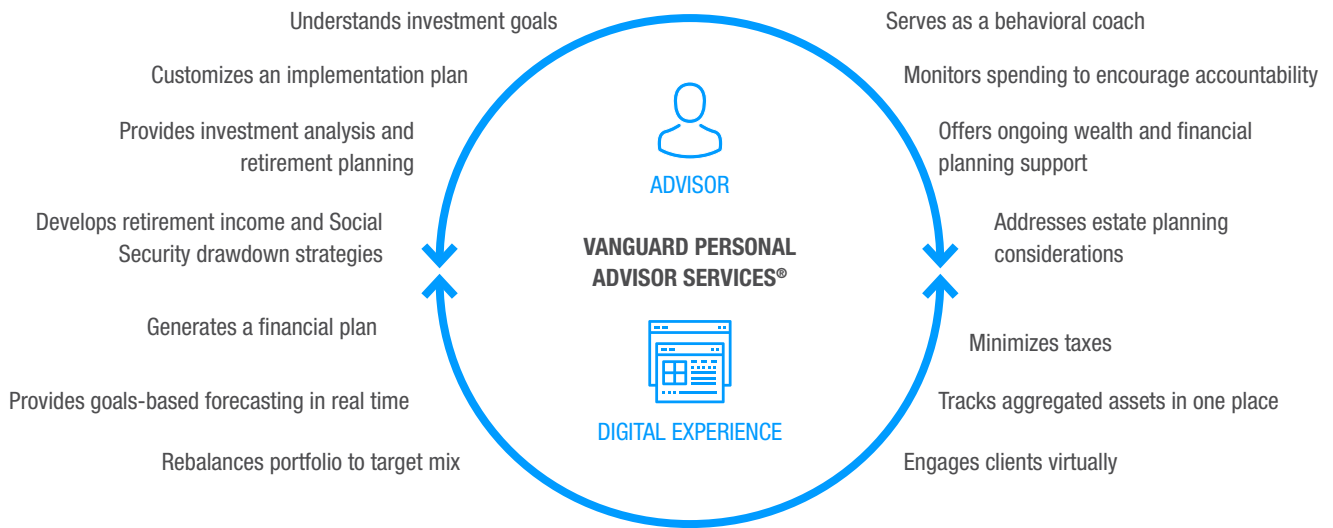
Account aggregation is another key component of automated advice. Many investors have accounts at multiple different financial institutions. Account aggregation allows all accounts to be viewed in one place, and enables advice based on investments across all accounts. VerticalOne and Yodlee (now merged and part of Envestnet) pioneered this approach in 1999 [Fujii et al. (2002)], and now many investment and wealth management firms offer Yodlee's account aggregation capabilities or their internal capabilities.

Automated advice also relies in part on large-scale econometric market models that estimate likely future returns from different asset classes. Most automated advice systems have such a model at their core. Vanguard, for example, says that many of its automated recommendations are based on its Vanguard Capital Markets Model [Kolimago (2017)]. Such models take into account factors like macroeconomic conditions, tax rates, and past returns by asset class.

Modern visual analytics play an important role in automated advice. Since many users of the systems are relatively unsophisticated investors, simple graphic displays are often ideal for that audience. Bar charts, pie charts, line charts, and the like abound. Most automated advice systems issue graphic-intensive quarterly and annual reports.

Finally, while traditional analytical models are widely used in automated advice, some financial firms are beginning to use artificial intelligence as well, and machine learning in particular. Morgan Stanley notes that its "Next Best Action" investment recommendation system is based on machine learning models that match investment opportunities to clients [Davenport and Bean (2017)]. Adam Nash, the CEO of Wealthfront, commented in a blog post [Nash (2016)] that the company's recommendations would increasingly include artificial intelligence capabilities, particularly with regard to actual spending, saving, and investing behaviors by customers: "We're firm believers that artificial intelligence applied to your actual behavior will provide far more powerful advice than what traditional advisors offer today. The reason is quite simple: actions speak louder than words.

Figure 1: Advisor versus machine tasks in Vanguard's Personal Advisor Services



Observed behavior can't be fudged on the phone or lied about in person. More importantly, observed behavior may reveal insights about ourselves that we aren't even consciously aware of."

It seems likely that other financial firms will begin to use machine learning, natural language processing, and other AI capabilities if they aren't already.

4. HOW DOES AUTOMATED INVESTING ADVICE CURRENTLY WORK?

Automated financial advice today is a hybrid process of machine and human participation. The relevant humans may be either the client, an advisor, or both. Vanguard, for example, has a clear division of labor among advisors and machines in its hybrid offering called Personal Advisor Services (Figure 1), which is typical of other hybrid systems.

An important first step (after a contractual agreement has been signed) is for the client to supply information. In most cases this is done directly into the computer. The client provides information on financial goals, family demographics, asset allocation preferences, financial needs, and risk tolerance. Goals most frequently include retirement planning, but may also involve saving for a home, college, or even a car.

After the client data has been supplied, a computer program constructs a proposed portfolio of ETFs and mutual funds, or (less commonly) recommends

particular stocks or bonds. In hybrid offerings, there may be a meeting with the advisor to clarify goals and objectives or answer questions. In most cases, the client has several days to agree to the proposed investments. After the client has agreed, the money is invested.

Over time, the machine performs an ongoing and repeated set of tasks, including rebalancing assets, identifying losses for tax loss harvesting, regular reporting, and analytics (including Monte Carlo simulation to show the likelihood of having sufficient funds through a lifetime). The results of account changes are typically displayed to clients on firms' websites.

Hybrid human/machine programs typically feature occasional meetings with advisors. Some, like Morgan Stanley's Next Best Action approach, mediate all recommendations through the advisor. At Vanguard, the Personal Advisor Services offering features advisors as "investing coaches," able to answer investor questions, encourage healthy financial behaviors, and be, in Vanguard's words, "emotional circuit breakers" to keep investors on their plans [Bennyhoff and Kinnery (2016)]. The PAS approach has been highly successful, quickly gathering more than U.S.\$80 billion in assets under management – far more than any other U.S. firm thus far.

Some firms that initially offered machine-only services have now moved to incorporate some human contact. Betterment, for example, offers two plans (with higher

fees) that include either annual or unlimited phone consultations with advisors. Personal Capital is also a hybrid service. Wealthfront, however, maintains its machine-only approach to advising.

Whether hybrid or machine-only, all automated advisors offer lower advising fees than purely human advisors. Automated advice generally costs between 0.2% and 0.5% of the client's assets, versus 1.0% or more for human-advised investing [ValuePenguin (2017)]. Some firms have tiered rates depending upon how much human advisor contact is allowed, or the amount of client assets under management.

Automated wealth or asset management also typically requires lower minimum balances for investors than human-only offerings. At Vanguard, for example, the minimum investment level for its human-advised asset management services was U.S.\$500,000. But with Personal Advisor Services, its hybrid machine/human offering, the minimum balance is U.S.\$50,000. Some online-only services have minimums of U.S.\$500 (Wealthfront) or even U.S.\$0 (Betterment) [Rieman (2017)].

5. WHAT IS THE FUTURE OF AUTOMATED INVESTING ADVICE?

Other than rapid growth, there are several likely attributes of “robo-advisors” of the future, including the following four domains for change.

5.1 Greater breadth of advice

This is perhaps the best bet for future development. Current versions of automated financial advice are relatively narrow in scope. They address only a relatively small part of consumers' financial lives – investing – and typically only recommend certain types of investments (mutual funds or ETFs).

More advanced investing features would enable investing in different asset classes like real estate, precious metals, or oil and gas. The systems could also focus on tax efficiency and optimization, the management of trusts, IRA management, 401K management for businesses, and so forth. One investment company estimated that there were 115 possible asset classes, but their existing robo-advisor only dealt with ten percent of them.

Automated advice will also extend into areas of financial services beyond investments. Robo-advisors are already also used in insurance to provide automated

advice [Schneeweiss (2017)]. Startups like Lemonade and Insurify are using artificial intelligence to engage in chat with customers and evaluate claims. They also have algorithms to recommend levels and types of coverage. USAA, an insurance and banking firm for U.S. military veterans, has a robo-advisor that provides advice not only on insurance, but also investing and spending [Gipson (2015)].

There will also be automated solutions aimed at the financial needs of particular customer segments. Wealthsimple, for example, a Canadian robo-advisor firm, offers systems for both socially responsible investing and Shariah-compliant investing for Muslim customers [George-Cosh (2017)].

5.2 Increased focus on risk mitigation

Most automated systems are not very transparent in terms of how they invest customers' money. The algorithms that they use to select investments or identify customers' risk tolerances, for example, are rarely publicized or made available. Although investment advisors have fiduciary responsibilities, it is often difficult even for regulators to prove that the systems' recommendations are in the best interests of customers. In addition, there may be operational (e.g., trade execution), security, and technical risks associated with automated advice systems.

While few customers appear to be concerned by these risks, regulators (the SEC and FINRA in the U.S., for example) have already issued rulings that specify that the risks are being addressed. And some accounting firms are beginning to offer services to assess algorithms, rules, and other system components to ensure that they do what they say they do, and that unnecessary risks are not incurred [Ameel and Stephenson (2017)].

5.3 New investing models

Almost all automated investment advice is based on so-called “modern portfolio theory,” first published by Harry Markowitz (for which he won a Nobel Prize in Economics) in 1952 [Markowitz (1952)]. This theory requires the advisor or system to ascertain the investor's risk tolerance, and then a set of asset classes (theoretically uncorrelated) are assembled in relatively fixed percentages to create an “efficient frontier” portfolio with optimal expected investment returns.

But modern portfolio theory is not the only way to construct a portfolio. Today, there are multiple

alternatives to it, including approaches based on behavioral finance, those that incorporate alternative asset classes, and those that allow for tactical asset allocation, or more flexible allocations over time.

As robo-advising technologies become more intelligent, they will increasingly be able to adopt some of these emerging strategies. Almost all of them would require more data and more calculations than the existing generation of automated advisors. Much of the external financial data is already available and is being employed by sophisticated professional investors.

5.4 Better customer knowledge from data

The more knowledge a financial advisor has of customers' financial behaviors, the better the recommendations can be about how to improve their financial situations. But to expect customers to supply extensive data is a burdensome customer experience.

In other financial sectors, firms are increasingly using external data to learn more about customers and minimize their data entry burden. Home insurers, for example, are employing satellite imagery of homes, rather than having to climb on the roof to inspect it. Automobile insurers are allowing customers to take smartphone photos of accident damage, rather than traveling to a claims center. Some providers of commercial loans, including Kabbage, are given permission by customers to connect to their Ebay or Paypal accounts, Amazon.com sales data, Intuit Quickbooks data, and so forth.

In the future, it is likely that automated financial advisors will also be able to connect to multiple sources of data in order to provide better recommendations. Access to a bank account or to credit card statements, for example, would give a robo-advisor an excellent window into a customer's earning and spending habits. The forays by several advisor firms into account aggregation, and the move by Wealthfront into using artificial intelligence to monitor customer investing behaviors, are just the beginning of this trend.

Of course, this external data access will have to be done with the permission of the customer to minimize privacy concerns. And advisor firms will have to be careful not to use the data for any purposes other than those that truly benefit the customer.

5.5 More market knowledge

Robo-advisors have thus far been largely based on passive investing and "set and forget" portfolios. But they don't have to be. More sophisticated technologies could take into account moment-by-moment market moves and changes in desirability of particular investments or asset classes. Again, this strategy has already been adopted by investment banking trading desks and hedge funds, and it seems likely to "trickle down" over time to individual investors' portfolios. And the vast amount of data and short timeframes involved require that decisions and actions be made by intelligent machines, rather than by human advisors or retail investors. As Kishnan (2017) put it: "Eventually algorithms and artificial intelligence will take over most aspects of money management, particularly picking investments for clients and for trading."

This approach is already being used in some form by several wealth management firms for their internal use or advisor-mediated work with clients. RAGE Frameworks, for example, a company recently acquired by Genpact, is introducing an "active advising" module in its wealth management software that is used by several leading firms [RAGE Frameworks (2016)]. It includes configurable "intelligent agents" to assist advisors in executing their strategies, advise them of patterns in market and customer data, and continuously monitor for changes in the external environment or the client's personal situation that can impact client portfolios. These capabilities are not yet available to retail investors, but probably will be in the near-term future.

All of these future directions tend to involve more sophisticated and complex investment strategies and technologies. However, key factors in the success of robo-advisors with financial consumers is that they are relatively easy to use and understand, and that fees are kept low. Firms that add these sophisticated features will have to balance their complexity with these other objectives.

6. WHAT ARE THE IMPLICATIONS FOR HUMAN INVESTMENT ADVISORS?

While many of the investment-picking aspects of financial advising will undoubtedly be taken over by machines, there are still some important roles for humans. Perhaps some advisors will lose their jobs, but probably not in large numbers. What roles can advisors continue to play?

There are a variety of possibilities for roles working alongside smart machines in various fields [Davenport and Kirby (2016)]. People who were formerly traditional financial advisors could become experts, for example, in how robo-advisors work, their strengths and weaknesses, and which advisors are best for particular circumstances. They could be integrators of different online advice sources, and help clients and investment firms to understand what systems to use for what purposes. They could also, like hedge fund managers, analyze the results from machine-advised financial portfolios and assess whether changes are necessary in the algorithms and logic employed by the machines.

Advisors could also shift to providing advice on investing for relatively obscure asset classes that are not included in automated advice systems. An advisor who specialized, for example, in distressed debt investing or assets like timber or oil and gas exploration would be unlikely to be replaced by a machine anytime soon.

Perhaps the most common role for financial advisors in adding value to smart machines is behavioral coaching. Over the past decade, many academics and investment firms have come to realize that behavioral and psychological issues play a large role in investing [Montier (2007)]. Deciding what investments to buy, and when to buy and sell certain investments, are often not entirely rational processes. As investment selection is taken over by algorithms and artificial intelligence, coaching investors on the appropriate behaviors for their situations can be a valuable role. Behavioral coaches could, for example, dissuade clients from buying at the top of the market or selling when markets crash. They could attempt to reconcile the diverse risk perspectives of husbands and wives who are investing jointly.

Several investment firms that have made substantial commitments to automated advice have embraced behavioral finance and coaching. Primarily online firms like Betterment and Wealthfront have included materials about behavioral finance on their websites. And firms with hybrid machine/human advice offerings, like

Vanguard's Personal Advisor Services, have encouraged financial advisors to learn more about behavioral coaching and to play that role with clients. Vanguard also makes extensive use of video interactions between advisors and clients to try to increase the engagement level of coaching interactions [Kolimago (2017)].

Of course, some investors will continue to prefer human advice, particularly at the high end of wealth management and for older clients. Hence, some advisors will not be greatly affected by automated advice, at least over the next decade or so.

However, many advisors will feel an impact from the robo phenomenon. As in other fields, financial advisors who want to keep their jobs may have to be flexible and adaptive. They may have to learn new skills in terms of understanding financial technologies, or in terms of mastering behavioral coaching. They may have to change their asset focus, or modify their business model. However, those who are willing to make such changes are likely to remain employed.

For the firms that employ those advisors, automated advice is likely to have mixed implications. Fees for advising clients and managing portfolios are likely to drop, as they already have at firms that have aggressively adopted robo-advice or hybrid machine/human models. However, the combination of high-quality automated advice at a relatively low cost could bring large volumes of new clients into the market for investing advice. Firms catering to the "mass affluent" [Nunes and Johnson (2004)] market are most likely to benefit from this market growth.

While the details of adoption of automated financial advice are unclear, there is little doubt that it will become increasingly popular. Financial services firms, financial advisors, and clients will all see substantial change in the financial advice process over the next several years. Extended face-to-face discussions between client and advisor may not vanish altogether, but they may become endangered.



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