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Robo-Advisors: Investing through Machines

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Investing through online automated platforms, known as robo-advisors, is increasingly popular. Robo-advisors expand access to wealth management services by making it easier and less costly to open investments accounts and receive financial advice, as well as plan and automate investment decisions. However, the rise of robo-advisors requires consumers to understand the limitations of these services and to get proper financial education. Policy makers need to grapple with the impact of robo-advisors on the overall financial system, as well as reassess their regulatory and supervisory practices.

The Rise of Robo-Advisors

The financial industry is continuously adopting new technologies to deliver financial services in cheaper and more efficient ways. The adoption of these technologies particularly deepened after the 2007–08 global financial crisis, when tighter regulations on traditional banks and developments in computer science increased incentives to develop non-bank, technology-based financial companies (IFC 2017). Some examples of technological innovations in finance include ATMs (automated teller machines), mobile payments, and trade finance using blockchain. Now, technological disruption has reached the realm of wealth management services, where automated financial advisors, known as robo-advisors, are starting to compete with human advisors.

Conceived as a low-cost alternative to traditional human advisors, robo-advisors are online platforms that use algorithms to automatically build and manage clients' portfolios. Though robo-advisors started as fintech start-ups in the aftermath of the global financial crisis, they have grown in popularity in recent years, particularly as more traditional financial institutions have started to offer their own robo-advisory services. For example, Charles Schwab, one of the largest brokerage firms in the United States, launched a robo-advisory service, Intelligent Portfolios, in 2015. Also in 2015, BlackRock, the world's largest asset manager, acquired the robo-advisory company Future Advisor. Robo-advisory has also caught the attention of bank giants, such as Bank of America and Wells Fargo, which have recently started to offer their own automated advisory services.

The United States is, by far, the leading market for robo-advisors. As of 2017, it had more robo-advisors than any other economy in the world (about 200) and captured 57 percent of all investments in robo-advisors (Burnmark 2017; CBInsights 2017). The estimated value of assets managed by robo-advisors in the United States exceeded US$400 billion in 2018 and is anticipated to grow at an average annual rate of 31 percent, reaching almost US$1.5 trillion by 2023 (Figure 1). Currently, the largest robo-advisors in terms of assets under management are Vanguard (US$112 billion), followed by Intelligent Portfolios (US$33 billion) and Betterment (US$14 billion) (Figure 2).

Robo-advisors are starting to grow in other parts of the world, too. In Europe, there are currently over 70 robo-advisors, with 5 of them managing more than €100 million (Burnmark 2017). Emerging economies have also witnessed the emergence of their own robo-advisors. For example, the number of robo-advisors is growing fast in Asia, driven by an emerging middle class and high technological connectivity (Forbes 2017). Robo-advisors are already present in China (mainland); Hong Kong SAR, China; India; Japan; Singapore; Thailand; and Vietnam, among other economies. Other emerging regions also have robo-advisors, but their presence is limited so far. For instance, there are only 6 robo-advisors in Africa and Latin America altogether (Burnmark 2017). Robo-advisors are expected to continue expanding around the world in years to come. Some projections even forecast that robo-advisors will manage around 10 percent of global investment assets by 2020 (Business Insider 2017).

Even though they are labelled "advisors," robo-advisors typically provide services that go beyond simple advisory services to encompass comprehensive portfolio management services that allow individuals to plan and delegate their investment decisions. For example, in 12 out of 15 surveyed economies, robo-advisors offered both advisory and management services (IOSCO 2016). In addition to portfolio allocations, the services provided can include portfolio rebalancing and tax management.

How Do Robo-Advisors Work?

To help with investment decisions, robo-advisors start by defining the investment strategy of each individual based on his/her investment goals and risk profile. Robo-advisors ask potential clients about the purpose of the investment and the time horizon. Robo-advisors offer investment strategies for a variety of goals, including retirement, saving for large expenditures, establishing a rainy day fund, or generating a stream of income to cover expenses. These questions are complemented with objective and subjective questions that evaluate a client's willingness and capacity to tolerate risk. Objective risk metrics can include a client's income and years to retirement. Subjective questions ask, for example, how the client would react to a market decline and how comfortable he/she is with fluctuations in the market (Lam 2016). To keep costs low and the process simple, clients'

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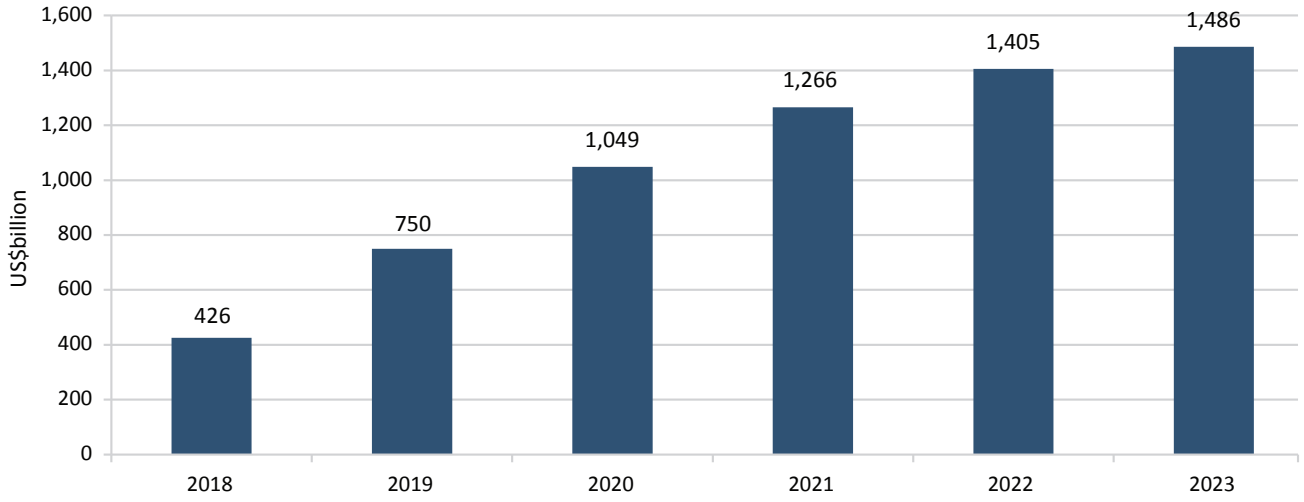
Figure 1. Projected Assets Managed by Robo-Advisors in the United States, 2018–23

The value of assets under management by robo-advisors is expected to more than triple between 2018 and 2023.



Source: Statista 2019.

assessments are conducted using standard online short questionnaires.

Based on these two dimensions, robo-advisors use automated algorithms to make recommendations on how to allocate funds across different types of assets. In most cases, these algorithms are based on modern portfolio theory (Bjernes and Vukovic 2017). This portfolio selection framework, introduced by Harry Markowitz (1952), is the most popular model of asset allocation and states that the optimal portfolio is one that maximizes the expected return given a level of risk tolerance or, alternatively, minimizes risk given a level of expected return. Robo-advisors construct portfolios with higher risk by increasing the ratio of equity to bonds and, within each type of instrument, investing in riskier assets (for example, moving away from government to municipal bonds or from U.S. to emerging market stocks). Portfolio optimization is adjusted by taking into account investment goals and the desired risk level. For example, for a given level of risk, asset allocation will be different if the goal is to generate income for expenses or saving for the long term.

In addition to recommending an initial allocation of funds, algorithms can be designed to continuously monitor portfolios and detect deviations from the targeted risk. Whenever deviations are identified, the portfolio is automatically rebalanced. For example, the value of equity might increase faster than the value of bonds over time, increasing the share of the portfolio invested in equity. Because a higher share of equity increases risks, the portfolio might be rebalanced by selling equity. Moreover, the portfolio can be automatically rebalanced to reduce risks as time goes by and as the time when the funds are needed approaches. Rebalancing can also occur when the investor changes his/her risk tolerance or investment goals.

A corollary of modern portfolio theory is that by diversifying assets, investors can reduce risk without sacrificing expected returns. To achieve diversification at a low cost, robo-advisors mainly offer to invest in exchange traded funds (ETFs) and index funds. These investment instruments tend to follow a basket of securities or an index (investing in all the securities included in the index and in the same proportion as the index). As a result, by acquiring only a few funds, investors can achieve a "market portfolio" while minimizing trading costs. Moreover, by passively holding funds, investors do not need to engage in active monitoring and trading, reducing trading costs even further. In practice, robo-advisors seem to follow a conservative approach, offering funds that have wide coverage, long operating history, market liquidity, and good performance over time (Deutsche Bank 2017; Phoon and Koh 2018).

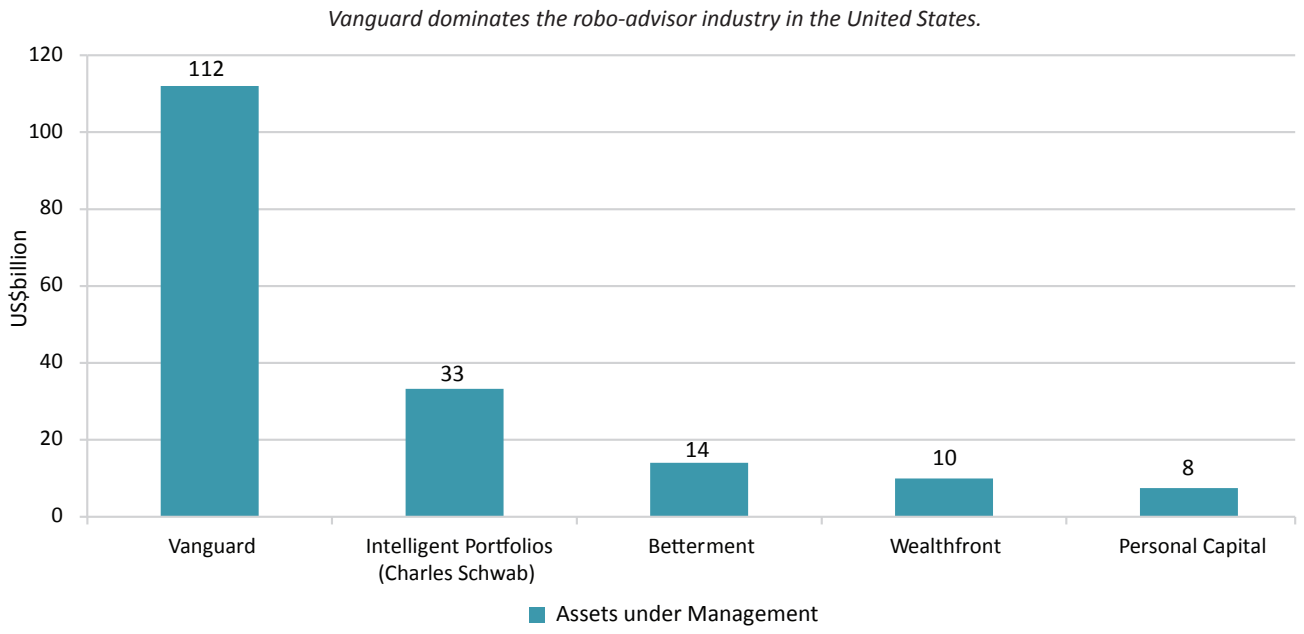
The entire process of using a robo-advisor (from opening an account to monitoring and readjusting the portfolio) can be performed online with no human interaction. Several robo-advisors are fully automated. These types of robo-advisors are usually less costly, and thus are oriented toward the mass market. Nevertheless, other robo-advisors offer a hybrid system where clients have human interaction, albeit limited. For example, only a certain number of contacts are allowed or they can occur only via the Internet, not in person. These robo-advisors charge higher fees, but are still cheaper than traditional human advisors.

Benefits and Limitations of Robo-Advisors

The use of robo-advisors for management wealth services can provide several advantages over traditional services that rely on human advisors. One appeal of using robo-advisors is that they are easily accessible. Instead of having to set an appointment with an advisor and attend a meeting at a physical location, robo-advisors offer clients the possibility of obtaining financial advice and managing investments at any time, from anywhere with an Internet connection.

Robo-advisors can also reduce the costs of financial advice. In contrast to human advisory firms, robo-advisors can save on fixed costs, such as the salaries of expensive financial advisors or the maintenance of physical offices. As

Figure 2. Largest Robo-Advisors in the United States, 2018



Source: Ortner 2018.

a result, they can reduce minimum investment requirements. For instance, Bank of America requires US$25,000 to open an account with a private financial advisor, but only US$5,000 to open an account with their robo-advisor. Some robo-advisors, such as Betterment, do not require a minimum investment at all. In addition, robo-advisors can charge lower fees than human advisors. For example, a fully automated robo-advisor can charge a fee as low as 0.25 percent of assets managed, whereas the fees for traditional human advisors are no less than 0.75 percent and can even reach 1.5 percent (EY 2015). On top of administrative fees, financial advisors usually charge fees for trades performed, which robo-advisors typically minimize by following passive investing.

Using robo-advisors can yield additional savings in the form of "tax harvesting." This is the practice of selling assets that experience a loss and using the proceeds to buy an asset with similar risk (keeping the same risk profile of the portfolio). Recording a loss decreases capital gains, reducing taxable income. Performing tax harvesting can be complex: it involves identifying harvesting opportunities in a portfolio with several assets, finding suitable substitutes, and performing multiple trading, among other tasks. Robo-advisors can perform tax harvesting more efficiently and frequently than human advisors.

Robo-advisors can also help reduce some of the behavioral biases that are common in financial advisory. Human advisors can be subjective, favor products for which they receive commission, have a limited capacity to monitor several assets simultaneously, and focus on domestic securities, among other biases. Thus, by transferring the decision-making process from humans to automated algorithms, robo-advisors can mitigate some of these biases. Nevertheless, even when robo-advisors are used, some biases might still be present. For example, similar to human advisors, robo-advisors might use certain brokers and other financial firms not because they are the cheapest but because they receive higher commissions from them (Fein 2015). Moreover, algorithms are inevitably programmed by humans, so biases could be introduced during their design, consciously or unconsciously. For example, robo-advisors could recommend that clients hold a relatively large share of their investment in cash to then re-invest for profit (Vox 2016).

Whereas robo-advisors can increase accessibility and affordability of wealth management services, they can also entail costs. Although straightforward and time-saving, robo-advisors might not be able to know clients as well as human advisors do through multiple interactions, tailored questions, and closer relationships. "One-size-fit-all" questionnaires might be too simple and narrow to provide a complete overview of a client's financial situation and his/her needs. Furthermore, these questionnaires assume that individuals with a similar risk profile would provide the same answers to the same subjective questions, which might not necessarily be true (Deutsche Bank 2017). Robo-advisors also lack other important aspects of a client-advisor relation, such as helping clients define their financial goals, counseling during market downturns, or dealing with possible changes in their lives (Accenture 2015).

Furthermore, limited risk-assessment might not provide a complete overview of a client's overall financial condition. Robo-advisors might not ask about a client's other investments (such as pension funds and real estate), future expenses, potential liabilities, spouse's financial condition, or insurances purchased, among other information (FINRA 2016). If robo-advisors act on partial information, they might not provide optimal recommendations.

Robo-advisors can also lead to consumer disengagement. In other words, because the entire process is automatic, consumers might not make efforts to

understand how the service works, or even continuously monitor their investments. This issue is particularly relevant when robo-advisors are offered to individuals with relatively lower wealth who might have no experience with investment products (OECD 2017).

Because robo-advisors are relatively new, their business models have not been tested in the long term and under financial stress. Thus, it remains unclear to what extent consumers will be protected in case a robo-advisor company fails. Some jurisdictions have taken steps to protect consumers. For example, robo-advisors in the United States are required to be members of the Securities Investor Protection Corporation (SIPC), which provides insurance for up to US$ 500,000 per customer in case of bankruptcy of a member firm.

The Future of Robo-Advisors

Because of their low cost and easy accessibility, robo-advisors have the potential to promote more sophisticated investment practices within a population not used to having access to financial advisors. Robo-advisors could be particularly attractive to certain groups such as households with relatively lower income or younger individuals, who might not invest because their investable funds are too small, are located far from urban centers, or simply feel intimidated by human advisors. Increased participation in capital markets, would offer these individuals new ways to save for retirement, rainy days, or any other purpose. At the same time, robo-advisors might benefit individuals that already have investments. Not only can their costs be reduced, but thanks to the enhanced computational power and (at least in theory) objectivity, robo-advisors can design more efficient portfolios compared to humans. In fact, there is empirical evidence that the use of robo-advisors can be associated with higher diversification and less behavioral biases (D'Acunto, Prabhala, and Rossi 2018).

Proper regulation and supervision will be a key determinant of the success of robo-advisors. Policy makers would benefit from establishing good practices that guarantee that robo-advisors are objective and transparent, and provide advice appropriate to each client's needs (Baker and Dellaert 2018). Regulatory agencies around the world have already started to think about how to adequately adopt robo-advisors and have issued guidelines, reports, and opinions on this issue. Regulators have stated that they would have to develop new skills to supervise robo-advisors effectively. For example, they would need to have the technical capacity to assess robo-advisors' algorithms. Similarly, regulators would need to understand how automated profiling of clients works. Regulators have also emphasized the importance of consumer education. Prospective clients need to have enough information to understand how robo-advisors operate and whether or not they are suitable to their needs. Regulatory organizations have also raised concerns related to cybersecurity and data privacy, among other issues (ESAs 2015; FINRA 2016; IOSCO 2016).

The robo-advisory industry is still at an early stage and, as such, few studies have analyzed its different impacts on the financial system, including on asset markets. As robo-advisors expand and more information on them becomes available, more analyses could try to shed light on these issues. For example, future work could analyze who uses robo-advisors, and thus to what extent they are contributing to better financial decisions by a wider array of investors. Further analyses could also focus on whether human and robo-advisors are substitutes or complements (either catering to different population segments or individuals using both at the same time), as well as on how the profit margins and cost structures compare between the two. To the extent that robo-advisors can be accessed by any individual from any location, it would also be interesting to study whether robo-advising activity tends to be concentrated in a few economies and accessed by investors from all over the world, or economies have their own robo-advisors catered to their own domestic investors. It would be useful to analyze if the same robo-advisor gives consumers in different economies tailored recommendations based on local products and environments (such as tax codes), or instead provides standard international products. Further insights on these topics would help to better understand the true potential and pitfalls of robo-advisors.

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