

Vision Inc.

Robo-Advisors

A Future Way To Invest?

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Abstract

Research Question: Are robo-advisors the future of investing?

As the capabilities of technology continue to advance, alternatives to conventional practices are created in an attempt to boost convenience and efficiency. This paper will focus on one such alternative, robo-advisors, an automated investment advisor platform. The technology is evaluated to answer the research question above and to assess whether it holds promise in the world of finance as well as the potential to ultimately outpace traditional forms of investment advice. To accomplish this goal, in-depth research is provided covering a broad range of topics concerning robo-advisors including the platform's history, analysis of the industries it falls under, underlying mechanics, firms, its regulatory framework, and comparisons to traditional financial advisors. Next, knowledge from this preliminary research was used to report additional insights gained from interviews conducted with one representative of a robo-advisor platform and another representing a traditional financial advising firm. The paper then provides a cost-benefit analysis quantifying the tangible historical gains and losses clients have experienced from using both robo-advisors and financial advisors. Finally, personal investments were made with one robo-advisor platform to test the effectiveness of the technology over the course of 1.5 months in order to share user experiences, feedback, suggestions, recommendations and to reconfirm earlier insights reported in the paper.

To assist in writing the report, websites, peer-reviewed journals and scholarly articles, data sources such as Statista and Morningstar, tools like Portfolio Visualizer and Excel, phone calls, emails, web portals, and an app were utilized.

In the end, it was found that robo-advisors have a strong, positive outlook in terms of future growth. However, hybrid robo-advisors and models of investing were determined to be the norm looking ahead since they effectively integrate the advantages of both robo-advisors and traditional financial advisors as well as address the downsides with each approach. Furthermore, it was concluded that there was no clear answer whether robo-advisors in their current state are better than conventional practices since it all depended on a client's financial situation and needs. Still, potential college entrants and those looking to generate retirement savings were deemed best fits for the technology. Regardless, it was discovered that robo-advisors would continue to improve in the future by expanding their investment offerings, strategies, plans, making significant strides in artificial intelligence, and continuing to remain cost-efficient.

Research Project Purpose

Importance to Authors

As two finance majors in the Orfalea College of Business at California Polytechnic State University - San Luis Obispo, we are both very interested in the world of investment and portfolio management. These are two areas we are actively looking to pursue our careers in as well. Initially, we wanted to do a project that would simulate what it would be like to be portfolio managers, but when we did further research, we discovered a program that automated investments for individuals at a low cost. This seemed like an interesting topic to explore further and since we were new to the finance world, we were interested in modern investing strategies. To our shock, robo-advisors were also a relatively recent concept when presented to our friends and professors, especially since it was originally created in 2008. Since our original project idea involved investment, this topic was in line with what we wanted to do. Furthermore, we believed it was important to learn about automation because it could become even more prominent in finance looking years ahead. This research project will allow us to fully understand the current software and predict its prospective growth. To give us the full experience, we will also be interviewing financial advisor and robo-advisor firms that will allow us to validate our research and evaluate whether robo-advisors have the potential to replace conventional investment advice in the future. In addition, an approximately one and a half month long investment of our personal money into a robo-advisor will allow us to personally assess the effectiveness of this technology.

Importance to Readers

As we move further into the technology revolution, the marketplace is slowly shifting into better, more convenient, and cheaper ways to trade. Many individual investors are either highly knowledgeable with the market through experience and research, while many others find the stock market similar to a casino where if they are lucky, they can walk away with positive returns. Generally, the public is uncomfortable with putting their money in the stock market due to their lack of experience. Additionally, in the past, individuals would have to go to investment advisors for advice; luckily, a solution has been created. Robo-advisors have emerged in the marketplace as an alternative for beginners to understand the stock market without fear of substantial loss. With no need for human intervention, one could create an investment portfolio within an hour using the algorithms (a set of rules) and asset allocation models that are custom fit for every individual based on their financial goals and risk profile.

This software should be the most useful for beginners interested in investment and individuals who are looking for cheaper ways to supplement their financial plans. This program will help

beginners who are fearful of losing money in the stock market because automation allows for a reallocation of funds when there is a large loss. Since most people are unfamiliar with the various assets to pick as a beginner without a large amount of research, this will allow them to get their feet wet in the world of investment by understanding the mechanics behind the technology.

Learning Outcomes

This paper will provide an in-depth look into robo-advisors and an understanding of their potential in the future. Interviews of robo-advisor and financial advisor firms conducted will give an insight on the creation and daily use of the software as well as how traditional ways of investment advice compare to the technology. Since this project focuses on the future of robo-advisors and automation as a whole, these companies will assist in that aspect along with the personal experience gained through the authors' investment in a specific robo-advisor, Betterment. This allows for real-life testing of a product to validate our research. A cost-benefit analysis will also be created to compare robo-advisors and traditional means of investing. This research will be beneficial for individuals to further understand the pros and cons of robo-advisors and traditional financial advisors. As computers become more powerful and the capabilities of automation advance every day, this paper will illustrate how robo-advisors can disrupt and shape the future of wealth management. Are robo-advisors just the start of something bigger? How influential can they become and will it put financial advisors out of business?

Note: Research by Statista in 2017 shows that although there were 361 robo-advisors worldwide, 200 came from the United States alone. Therefore, this paper will lean more towards the robo-advisors in the United States due to their strong presence in the country.¹

Robo-Advisor Background

History

First created during the financial crisis in 2008, the robo-advisor was initially created to rebalance (realign) investor assets within target-date funds (a fund designed to become more conservative as the end financial goal approaches closer for a client), and introduce investors into the new world of online interfaces. Most robo-advisors have a passive investing strategy that allows for the computer to rebalance a portfolio when the market shifts to skew allocations among equity (stocks), debt (like bonds), and other assets. Robo-advisors were not available to the public until 2008 and before then, the software was only used by human financial advisors to automate their workload while still charging the same annual fees of 1% to 3% of total assets under management (total financial value of client managed money). Now available to the public, robo-advisors can be

¹ "Number of Robo-Advisors Globally by Country 2017 | Statistic." *Statista*, Apr. 2017

used for a lower fee of 0.3%-0.5%.² Now with robo-advisors available, there are three methods of investment as shown in Figure 1. In the past, investors would either do it themselves, but since they are not professionals, it required a large amount of research on companies and stock tickers. The alternative was hiring a financial advisor which was expensive and required a large amount of money to start investing. These two options are not preferable to the average American who doesn't have a lot of time to research companies or has a large amount of money to meet the minimum investment requirement. Now with the introduction of robo-advisors, it is beneficial for beginners to use this system, both to save time and allows for them to invest as much as they want. Robo-advisor companies such as

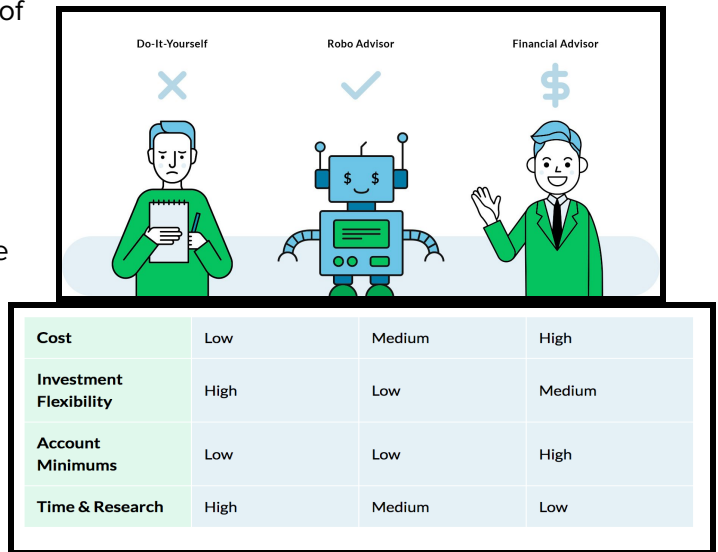


Figure 1. Investment Route Summary.
Source: <https://investorjunkie.com/35919/robo-advisors/>

Betterment and kaChing (later Wealthfront) began to start up and manage target-date funds, requiring investors to move their assets to a new custodian, an individual who is responsible for looking after their assets. Soon after, new services such as tax-loss harvesting were added, which allowed investors to reduce their overall tax bill by harvesting losses, selling their stock losses in the trough therefore offsetting the gains they experience elsewhere in the portfolio. Around 2010, another company by the name of FutureAdvisor began to offer automated advice on investment and retirement accounts which allowed for a first-time exposure to a large number of investors. This company allowed for investors to manage multiple, pre-existing brokerage and retirement accounts, with the added benefit that they were not required to move their assets and it allowed automation to do its job. Once a service for top investors, robo-advisors allow for automation of asset allocation and portfolio management and stand to represent the next generation of financial advice and investment management firms.³ With every year, wealth management software moves closer and closer towards having the ability to automate all financial advisory services. The future will soon have robo-advisors being able to automate services such as tax planning, cash-flow management, college savings, and possibly an individual's entire financial future.

General Attributes

² Ludwig, Larry. "The Rise of the Robo Advisors | Should You Use One?" *Investor Junkie*, 13 Mar. 2018

³ "A History of Robo-Advisors." *FutureAdvisor*, 8 Apr. 2015

The term “robo-advisor” specifically refers to the number of Internet-based investment advisory services aimed to automate what financial advisors have been doing for individuals. Before a portfolio is created, the customer answers a questionnaire for the machine to learn about the user’s risk parameters and investment preferences in order to create an asset allocation program with specific investment recommendations.

The main strategies that robo-advisors run are investments in mutual funds and exchange traded funds (ETFs). Investments in ETFs are a main method of trading for Betterment, the robo-advisor currently used for this project. These funds allow for full diversification of portfolios through a single ticker by tracking an index, bonds, or commodities. Investing in a normal company like Apple or Nike allows the investor to share a portion of the company, but by investing in ETFs, investors can purchase a share in an entire fund. Robo-advisors utilize these funds in order to fully diversify portfolios and continually rebalance investments to ensure that it maintains the risk parameters and investment preferences.⁴ The minimum balance required to create a robo-advisor account is small compared to the minimum required by financial advisors. They usually range from \$500 all the way down to \$0. Robo-Advisors are rapidly growing since their first creation during the financial crisis. A study created by Deloitte found that there were close to 100 robo-advisors in 15 countries as of 2016. As of April 2017, there were 200 robo-advisors in the United States alone.⁵ The estimates for the robo-advisory market are a big reason for the surge in this product. The market is predicted to grow to almost \$900 billion in assets to be managed with the support of robo-advisory services in 2020. By 2022, it is expected to explode to rise over \$1.45 trillion in assets under management.

Public Attitudes Towards Robo-Advisors

In a 2015 survey, 82% of registered investment advisors (RIAs) said they weren’t concerned about robo-advisors. In the following 2016 survey, the results were very close to the same, RIAs were not concerned about robo-advisors. Only 1% of the RIAs responded that they were “extremely concerned” in both years of the survey. In the report’s view, wealth managers dismiss the robo-advisors for being something such as a “small fry” (often used to describe any smaller tag along trying to act older or grown up because they want to fit in and gain undeserved respect). Figure 2 shows Millennial and GenX opinions on financial advisors. About half of each group believes that a financial advisor is “nice to have,” which could mean that they may or may not have a financial advisor themselves. In this age of modern technology, almost everything can be found online. These are the people that are the most likely to be influenced to get a financial advisor if it was readily available and inexpensive. Based on this survey, robo-advisors could potentially have a big potential to grow with a large, young target market. The survey further found that two in five Millennials have not worked with a financial advisor because they believe

⁴ “Should You Consider Using a Robo-Advisor?” *The Link Between*, 2 Apr. 2018

⁵ “Number of Robo-Advisors Globally by Country 2017 | Statistic.” *Statista*

that they don't have enough money saved to begin investing.⁶ A troubling thought for investors should be the fact that a third of Millennials think investment professionals are too expensive. A popular marketing method for robo-advisors is the fact that the product is much more inexpensive than traditional financial advisors. Once the public is more informed, wealth managers and RIAs should be extremely worried.

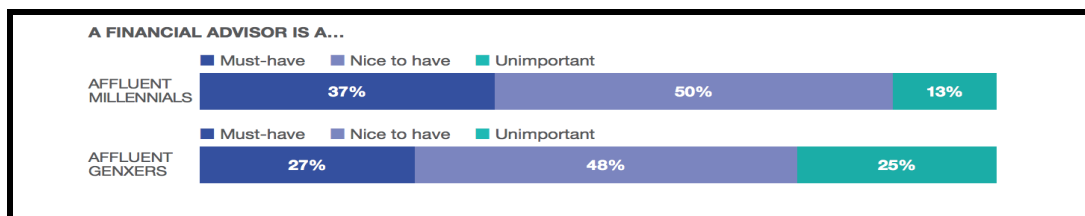


Figure 2. Millennial and Gen X survey responses to the importance of financial advisors (2017). Source: https://www.ipsos.com/sites/default/files/2017-07/ipsosMarketing_POV_RoboAdvisors.pdf

Industry Analysis

Robo-Advisor Industry Overview

The robo-advisor industry falls under the broad FinTech (or Financial Technology) industry (see Figure 3). This industry, generally speaking, involves the digitization and structural change of financial services. Digitization in this context means easier access for Internet/mobile app users, processing speed increases of automated processes, cost reductions, more convenience, more transparency, and a focus on quality customer service. Furthermore, the FinTech industry branches out into five sub-segment industries: Alternative Financing, Alternative Lending, Digital Payments, Personal Finance, and Special InsurTech: Online Distribution.⁷

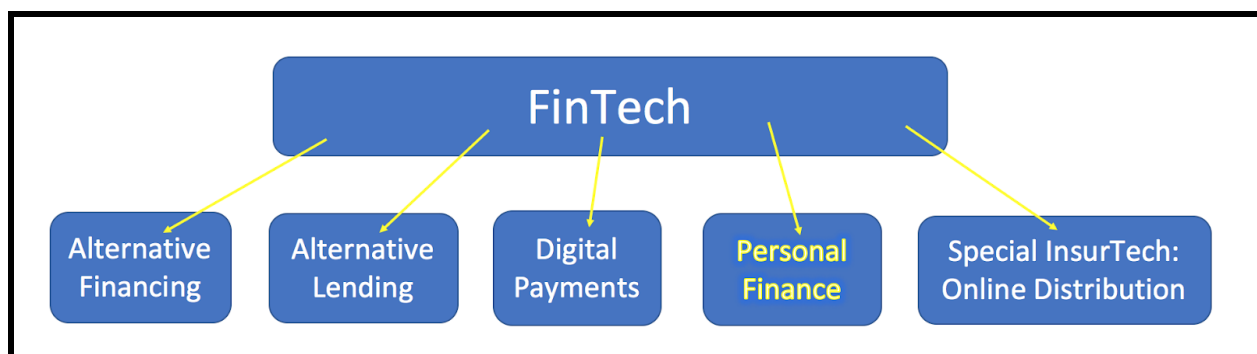


Figure 3. FinTech Industry Breakdown. Source: Author-Generated

Alternative Financing

⁶ Ponnaiya, Sanjay, and Kerri Ryan. "Robo-Advisors: the Rise of Automated Financial Advice." *Ipsos*, 1 May 2017

⁷ "FinTech - Worldwide | Statista Market Forecast." *Statista*, 2018

Alternative Financing involves specific digital financial services for business customers. These services include equity-based crowdfunding models (start-ups exchanging company shares for investment) and crowdfunding solutions (for non-monetary compensation like product launches and visual art financing). This industry primarily focuses on small and medium sized enterprises as well as freelancers (self-employed individuals). Bank financing is not used here.⁸

Alternative Lending

The Alternative Lending industry builds upon the Alternative Financing industry by catering digital financial services for business customers but also to private borrowers. This includes loans without bank financing for small and medium sized enterprises (Crowdlending) and for personal loans (Marketplace Lending). These loans are carried either through private or institutional investors using online platforms. This industry primarily focuses on small and medium sized enterprises, freelancers, and private individuals.⁹

Digital Payments

The Digital Payments industry includes Internet-made payments for goods and services and mobile-made payments through smartphone apps. Consumer transactions dictate this industry.¹⁰

Special InsurTech (Insurance Technology): Online Distribution

This industry involves the distribution of digital insurance to private customers. Digital insurance products include life, health, property, etc. policies that are sold directly to the customer using online channels like an insurance company website or platform.¹¹

Personal Finance

As it turns out, the Personal Finance industry (provides financial services and gives financial/investment opportunity advice to individuals and/or households) is further broken down into online peer-to-peer (P2P) money transfers and the robo-advisor segments (see Figure 4).¹² Online P2P money transfers are essentially internet-made money transfers between private individuals. This includes cross-border payments (across national boundaries) and remittances (payments sent by an expatriate to their country of origin).¹³ Thus, robo-advisors can be thought of as falling under the broad FinTech industry and more

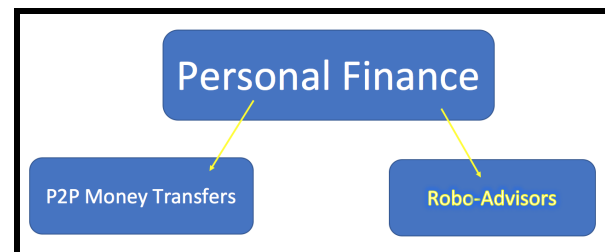


Figure 4. Personal Finance Industry Breakdown. Source: Author Generated

⁸ "Alternative Financing - Worldwide | Statista Market Forecast." *Statista*, 2018

⁹ "Alternative Lending - Worldwide | Statista Market Forecast." *Statista*, 2018

¹⁰ "Digital Payments - Worldwide | Statista Market Forecast." *Statista*, 2018

¹¹ "Special InsurTech: Online Distribution - Worldwide | Statista Market Forecast." *Statista*, 2018

¹² "Personal Finance - Worldwide | Statista Market Forecast." *Statista*, 2018

¹³ "P2P Money Transfers - Worldwide | Statista Market Forecast." *Statista*, 2018

specifically the Personal Finance industry.

User Growth

More and more users are starting to use robo-advisors. According to Statista, approximately 25.8 million users in 2018 are active paying customers in the Robo-Advisor segment worldwide (see Figure 5). To put this into perspective, there were only 13.0 million users in 2017. This represents a 99% increase year-over-year (YoY) growth rate. By 2022, there are expected to be nearly 122.0 million users of robo-advisors worldwide.¹⁴ In the United States, 6.6 million users in 2018 are active paying customers (see Figure 6). This means that as of now, a little more than 25% of worldwide users come from the United States. In 2017, there were 4.9 million users giving approximately a 35% increase YoY growth rate from 2017 to 2018. By 2022, there are expected to be 12.7 million users of robo-advisors.¹⁵ Since nearly 25% of worldwide users come from United States, this indicates that a thorough investigation must be carried out to understand what countries contribute to the remaining 75% of users. As it turns out, more than 90% of the remaining users come from China, or 17.5 million users as of 2018 (see Figure 7).¹⁶ Why? Millions and millions of Chinese customers are recently starting to hold investable assets that they are seeking to place elsewhere. Therefore, the only way to service the high volume of clients is to automate the processes. Billion-dollar companies such as Alibaba, more specifically its FinTech subsidiary Ant Financial, are fueling this effort. Moreover, because low interest rates and expensive real estate in China persist, there is a need to seek alternatives in generating returns. At the same time, mitigation of volatility (variation) exposure after-effects from the crash in Shanghai and

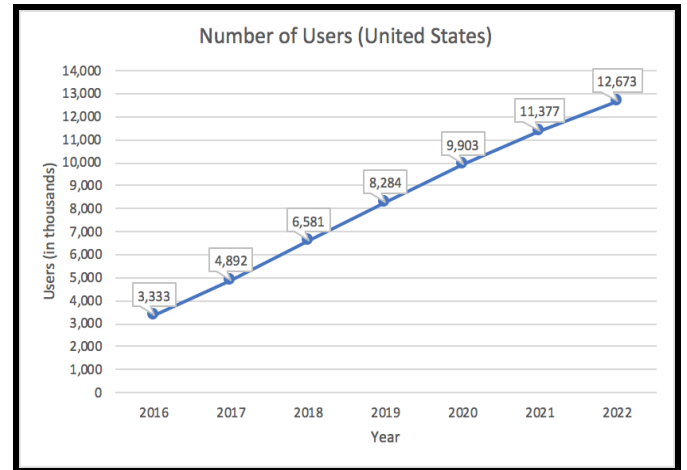


Figure 5. Number of Robo-Advisor Users Worldwide (in thousands) 2016-2022. Source: Author Generated

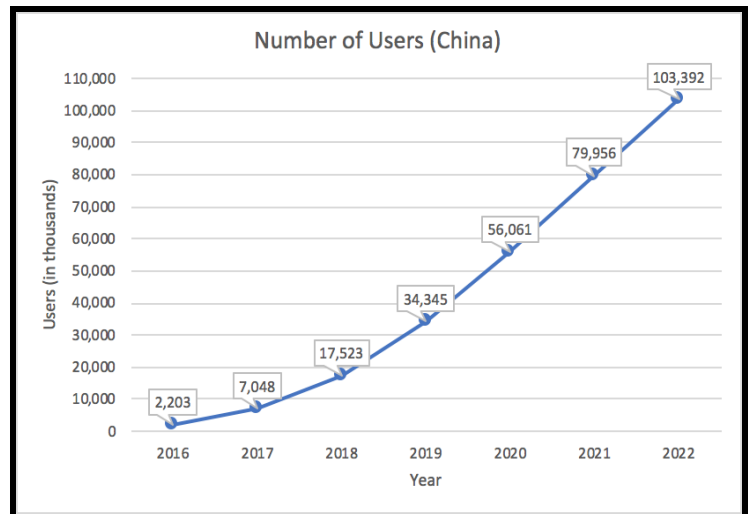


Figure 6. Number of Robo-Advisor Users - United States (in thousands) 2016-2022. Source: Author Generated

¹⁴ "Robo-Advisors - Worldwide | Statista Market Forecast." *Statista*, Sept. 2018

¹⁵ "Robo-Advisors - United States | Statista Market Forecast." *Statista*, July 2018

¹⁶ "Robo-Advisors - China | Statista Market Forecast." *Statista*, July 2018

Shenzhen stock markets in 2015 is a priority as well.¹⁷ Thus, China’s robo-advisor growth rates are primarily the reason why the number of users worldwide increased and were inflated to 99% from 2017 to 2018 (China’s own growth rate in these two time periods was 248%). Moreover, this is the reason why the user trends both in worldwide and in China closely resemble one another in form. Still, the robo-advisor segment is gaining significant traction in its registered users in many countries and is the fastest growing segment in the FinTech-Personal Finance industry (see Figure 8).

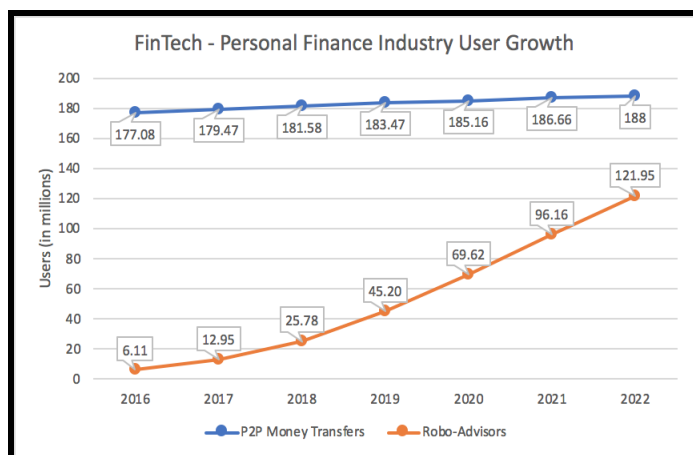
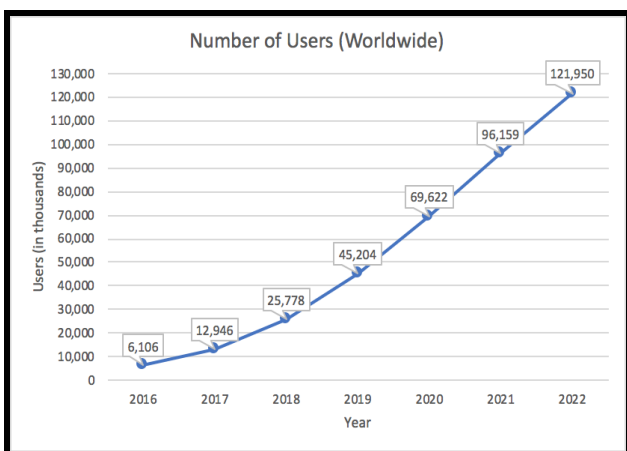


Figure 7. Number of Robo-Advisor Users - China (in thousands) 2016-2022. Source: Author Generated Figure 8. FinTech - Personal Finance Industry User Growth (in millions) 2016-2022. Source: Author Generated

Market Segmentation

After analyzing robo-advisor user growth trends, the focus now turns to analyzing the users’ demographics. While robo-advisors were originally thought to be tailored towards millennials because of their affinity for new technologies, recent studies show that roughly half of robo-advisor investors are over the age of 36.¹⁸ Furthermore, the average age of a robo-advisor investor is somewhere between 40 and 50.¹⁹ What’s causing a surge in Baby Boomers and Gen X clients? For one, the older clients typically have large retirement savings, are willing to take on less risk, and are approaching retirement. Because robo-advisors typically have lower management fees, this spurs an opportunity to move to this platform in order to save more money for

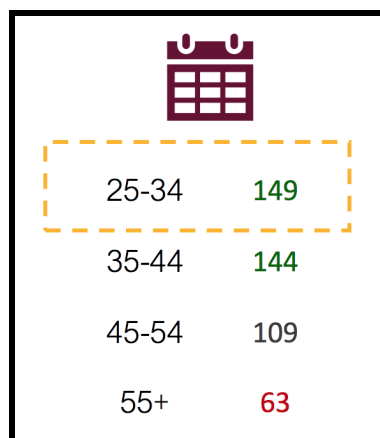


Figure 9. Interest in the robo-advisor concept as an index by age group (2018). Source: https://c.yimcdn.com/sites/www.bisanet.org/resource/resmgr/2018_AnnualConv/2018_Education/Man_vs_Machine.pdf

¹⁷ Barreto, Elzio, and Shu Zhang. “Robo Advisors Are Becoming the Hot New Item in China’s Finance Sector.” Edited by Will Waterman, *Disruptive.Asia*, 27 Apr. 2017

¹⁸ O’Hara, Clare. “Robo-Advisors Find Popularity Where Few Thought They Would.” *The Globe And Mail*, 27 Oct. 2017

¹⁹ Schapiro, Ken. “Robo Advisor Data For Two Year Period Now Available for Advisors.” *Advisor Perspectives*, 6 Mar. 2018

retirement purposes.²⁰ In fact, according to an Accenture research study, 90% of Baby Boomers and 91% of Gen X clients viewed fee structure as important when it came to selecting a financial advisor.²¹ And yet, the trend reverses when analyzing the amount of interest robo-advisors has generated among different age groups. Research shows that there is greater interest in robo-advisors the younger the consumer gets (see Figure 9).²² Lower fees and minimum investment amounts are factors that certainly pique this interest to consumers who grew up with technology and often have less savings. However, these millennials still remain largely an untapped market. For instance, while only 24.3% of millennials worked with a robo-advisor, the reality is that nearly 62% of those who haven't used a robo-advisor weren't aware they existed.²³ Therefore, when it comes to identifying target markets, marketing efforts have largely overlooked the younger generation. As intergenerational wealth transfers continue to occur from Baby Boomers and Gen X'ers to millennials, it becomes especially important to create value and long lasting relationships with them. Moreover, the technology does have this capability by tailoring portfolios to millennials as they continue to change their investment objectives and portfolio sizes.

Assets Under Management

The financial value of the assets under robo-advisor management has seen incredible growth. According to Statista, the total value globally in 2018 amounted to nearly \$400 billion in assets (see Figure 10). This represents a 63% YoY growth rate compared to 2017 with \$244 billion in AUM (assets under management). By 2022, there are expected to be \$1.45 trillion in assets. What countries are driving this growth? While there might be a tendency to conclude that China explains the overall increasing trend due to its phenomenal user growth explained earlier, this is not the case. It turns out that United States leads the world in the total number of assets under management (see Figure 11). With \$283 billion in assets in 2018 (a little more than 70% of the world total), China holds just \$88 billion or 22% of worldwide assets. This means that although

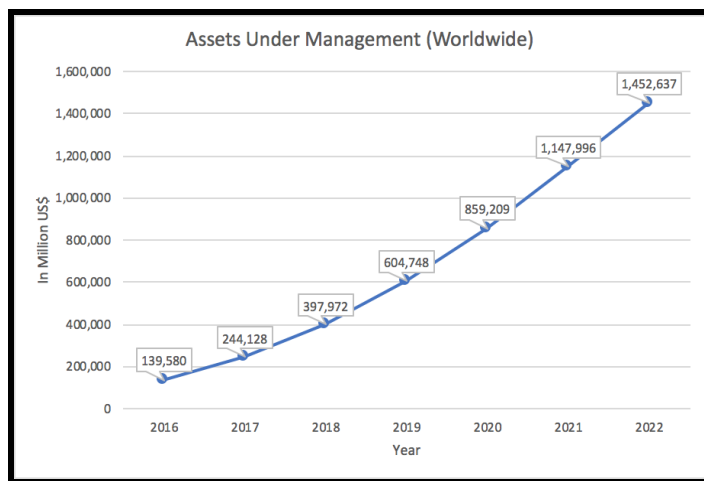


Figure 10. Assets Under Management Worldwide (in millions of dollars) 2016-2022. Source: Author Generated

²⁰ Chen, Jeffrey. "Robo-Advising: The Unforeseen Challenge – Ivey FinTech: Perspectives – Medium." *Medium*, Ivey FinTech: Perspectives, 7 Apr. 2018

²¹ Kirakosian, Margaryta. "Geneva Adviser on Key Industry Transformations and New Banking Platform." *Citywire Switzerland*, 18 Dec. 2017

²² Cutler, Wayne. "Man vs. Machine." *Novantas*, 2018

²³ Brown, Mike. "Robo-Advisors vs. Financial Advisors: What Do Millennials Prefer?" *CloudTweaks*, 2018

there are a lower number of users in the United States, each of them holds, on average, more assets under management. For instance, since there are 6.6 million users, each user holds nearly \$43,000 on average with robo-advisors. Compare this to China with an outstanding 17.5 million users but amounting to barely \$5,000 per user on average. Why is this so? For one, China developed robo-advisors years after the United States created them back in 2008. This explains why

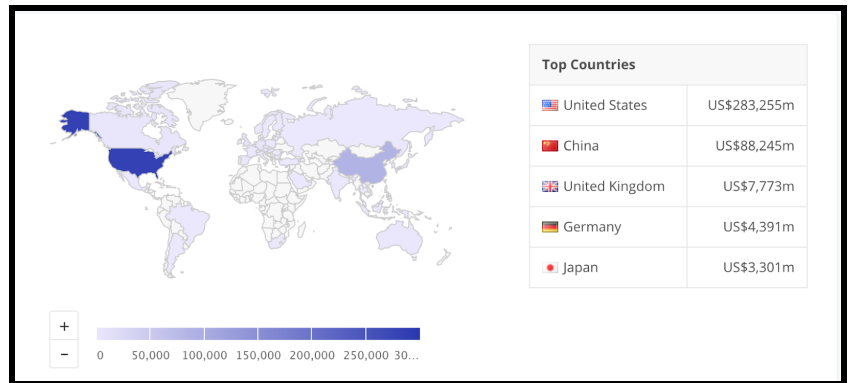


Figure 11. Top Countries with Most AUM (2018).

Source: <https://www.ironpaper.com/webintel/articles/banner-advertising-stats-and-trends-for-2017/>

they are still in the very early stages of adoption.²⁴ On top of that, different cultural attitudes exist. For example, rich investors who would otherwise have boosted China's AUM per user are distrusting of robo-advisors to manage their investments. In fact, only 11% of mainland China investors with investable assets of more than \$477,000 support the technology. In the United States, however, there has been more faith in robo-advisors. Moreover, Chinese investors in general tend to be much more involved in their investments, taking an active approach.²⁵ At the same time, the scarcity of Asian ETFs has dampened the development of the passive management approach which is a primary strategy used by robo-advisors. Lower regulation on capital flows and cheaper fees in US also make it more likely that the domestic robo-advisors have greater access to wealth than China.²⁶ This greater access, of course, isn't negligible. As explained in the earlier section, many older clients (Baby Boomers and Gen X) with large portfolio sizes are attracted by these lower fees thereby boosting assets under management significantly in US. These Baby Boomers and Gen X investors represent roughly $\frac{3}{4}$ of the affluent market with investable assets of at least \$100,000.²⁷ Still, China's second mover advantage, development of more robo-advisor platforms by FinTech firms, and fast growing middle class providing access to more wealth positions the country to grow very fast in metrics such as assets under management.²⁸ For instance, it's been forecasted that by 2022, China's AUM will outperform US's AUM (see Figure 12).

²⁴ Phoon, Kokfai, and Francis Koh. "Robo-Advisors and Wealth Management." *The Journal of Alternative Investments*, vol. 20, no. 3, 2017, pp. 79–94., doi:10.3905/jai.2018.20.3.079.

²⁵ Zhang, Maggie. "China's Super Rich Are Wary towards AI 'Robo Advisers', Preferring Humans Instead." *South China Morning Post*, 4 Apr. 2018

²⁶ O'Connell, Brian. "Robo-Advisors Are a Big Hit in U.S. - but Not so Much in Europe." *TheStreet*, 16 Feb. 2017

²⁷ "Boomers and Silents Represent 70% of the Wealth and Affluent Market." *Marketing Charts*, 24 Feb. 2017

²⁸ Rogers, Jonathan. "Digital China: March Of The Machines." *Global Finance Magazine*, 15 Feb. 2018

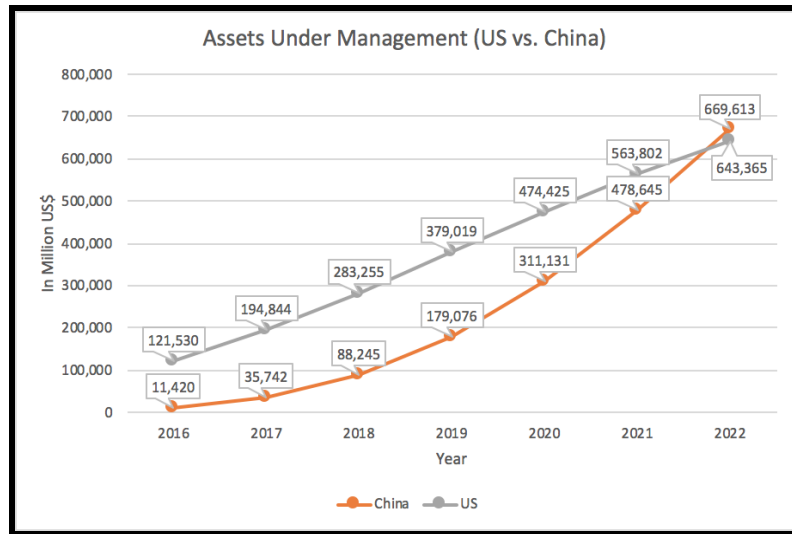


Figure 12. Assets Under Management - US and China (in millions of dollars) 2016-2022. Source: Author Generated

Market Shares and Key Participants

In this analysis, market shares will be based on the measure, assets under management (AUM)/transaction value. While market share has been traditionally calculated as sales as a percentage of an industry's total revenues, it makes sense to use assets under management/transaction value as a percentage of an industry's total assets under management/transaction values. Why? Assets under management/transaction value is a measure that is closely related to the function of revenue. Just as revenue can be thought of as the amount of money that is brought into the business from the sale of goods and services, assets under management depends on the flow of money coming in by selling or providing financial services. Transaction value can be another term used for assets under management and applies to industries where the value of transactions being executed determines the success of the financial service led primarily by consumer activity. In this case for robo-advisors, these services are managing assets for clients and therefore investor money flows in to provide these services. Furthermore, robo-advisor market shares will be compared to other industries within the FinTech industry primarily because the distinguishing factors here are on digitization and structural changes revolutionizing conventional financial services. Later in

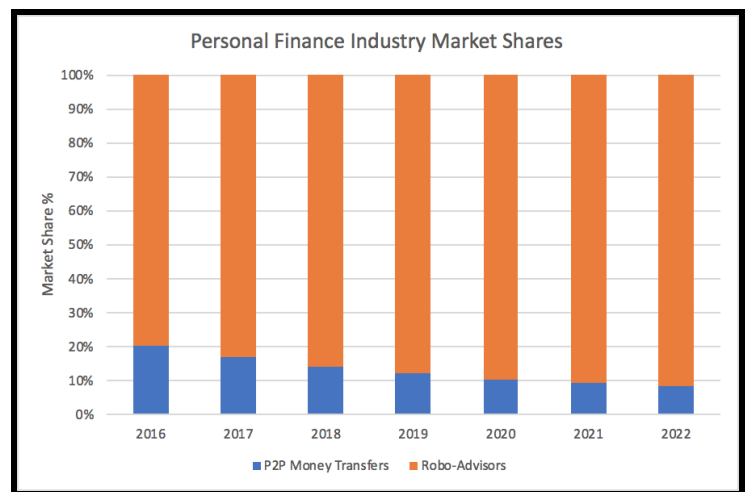


Figure 13. Personal Finance Industry Market Share Breakdown 2016-2022. Source: Author Generated

this paper, robo-advisor market shares will be analyzed in interaction with its traditional counterpart, financial advisors, to understand the interconnectedness between the two and perform comparative evaluations. As was established earlier, robo-advisors fall under the Personal Finance industry which also includes P2P Money Transfers. Market shares within this industry indicate that as of now, robo-advisors hold roughly 85% market share (see Figure 13). By 2022, this number increases to more than 90%. While P2P Money Transfers are in fact increasing in transaction value, the truth is that Robo-Advisors comprise a significant portion of the market and will continue to do so mainly because of stronger effects such as growing customer bases in China, the attractiveness of lower fees in US, and the possibility to developing an even stronger pool of millennial investors.

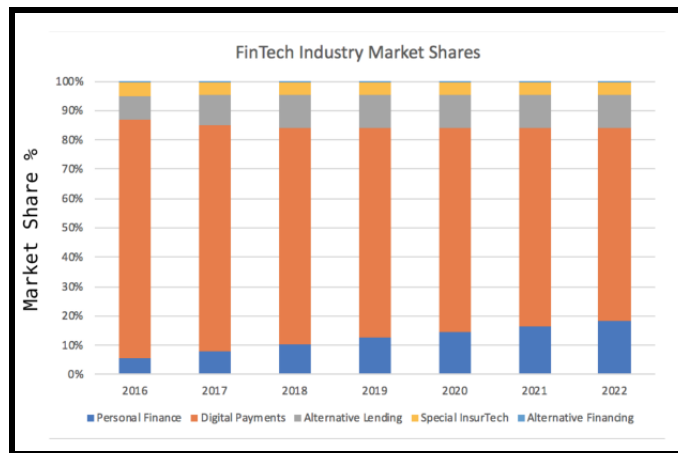


Figure 14. FinTech Industry Market Share Breakdown 2016-2022. Source: Author Generated

When comparing the Personal Finance industry to the other four industries in the overarching FinTech industry, results show that this industry is the only one to show significant market share gains over time when taking into account other industries (see Figure 14). Even if Digital Payments hold the greatest market share followed by a close tie between Alternative Lending and Personal Finance, Digital Payments starts to show noticeable declines in market share percentage over time and Alternative Lending stays relatively flat at 11%. Meanwhile, Alternative Financing stays flat at 1% and Special InsurTech flat at 4%. More importantly, it is the robo-advisor segment that contributes nearly 90% to the growth of Personal Finance. Therefore, robo-advisors are not only the fastest growing segment in Personal Finance, they are almost solely the reason why Personal Finance is the only growing industry in terms of market share compared to the other four industries under the FinTech umbrella.

After analyzing the robo-advisor segment in relation to other industries, it becomes imperative to learn how many robo-advisor platforms operate in each country around the world. According to Statista, the most recent data as of April 2017 shows that the United States leads the world in the number of robo advisors followed by Germany, United Kingdom, and China (see Figure 15). Why does United States have an advantage? Again, as explained earlier, different investment cultures by country play a role. There's also less regulation of robo-advisors and lower fees relative to other countries. For instance, robo-advisors in Canada charge on average a 0.4-0.5% fee compared to the U.S. 0.25% fee.

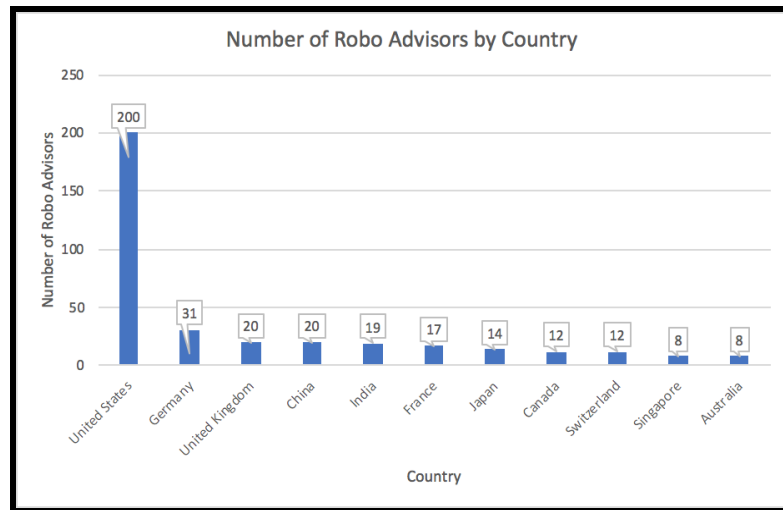


Figure 15. Number of robo-advisors by country (2017). Source: Author Generated

Next, key robo advisor platforms are identified based on their financial value of assets under management (see Figure 16). These robo-advisors were chosen because they have proven themselves to be market leaders and quite popular in the robo-advisor segment evidenced by their high AUM numbers. As it turns out, 90% of the top ten robo-advisors globally are from the US which is not surprising given the large amount of platforms present there domestically. The Vanguard Personal Advisor holds the greatest market share in the list followed by Schwab Intelligent Portfolios and Betterment. Each robo-advisor is also classified either as automated or hybrid. These categorizations will be explained in “Future Services”. An in-depth look into each of these robo-advisors will also be developed later on under “Robo-Advisor Offerings and Differences.”

Robo Advisor	Country	Automated/Hybrid	AUM (\$)
Vanguard Personal Advisor		Hybrid	101B
Schwab Intelligent Portfolios		Automated	27B
Betterment		Hybrid	13.5B
Wealthfront		Automated	10.2B
E-Trade Core Portfolios		Hybrid	3.9B
Wealthsimple		Hybrid	1.5B
FutureAdvisor		Automated	1.1B
Acorns		Automated	545.1M
Rebalance IRA		Hybrid	525.1M
Fidelity Go		Automated	186M

Figure 16. Robo-Advisors Ranked by AUM; Identified by Country, Type (2018). Source: Author Generated

Future Services

Looking ahead, robo-advisors have much to offer in the future based on growing trends and emerging opportunities. Here are three main things to look forward to in the future:

- Hybrid Robo-Advisors
- Improved Artificial Intelligence
- Expanded Robo-Advisor Applications

Hybrid Robo-Advisors

In contrast to fully automated robo-advisors (which use computer algorithms to build and manage a client's portfolio based on personal parameters such as risk and time horizons) that require little to no human interaction, hybrid robo-advisors are increasingly starting to gain prominence and importance in the market. This type of robo-advisor still offers automated investing but is also paired with access to a human financial advisor.²⁹ What are the benefits? Essentially, pairing the two strikes an optimal balance. This model utilizes the efficiency of automated investment management but also offers a personal touch which many individuals value. According to a survey, 56% of American investors value automated robo-advisors but the number jumps up to around 70% of investors who seek a blend of human and digital guidance.³⁰ Being able to talk to a human consultant could very well provide the much-needed advice to complement automation such as identifying important investment goals, understanding the best approaches during market volatility, learning customer behaviors, and guiding them through major life events and complex financial needs such as estate planning (arranging the transfer of assets to pass on to future heirs)³¹. Of course, when it comes to hybrid robo-advisor fees, they do come at a premium compared to purely automated robo advisors but are certainly cheaper than full-time human financial advisors. The trajectory for hybrids is also seen as more optimistic than "pure" robo advisors. By 2022, hybrids worldwide are expected to represent 66% of robo-advisory AUM compared to 25% for fully automated robo-advisors.³² Currently, the top hybrid robo-advisors are Vanguard Personal Advisor, Betterment, E-Trade Core Portfolios, Wealthsimple, and Rebalance IRA.

Improved Artificial Intelligence

As cognitive computing, big data, and behavioral analytics continue to improve, investment opportunities will become better matched to the needs of clients. Based on historic client behavior, artificial intelligence (AI) will be able to pick up patterns, adapt to changes, and provide necessary guidance. From gathering data about the choices the investor makes and from market

²⁹ Voigt, Kevin. "Robo-Advisor vs. Personal Financial Advisor: How to Decide." *NerdWallet*, 8 Oct. 2018

³⁰ Anderson, Tom. "Man vs. Machine: How to Figure out If You Should Use a Robo-Advisor." *CNBC*, CNBC, 13 Mar. 2017

³¹ Sin, Ray. "Robo-Advisors vs. Financial Advisors: Will Only One Remain? - Morningstar Blog." *Morningstar*, 24 July 2018

³² "Fully-Automated Roboadvisors to Manage Nearly \$1 Trillion Assets by 2022, Growing at 154% Per Annum." *Juniper Research*, 17 Jan. 2018

events, new investment products and services will be suggested as well.³³ One of the biggest caveats with artificial intelligence in robo-advisors as of now is the inability to deal with the emotional side of investing. However, there is hope that this will change and that AI will actually be able to assess investors' moods to be factored into investment decisions. For instance, sensing that clients are having a difficult time remaining calm during a turbulent and declining market will actually provide opportunities to convince them to hold their portfolios.³⁴ This would prove to be a major improvement from ultimately being controlled by users' emotional impulses to sell the assets completely. Furthermore, it is expected that artificial intelligence will enable robo advisors to be able to choose an investment strategy and then smoothly change strategies back and forth in real time without human interference. Lastly, machine learning will be leveraged by actually being able to predict changing market conditions and then optimizing strategies accordingly.³⁵

Expanded Robo-Advisor Applications

Existing wealth management services can be improved upon using the robo-advisor platform through digitization and by taking advantage of the technology's existing strength of cost effectiveness. As of now, very few robo-advisors assist in retirement planning for their clients and the vast majority focus on passive portfolio management. Using data analytics and simulations, the platform can become more involved in processes such as calculating actuarial (statistical) life expectancies to understand when the individual can start receiving retirement benefits. In the realm of estate planning, robo-advisor analytics and simulations can also help determine optimal intergeneration asset transfers from the client to their heirs and close ones with the most efficient tax structures. It is important to understand that clients in both retirement and estate planning tend to be very affluent, thereby making it a likely possibility that robo-advisors will pursue this to maintain and grow their existing affluent base rising from cheap fee structures. Though some robo-advisors are already helping their clients manage taxes through services such as tax loss harvesting, customized algorithms for global clients can be used to recommend asset/security combinations from different countries which are ultimately tax beneficial to clients depending on where they live. Finally, the technology can add insurance products to protect a client's' wealth and/or income.

³³ Spitz, Christian J. "How Artificial Intelligence Will Change the Role of Financial Advisors." *Accenture Capital Markets Blog*, 24 Jan. 2018

³⁴ Berman, Larry. "Financial Planning: The Future of Artificial Intelligence and Robo Advisors." *Berman's Call*, 27 Nov. 2017

³⁵ jklm. "Robo Advisors and the Business of Automated Advice." *Digital Innovation and Transformation*, 9 Apr. 2018

A Closer Look at Robo-Advisors

Underlying Mechanics

The purpose of this section will be to take an in-depth look into the asset allocation process of robo-advisors. This process can generally be divided into three sections: Evaluation, Selection, and Adjustment.

Evaluation

To initiate the process, clients first complete an online questionnaire that touches on areas such as investment needs, financial goals, and their willingness to take on risk. What's the purpose? Feedback from investors ultimately factors into the process of developing a tailored portfolio set up with defined investment goals, a particular risk category, and responsive portfolio breakdowns among asset classes. To get a better understanding of what particular questions are asked on the evaluation form, readily available questionnaires were extracted from Schwab Intelligent Portfolios, Betterment, Wealthfront, E-Trade Core Portfolios, and Fidelity Go (see Figure 17), compiled, and then analyzed to identify their respective similarities. Consequently, a generic client questionnaire was created that included questions which would more or less typically be asked by a robo-advisor. This questionnaire has ten questions, which is usually the average amount listed in this kind of survey.

With regards to the first question, robo-advisors mainly ask whether the investor's goal is to prepare for retirement, save for major expenses such as an education/vacation, a rainy day fund for emergencies, generate income to cover future expenses, or simply to build long term wealth. These are typically the options provided in order for the user to answer the question. Sometimes, robo-advisors may want the user to respond in terms of the risk they're willing to take (see Figure 18).

Robo-Advisor Client Questionnaire

1. What is your primary goal for this investment account?
2. How old are you?
3. What is your annual pre-tax income?
4. When will you need to start withdrawing money from your investment account?
5. How much do you want to invest to get started?
6. How much do you want to contribute each month?
7. Which account type would you like to open?
8. On a scale from 1 to 10, how high is your risk tolerance?
9. After investing for one year, which results would you be most comfortable with?
10. If your entire investment portfolio lost X% of its value in an n-month time period during a market decline, what would you do?

Figure 17. Generic Robo-Advisor Client Questionnaire. Source: Author Generated

What best describes your investing goal? Ⓞ

Avoiding losses while accepting lower returns

Keeping risk low while seeking modest returns

Seeking greater returns while taking on moderate risk

Maximizing returns while accepting potential large account value fluctuations

Figure 18. Investing Goal Risk-Based Answers. Source: E-Trade Core Portfolios Web Portal

Number 7 in the questionnaire asks what kind of account the investor would like to open. While there are a wide variety of accounts which can be selected from, options typically would be categorized into three types of accounts:

- Brokerage
- IRA
- Trust

Brokerage

A brokerage account is a taxable account which has no tax advantages. For example, income earned yearly from this account will not be exempt from any deductions. However, there are no rules that limit the amount and timing of the user's contributions and withdrawals to and from the account. This account usually can either be individual or joint. Individual brokerage accounts have only one user as the sole owner whereas joint brokerage accounts are co-owned with another individual or individuals. For joint brokerage accounts, a person's interest in the account transfers to the surviving owner(s) upon death.

IRA

IRA's are also known as Individual Retirement Accounts. They are typically utilized for users investing in growth for a long time horizon and who don't seek to use their investment money before retirement. IRA's are tax-advantaged and can provide tax savings for investors. On the flip side, there are contribution limits and penalties for premature withdrawals. This account usually can either be Traditional, Roth, or SEP. Traditional IRA's allow users to avoid paying taxes on their investment earnings until withdrawals are made. If income is below a certain level, then tax benefits could also be provided upon contribution to an account. With Roth IRA's, contributions are made that have already been taxed so withdrawals (except early withdrawals) can be tax-free. SEP IRA's or Simplified Employee Pension plan IRA's are for individuals who are either self-employed or are a sole proprietor of a small business. Contributions, like a Traditional IRA, can be tax deductible but taxed upon withdrawal. They also have a higher yearly contribution limit compared to Traditional or Roth IRA's and are easier to set up and maintain.

Trust

A revocable living trust is an account that the user would like to pass on to another individual after their death. This is a private legal arrangement that places the user's assets in trust during their lifetime and specifies where they would go upon death. The user can name themselves as the only trustee or can include their heir as a second trustee to manage the account if needed.³⁶

Questions 8-10 help define the user's risk profile. For question 8, a scale of 1 to 10 is incorporated for the user to manually select their risk tolerance, 1 being the least risk tolerant (minimize short-term losses) and 10 being the most risk tolerant (maximize total returns). This question can also be posed in different ways such as determining the amount of risk that the user is willing to take to keep up with inflation (reduction in purchasing power/increase in prices) or evaluating their attitudes towards high risk and volatility (see Figures 19 and 20).

How much risk are you willing to take to try and beat inflation? ☺

- Very low risk
- Some risk
- Moderate risk
- High risk

Figure 19. Risk Willingness vs. Inflation Question. Source: E-Trade Core Portfolios Web Portal

How do you feel about your portfolio value rising and falling if it could mean higher returns in the long run? ☺

- Very uncomfortable
- Uncomfortable
- Neutral
- Comfortable
- Very comfortable

Figure 20. Investor Attitude Gauge vs. Volatility Question. Source: E-Trade Core Portfolios Web Portal

The robo-advisor provides various scenarios as options for question 9 to determine the investment outlook most ideal for the user. These include sliders/graphs to determine the preferred amount of investment value gain/loss fluctuation (volatility) given an year in % and dollar terms (see Figures 21-24). If low fluctuation is selected, the user will likely have a low risk profile and vice versa.

³⁶ "What Type of Account Should I Open with Schwab Intelligent Portfolios®?" *Charles Schwab Intelligent Portfolios*, 25 Sept. 2017

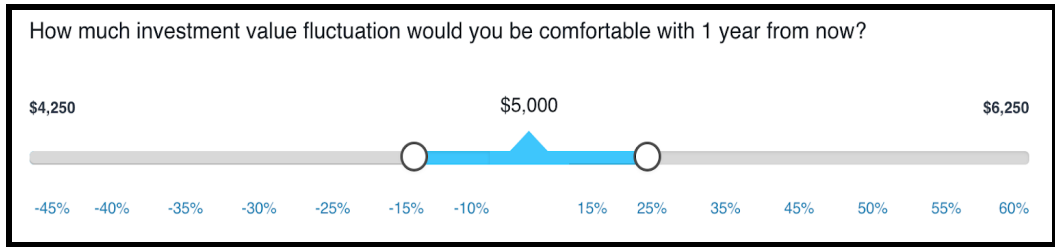


Figure 21. Investment Value Fluctuation Comfort Level. Source: Schwab Intelligent Portfolios Web Portal

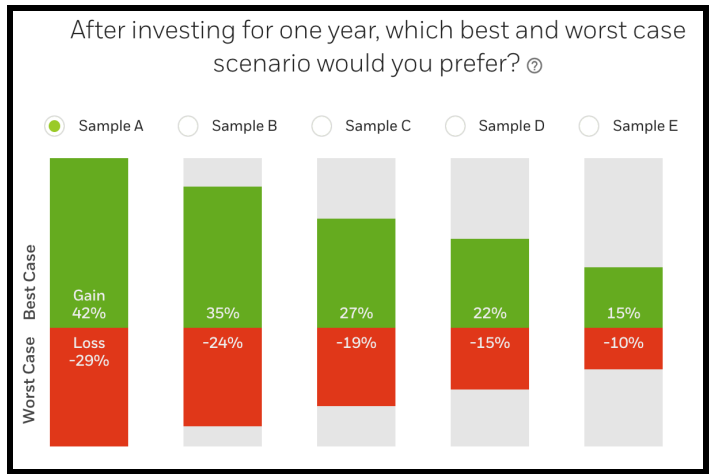


Figure 22. Best/Worst Case Volatility Scenarios. Source: E-Trade Core Portfolios Web Portal

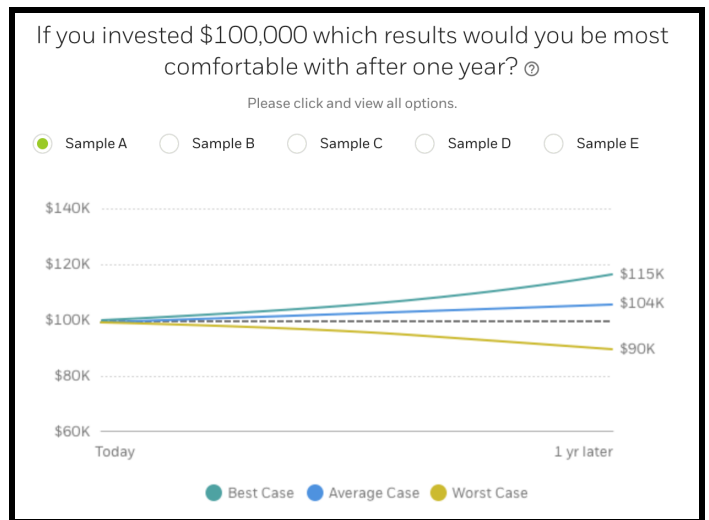


Figure 23. Best/Average/Worst Case Returns Scenario Picker - Sample A. Source: E-Trade Core Portfolios Web Portal

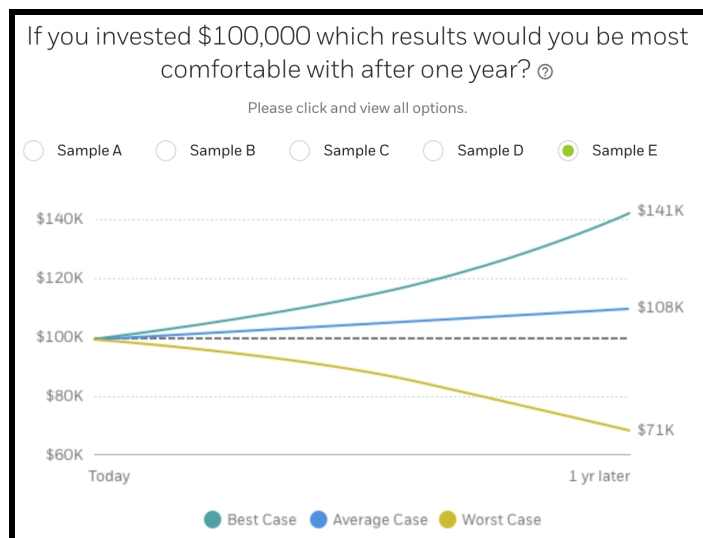


Figure 24. Best/Average/Worst Case Returns Scenario Picker - Sample E. Source: E-Trade Core Portfolios Web Portal

Finally, question 10 assesses the investor’s risk profile by posing the question so that the options available to select would represent behavioral responses. Hypothetically, users’ reactions are evaluated during a difficult time (when the market dips). In this case, if the user chooses to “Buy more” in response to the first question and “Do nothing” in response to the second question, then the user will likely have a high risk profile (see Figures 25 and 26).

If you were ever to experience a 20% decline or more in the value of your investments in one year, what would you do?

Sell everything

Sell some

Do nothing

Reallocate my investments

Buy more

Figure 25. Market Decline Behavioral Responses - Variation 1. Source: Schwab Intelligent Portfolios Web Portal

What would you do if your portfolio decreased 20% during a market decline, but you didn't need the money for 10 years? ☺

Do nothing

Move to less risky investments in 1 year

Move to less risky investments in 3 months

Move to less risky investments immediately

Figure 26. Market Decline Behavioral Responses - Variation 2. Source: E-Trade Core Portfolios Web Portal

Selection

After receiving inputs from clients, the robo-advisor then uses specialized, computer algorithms to select a customized portfolio based on investor requirements. Research shows that the algorithms utilized by robo-advisors are proprietary and therefore unknown to the public since

they are a commercial secret.³⁷ However, it is known that these formulas are derived from existing, well-known theories, models, and approaches. These primarily include:

- Modern Portfolio Theory
- Full Scale Optimization
- Black-Litterman Model

Modern Portfolio Theory

The Modern Portfolio Theory is an investment theory put forth by Harry Markowitz. This theory is based on the notion that investors can optimize their stock portfolios in order to maximize returns for their given level of market risk. Its central component essentially involves looking at the expected risks of a number of stocks and then

understanding how these risks play off one another. For instance, this includes analyzing stocks that

move in different directions given the same market conditions. In this way, investors can benefit from having a diversified portfolio by strategically positioning assets to reduce the portfolio's overall risk. With the theory's formulas, a relatively passive approach to investing is advocated.³⁸ Despite this, the theory shows that the risk of a portfolio cannot be entirely eliminated with diversification. For instance, the risk of an individual asset can be divided into either firm-specific and systematic risk.

Firm-specific risk refers to risk associated with a particular company but can be averaged out with diversification since the fluctuations of an asset's return caused by firm-specific news are independent. On the other hand, systematic risk cannot be eliminated because here, fluctuations in returns are dependent on *market* news like economic cycles and interest rate changes.

Through diversification then, risk can be reduced in a portfolio only if individual stocks have small correlations with the rest of the stocks in the portfolio. In other words, low correlations reduce portfolio risk since this indicates that each stock has a varying risk relative to other stocks thereby eliminating firm-specific risk. However, when calculating the expected return of a portfolio, the expected return of the portfolio essentially equals a weighted average (an average of values by taking into account each value's importance which is quantified) of the expected returns using individual stocks. Therefore, this makes it possible for diversification to yield high returns but also lower risk or volatility. Furthermore, Figure 27 shows that increasing the number of securities in a portfolio can reduce firm-specific risk significantly.

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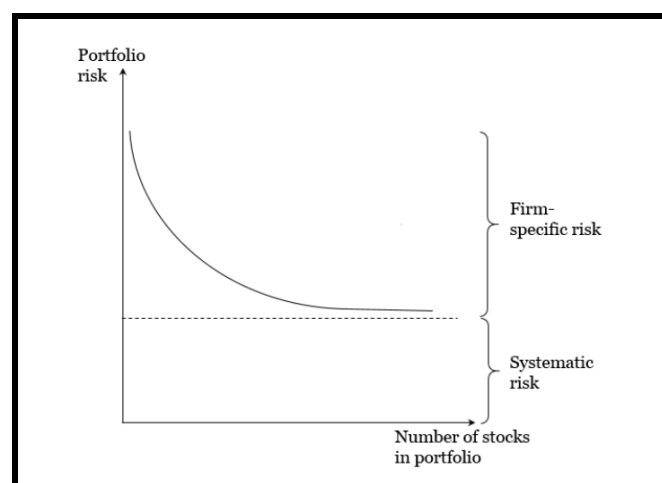


Figure 27. Firm-Specific Risk Reduction With Increasing Security Amounts.
Source: https://brage.bibsys.no/xmlui/bitstream/handle/11250/2473732/17822_FULLTEXT.pdf?sequence=1

³⁷ Ivanov, Oleskii, et al. "Implementation of Robo-Advisors Tools for Different Risk Attitude Investment Decisions ." p. 3.

³⁸ Soroker, Tali. "How Using A Robo Advisor Will Make Your Portfolio More Valuable." *I KnowFirst*, 28 Oct. 2017

One key framework included in the Modern Portfolio Theory is the concept of mean-variance optimization. This is a key strategy to developing optimal portfolios. According to the idea, two measures are required to understand this concept.

First, an expected portfolio return is calculated by performing a weighted average of individual security returns. Next, a portfolio's variance is similarly computed by finding the weighted average of individual security variances. Variance can be thought of as a measure of risk or volatility. Assuming investors seek higher expected returns and lower variances, the optimal portfolio can be constructed by essentially solving a quadratic equation to maximize the expected return for a certain target variance. Maximizing expected returns for every possible target variance provides an efficient frontier. Where does diversification come into play here? By adding more assets to a portfolio, diversification can be increased and thereby improve the efficient frontier. Figure 28 represents the efficient frontier as a line that represents optimal portfolios for a given expected return and volatility.³⁹ If portfolios fall below this line, they are not optimized.

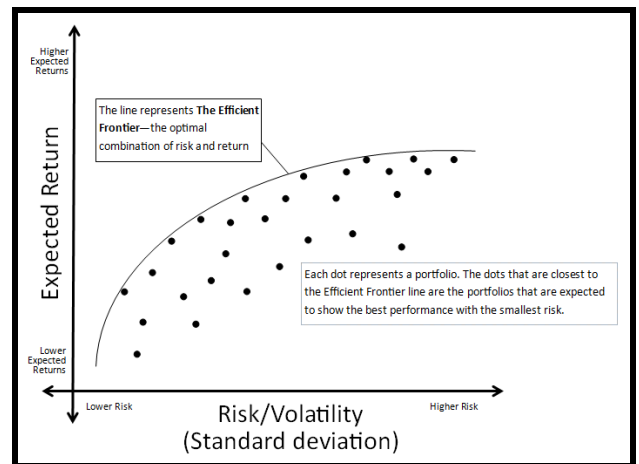


Figure 28. The Efficient Frontier

Source: http://www.gettingyourrich.com/uploads/1/2/0/5/12058968/sh_-_what_is_the_efficient_frontier_theory.pdf

Full Scale Optimization

Mean-variance optimization, as explained earlier, unfortunately has disadvantages. When calculating individual asset expected returns to be factored into the computation of a portfolio's expected return, periodic returns for the assets (or returns calculated for a specific time interval in the assets' history of returns) are ignored and assumes that the distribution of the expected returns are not skewed (asymmetric). In reality, returns are extreme (take the financial crisis of 2007-2008, with returns skewed to the left). Variances of individual assets also suffer from this flaw in a similar way. Furthermore, mean-variance optimization assumes that clients are indifferent to gains and losses. In reality, investors avoid risk when gains exist and seek risk when losses exist. Moreover, preferring to avoid losses outweigh seeking gains, a concept known as loss aversion. Therefore, many possible outcomes of investor preferences can be generated by tweaking the degree of loss aversion and tendencies to avoid risk as well as seek risk. With full scale optimization, any set of return distributions (skewed, normal (symmetric), etc.) and investor preferences can be accommodated. *True* optimal portfolios can therefore be generated rather than the mean-variance *approximate* optimal portfolios.

Black-Litterman Model

³⁹ Hari, Smitha. "What Is the Efficient Frontier Theory?" *Getting You Rich*, 18 June 2015

Another downside to mean-variance optimization is that the optimal portfolios generated have unreasonable portfolio weights. For instance, large weights are assigned to only a few assets with zero weights to a majority of assets. This is caused by extreme sensitivity to asset return assumptions as well as the difficulty of estimating asset returns. These imbalanced weights ultimately are unlikely to provide enough diversification benefits in the long run. To resolve this issue, the Black-Litterman model calculates expected individual asset returns using equilibrium returns and the views of investors. How are equilibrium returns calculated? A process known as reverse optimization is used to calculate what an asset's expected return should be in order for mean-variance optimization to generate an optimal portfolio where the asset's weight equals its weight in a market portfolio (a bundle of all types of assets in the world, with each asset weighted according to its market capitalization (weight)). If an investor believes the expected asset return differs from what the market calculates it to be, expected returns are adjusted. Adjustments can also respond to the degree of confidence an investor has in their own beliefs. Otherwise, expected returns equal equilibrium returns. From there on, these expected return estimates can be factored into the mean-variance optimization model to obtain the efficient frontier. One downside to this approach, however, is that it is often difficult to identify the market portfolio.⁴⁰

According to a study in 2017 (see Figure 29), nearly 41% of robo-advisors actually end up incorporating the Modern Portfolio Theory, 4.5% use the Black-Litterman model, and 2.3% use Full Scale Optimization.⁴¹ Taking out the 31.8% of robo advisors who have not specified a methodology, these numbers change significantly. Now, 60% of robo-advisors reporting their methodology use the Modern Portfolio theory, 6.6% use the Black-Litterman model, and 3.4% use Full Scale Optimization.

After completing the questionnaire, users are navigated to a separate page which shows the algorithm-generated portfolio tailored to their needs. What does this look like? After analyzing "results" pages for each of the five robo-advisors introduced earlier, the E-Trade Core Portfolios was the one robo-advisor that was deemed to be the most optimal for understanding the essential layout of this final page. It encompasses more or less the same elements that would be found on the other four robo-advisor sites and unlisted robo-advisors in this paper as well. Figures 30 and 31 show these visualizations. Based on these images, users can expect to see the response structured in three parts: risk assessment, portfolio allocation breakdowns, and hypothetical returns given the tailored portfolio.

⁴⁰ Bjerknes, Line, and Ana Vukovic. "Automated Advice: A Portfolio Management Perspective on Robo-Advisors." June 2017, pp. 14–23.

⁴¹ Gavhane, Prashant. "Portfolio Management:- Which Algorithms Do Robo-Advisor Use?" *LinkedIn*, 14 Apr. 2017

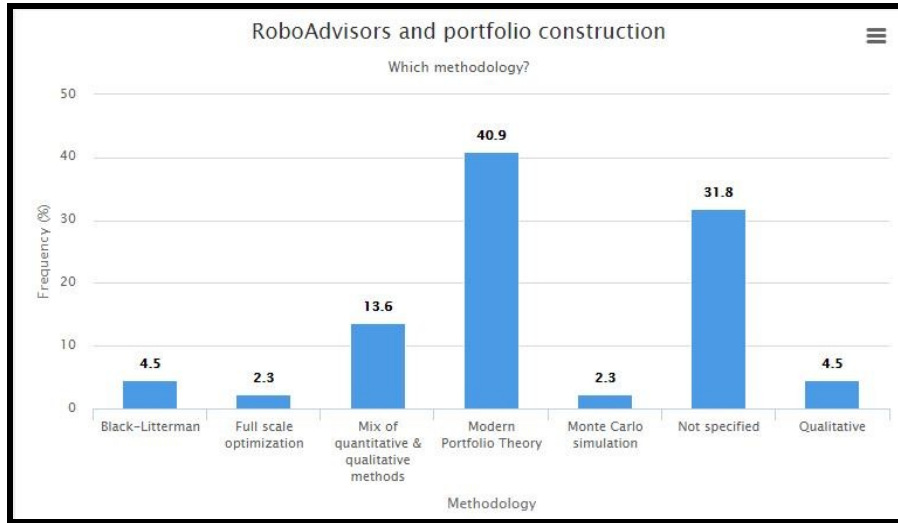


Figure 29. Percent of Robo-Advisors using the Modern Portfolio Theory, Black-Litterman Model, and Full Scale Optimization. Source: <https://quant.stackexchange.com/questions/21149/which-algorithms-do-robo-advisors-use>

Risk Assessment

In Figure 30, it can be seen that E-Trade Core Portfolios describes the user’s risk profile in two-three key words (e.g. “optimistic, yet cautious”) and then provides a short description explaining what these words mean. In this scenario, the client would be considered to have a moderate risk tolerance since they are looking to grow their money but do not want to take excessive risk. Risk profiles do not necessarily have to be provided in this manner. For instance, Schwab Intelligent Portfolios, Betterment, Wealthfront, and Fidelity Go either rate risk tolerance on a scale from 1 to 10, with 1 being the least tolerant and 10 the most tolerant, provide simply one word describing the user either as conservative, moderate, or aggressive and to what extent, or place their tailored portfolios on a scale ranging from low risk and return potential to high risk and return potential.

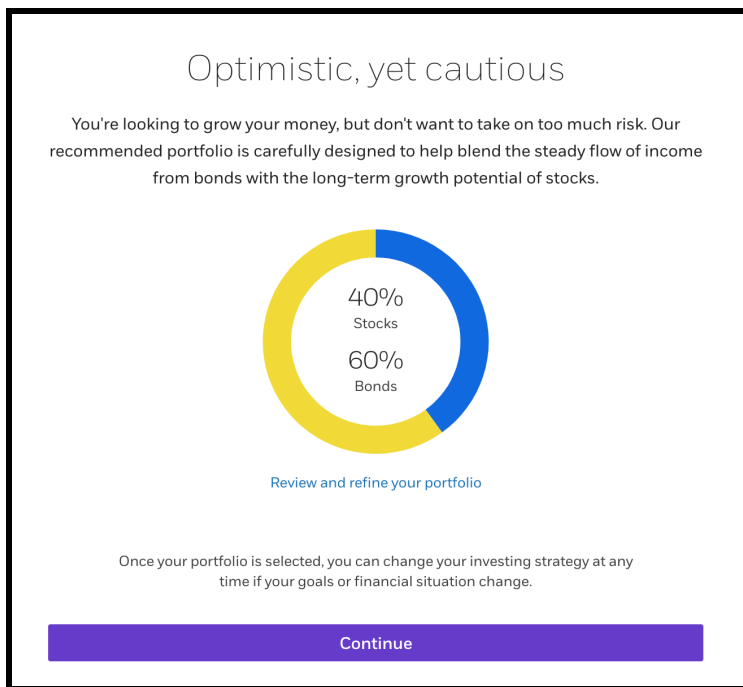


Figure 30. E-Trade Core Portfolios Investor Risk Profile and General Portfolio Allocations.
Source: E-Trade Core Portfolios Web Portal

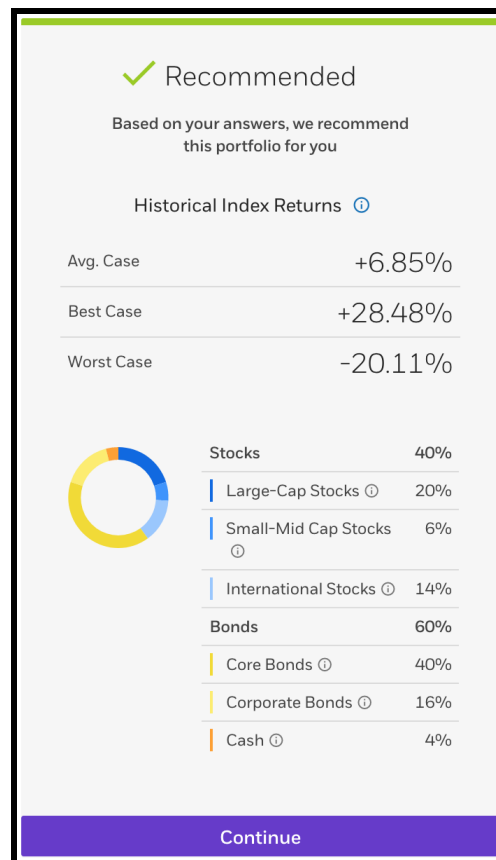


Figure 31. E-Trade Core Portfolios Detailed Portfolio Allocations and Hypothetical Portfolio Returns.
Source: E-Trade Core Portfolios Web Portal

Portfolio Allocation Breakdowns

Next, the user's portfolio would be segmented into different asset classes. Generally, robo-advisors would allocate available funds into either stocks or bonds. Occasionally, some of the platforms would also add another separate asset class such as cash or commodities (precious metals). Within the stock asset class, funds would be allocated to either large-cap stocks (market value of \$10 billion or more), small-mid cap stocks (market value between \$500 million and \$10 billion), and international stocks (foreign stocks from countries with established markets). Sometimes, domestic or international exchange-traded REIT's (real estate investment trusts, or companies that finance/operate income-producing real estate) may even be included. Other robo-advisors break down international stocks into foreign stocks and emerging market stocks. Still, large-cap stocks could also be called dividend stocks and US stocks could be its entire separate class within the stock asset class by just investing in US corporations. The bond asset class can be broken down into core bonds (low-risk debt backed by the government, mortgages, etc.), corporate bonds (riskier debt issued by corporations), or cash (money market funds).

Breakdowns of core bonds could consist of US government bonds, TIPS (treasury inflation-protected securities), municipal bonds, and securitized bonds (backed by the cash flows of a particular asset). Bonds can additionally be either domestic or international just like stocks. Typically, investments in portfolios generally consist of ETFs or exchange traded funds, with the exception of very few robo-advisors such as Fidelity Go using mutual funds for their investments. Why ETFs? By using them, robo-advisors have the ability to create a diversified, risk-adjusted portfolio for their clients, largely mimicking the Modern Portfolio Theory that many robo-advisors are based off of. By investing in ETFs, for instance, there would be a broad exposure to a collection of stocks or bonds minimizing the risk compared to just a portfolio with a single stock. Additionally, robo-advisors incur low costs of managing a portfolio created solely with ETFs. Because of these cost savings, clients would typically experience lower management fees as well (on average between 0.3-0.5% compared to 1% or more for mutual funds).⁴² ETFs generally chosen come from investment management companies such as Vanguard, Blackrock, Schwab, SPDR, and Invesco.

Hypothetical Returns

Finally, the user would be able to view speculative returns based on the portfolio that was constructed by algorithms. Figure 31 shows this by displaying the historical index returns. How is this calculated? Essentially, a weighted average is calculated using the weights determined for each asset class in the portfolio as well as market index historical returns representing each asset class. What are market indexes? Most robo-advisors utilize ETFs as investments comprising the entire portfolio. An essential component of these ETFs are their ability to track a broader index as their benchmark in order to mimic their performances. For instance, the small-mid cap stock asset class would track an index such as the S&P SmallCap 600 Index which measures the small-cap segment of the U.S. equity market.⁴³ The returns that are displayed, however, assume that any dividends paid out are reinvested and are rebalanced twice a year (a discussion of rebalancing is explained shortly). All three returns shown in the figure are returns in an year, or a 12-month time period. The best and worst cases use a rolling 12-month period with a one-month moving time step. Other hypothetical returns could be shown on a graph over time with average case, best case, and worst case being called average market, strong market, and poor market respectively. These returns tend to be represented cumulatively and therefore, twenty years down the road, returns could very well be greater than 100%. However, a range of returns is given to the client for bear and bull case scenarios in a 12-month period with an average annual return. Finally, clients may even directly be provided future values of their portfolio in dollar terms over time in a weak and average market. These values can be calculated by first creating a hypothetical portfolio of *indexes* with similar asset allocations to show its performance. For instance, a portfolio with a 80% bond, 20% stock allocation would have a comparable portfolio of indexes with these same allocations. Magnitude of values ultimately depend on the amount of money contributed to the

⁴² O'Connell, Brian. "Are Robo-Advisors And ETFs a Match Made in Heaven?" *TheStreet*, 1 Nov. 2017

⁴³ "Core Portfolios - Asset Classes and Benchmark Indexes." *ETRADE*, 2018.

account and assuming non-withdrawals occur until the withdrawal date specified by the user. Again, historical data would be used and then many simulations would be run for the hypothetical portfolio under many market conditions. One caveat, however, with these numbers is that they are all conjectural and so do not represent actual performance of these custom portfolios. They are used only for an overview demonstration, help set expectations, and sometimes, do not take into consideration important factors such as past portfolio allocation changes as well as deduction of fees and other charges. Therefore, actual returns will be different and the projections do not guarantee investment performance.

Adjustment

Even after users deposit funds into their tailored portfolios after account creation, not everything is set in stone. Stock markets can move unpredictably over time, especially with market corrections. This may cause relative, pronounced gains or losses in several different asset class or classes comprising the portfolio throwing off asset allocations from the initial set-up. For example, if the stock market makes sizable gains over a period of time, then a 50%/50% allocation between stocks and bonds respectively could shift to a 70%/30% allocation. What happens here is that now the investor is exposed to more downside risk if the market actually corrects itself. This can be especially frustrating for individuals who are not willing to tolerate large amounts of risk. Therefore, robo-advisors rebalance or realign investors' portfolios automatically using proprietary algorithms so that their asset allocations do not deviate from their original positions.⁴⁴ Rebalancing is performed by buying/selling assets that are over/underrepresented in the portfolio. This is done through selling or reducing the holdings in stocks that have increased in value while buying stocks that have decreased in value, or buying low and selling high. Because of this, rebalancing can often generate gains as well, called rebalancing bonuses. This phenomenon can also occur if investors re-adjust their goals (e.g. by updating their retirement age and thereby changing the date at which funds need to be withdrawn), their risk tolerance (choosing to tolerate more risk with increased confidence in the stock market), or for instance, simply by approaching closer to their goals after customized portfolio creation. Rebalancing, by in large, costs nearly nothing, however, capital gains taxes may have to be paid out with the sale of appreciated assets (assets risen in value) depending on the account (a discussion of the types of accounts was discussed earlier). Additionally, there could be transaction costs for ETFs such as brokerage commissions and bid-ask spreads (the difference between the price that you can buy a fund and the price you can sell the fund). Algorithms, however, are employed to minimize these expenses during the process of rebalancing. How often does rebalancing occur? It is all up to the user. Reverting investments back to a target allocation can be done every three months, six months, annually, etc. This is called calendar rebalancing, the simplest and most common rebalancing strategy among investors and wealth managers. However, intermediate fluctuations in asset allocations are not accounted for in drift (or deviation) during the time of rebalancing. The other type of rebalancing is called

⁴⁴ Wohlner, Roger. "Automatic Rebalancing: Everything You Need to Know." *Investor Junkie*, 13 July 2018

market-based rebalancing (also called opportunistic or threshold-based rebalancing). Rather than realigning the portfolio at set intervals, drift is continuously monitored. Whenever drift exceeds a pre-set percentage, rebalancing is triggered. Variations in both these strategies with regards to the level of drift that triggers readjustment and how far the portfolio is rebalanced to target asset allocations result in hybrid rebalancing strategies.

To ensure consistency with this section, research was done to understand which rebalancing strategy each of the five robo-advisors utilize (Schwab Intelligent Portfolios, Betterment, Wealthfront, E-Trade Core Portfolios, and Fidelity Go). All these robo-advisors mainly perform market-based rebalancing or share its features which is logical partly due to the fact that computers do have the capability especially today to continuously monitor the portfolio for any deviations. Everyday, portfolios are inspected for drift by a proprietary algorithm. To understand how drift is calculated, consider a simple example. Table 1 below shows a hypothetical portfolio with four asset classes.

Table 1. Hypothetical Portfolio Containing Stocks and Bonds With Four Specific Asset Classes

Asset Class	Number of shares	Price per Share	Value (Number of Shares x Price per Share)	Weight (Value of Each Asset Class/Total Portfolio Value)
US Bonds	200	\$40	\$8,000	23.2%
International Bonds	400	\$25	\$10,000	29%
US Stocks	300	\$45	\$13,500	39.1%
International Stocks	100	\$30	\$3,000	8.7%
Total Portfolio Value	-	-	\$34,500	100%

Now suppose some price movement occurs (see Table 2):

Table 2. Hypothetical Portfolio Post-Price Movement Results and Changes

Asset Class	Number of shares	Price Move	New Price per Share	New Value (Number of Shares x Price per Share)	New Weight (Value of Each Asset Class/Total Portfolio Value)	Change in Weight
US Bonds	200	5%	\$42	\$8,400	27.1%	3.9%
International Bonds	400	-15%	\$21.25	\$8,500	27.4%	-1.6%
US Stocks	300	-20%	\$36	\$10,800	34.8%	-4.3%
International Stocks	100	10%	\$33	\$3,300	10.7%	2%
Total Portfolio Value				\$31,000	100%	

Clearly, each asset class weight has changed due to these price movements. To allow for understanding, portfolio drift could be calculated in simpler terms as follows (see Table 3):

Table 3. Portfolio Changes and Absolute Changes in Weight for Portfolio Drift Calculation

Change in Weight	Absolute Change in Weight
3.9%	3.9%
-1.6%	1.6%
-4.3%	4.3%
2%	2%

Total Absolute Change in Weight: $3.9\% + 1.6\% + 4.3\% + 2\% = 11.8\%$

Since the four asset classes fall under two broader categories, stocks and bonds:

$$11.8\% / 2 = \mathbf{5.9\%}$$

Thus, 5.9% is the drift of the portfolio after taking into account price movements of each asset class.

To reduce drift, market-based rebalancing can occur in these three cases:

- Cash Flow Rebalancing
- Sell/Buy Rebalancing
- Allocation Change Rebalancing

Cash Flow Rebalancing:

Whenever there is a cash deposit, withdrawal, or accrual of portfolio dividends (fund payouts), proceeds are used to invest in underrepresented asset classes or come from selling overrepresented asset classes with withdrawals. If a user auto-deposits or receives dividends, robo-advisors use these cash inflows to buy underweight asset classes in order to reduce drift (in the above example, these would be US Stocks and International Bonds). Because this reduces the need to sell appreciated asset classes, capital gains taxes on proceeds are avoided. On the other hand, overrepresented asset classes such as US Bonds and International Stocks here would be sold if cash withdrawals become a priority.

Sell/Buy Rebalancing:

This happens whenever portfolio drift deviates by more than a specified amount. When cash flows (deposits, dividend reinvestments, or withdrawals) do not occur in a robo-advisor account, assets that are already in the portfolio are reshuffled through selling and buying. If cash flows are not sufficient to keep drift within a tolerance level, then some overweight asset classes are sold and the resulting proceeds are used to buy underweight asset classes to eliminate the drift. For example, refer back to Tables 1-3. Under Sell/Buy Rebalancing, US Bonds would be sold first until its weight returns back to 23.2% because this asset class increased the most in terms of change in weight. Next, International Stocks would be sold until 8.7% weight is achieved since this was the second class that also experienced gains in weight, but not as much as US Bonds. Proceeds from the sales of these classes are reinvested and first used to buy shares of the US Stocks class since it is the most underweight followed by International Bonds until target weights of 39.1% and 29% are once again accomplished. It is important to note however that sometimes, reverting back to target weights fully is not possible especially if an account is small and fractional shares are needed to satisfy this goal but the robo-advisor in question does not support this capability.

Allocation Change Rebalancing:

If a client changes their investment goals, time horizon, and/or risk preferences, then the portfolio strategic allocation will consequently change.⁴⁵ For instance, an investor may decide to tolerate less risk or become more conservative after losing confidence in the market which can then be updated in the platform. To rebalance the portfolio, securities would be sold and capital gains (profits from sales of assets) could thereby be realized as well, potentially subject to taxation.⁴⁶ In this scenario, executing trades such as selling shares of International Stocks in favor of US Bonds could be a likely possibility to satisfy the client's changing attitude and the new target allocation.

Robo-Advisor Offerings and Differences

⁴⁵ Bjerknes, Line, and Ana Vukovic. "Automated Advice: A Portfolio Management Perspective on Robo-Advisors." June 2017, pp. 33-36.

⁴⁶ "How and When Is My Portfolio Rebalanced?" *Betterment*

Next, the top ten robo-advisors by AUM from Figure 16 were researched to better understand what each offered and how they compared to each other. Figures 32 and 33 display this information below.






Robo Advisor					
Account Minimum	\$50,000	\$5,000	\$0 for Betterment Digital, \$100,000 for Betterment Premium	\$500	\$5,000
Account Management Fee	0.3%, Discounts available on balances above \$5 million	0%	0.25% for Betterment Digital, 0.4% for Betterment Premium	0.25%	0.30%
Investment Expense Ratios	0.04% - 0.12%	0.06% - 0.20%	0.13%	0.08%	0.03% - 0.11%
Account Fees	\$20 service fee annually, transaction fees may be incurred	\$0	\$0	\$0	\$0
Portfolio Mix	Mutual Funds and ETF's	ETF's	ETF's	ETF's, A mutual fund and individual stocks held in larger accounts	ETF's
Accounts Supported	Brokerage accounts, IRA's, Trusts	Brokerage accounts, IRA's, Trusts	Brokerage accounts, IRA's, Trusts	Brokerage accounts, IRA's, Trusts, 529 college savings plans	Brokerage accounts, IRA's
Tax-Loss Harvesting	Yes, on a client-by-client basis	Yes, on accounts with AUM of at least \$50,000	Yes	Yes	No
Automatic Rebalancing	Yes, once per quarter usually	Yes	Yes	Yes	Yes
Customer Support	Access to Vanguard financial advisors with AUM under \$500,000, Access to an individualized personal advisor with AUM \$500,000 or more	Phone and live chat support	Phone, email, and live chat support, All customers receive financial advisor consultation with in-app messaging, Premium customers get financial advisor access through phone	Phone and email support	Phone support

Figure 32. Robo-Advisor Offerings and Differences (Part 1). Source: Author Generated






Robo Advisor					
Account Minimum	\$0 for Wealthsimple Basic, \$100,000 for Wealthsimple Black	\$10,000	\$0 to open account, \$5 to invest	\$100,000	\$0 to open account, \$10 to invest
Account Management Fee	0% - 0.4%	0.5% for Premium, Portfolio Analysis free	\$1/month for a taxable account, \$2/month for an IRA account	0.50%	0.35% for retirement accounts, up to 0.4% for taxable accounts
Investment Expense Ratios	0.10%	0.15%	0.10%	0.15%	Included in management fee
Account Fees	\$0	Varies	\$0	\$250 setup fee per account	\$0
Portfolio Mix	ETF's, Plus individual stocks for halal portfolios	ETF's	ETF's	ETF's	Mutual Funds
Accounts Supported	Brokerage accounts, IRA's, Trusts	Brokerage accounts, IRA's	Brokerage accounts, IRA's	Brokerage accounts, IRA's	Brokerage accounts, IRA's
Tax-Loss Harvesting	Yes	Yes	No	No	No
Automatic Rebalancing	Yes	Yes	Yes	Yes, twice a year, \$50-\$70 per rebalance	Yes, but done by investment managers
Customer Support	Phone and email support, customer support calls can be scheduled with a financial planner	Access to financial advisors via chat, email, and phone	Phone and email support	Phone and email support, one live meeting with a consultant per year	Phone and live chat support

Figure 33. Robo-Advisor Offerings and Differences (Part 2). Source: Author Generated

In order to completely understand what is being portrayed, it is necessary to explain some concepts, terms, and cases special to specific robo-advisors. The account minimum essentially states how much is needed to open an account. On top of that, some robo-advisors like Acorns and Fidelity Go are free when it comes to account creation, however the service needs a small amount of funds in order for investment management to initiate. Furthermore, the account management fee is usually expressed as an annual percentage of assets under management. In exceptional cases however, like Acorns, the management fees are a flat rate (here, charged every

month). In Vanguard Personal Advisor, the fee is 0.3%, however discounts are given for balances above \$5 million. For example, the fee drops down to 0.2% for balances between \$5 million and \$10 million, 0.1% from \$10 million to \$25 million, and 0.05% above \$25 million. For Wealthsimple, these fees can vary. Why is this? It all depends on the AUM for each account. For instance, if investors have balances from \$0 to \$5,000, then fees are 0%. With \$100,000 or less, the fees jump up to 0.5% but above \$100,000, fees are 0.4%.⁴⁷ For FutureAdvisor, portfolio analysis services are free. These include personalized recommendations on an investor's portfolio through analysis and trade recommendations based on the Modern Portfolio Theory. The free service also reminds investors to rebalance.⁴⁸

Account management fees are one area where clients will be charged, but investment expense ratios add on to the total cost as well. What are investment expense ratios? Expense ratios are the percentages of total assets that are required to operate a fund. This is determined annually by dividing a fund's operating expenses by the value of assets under fund management. Operating expenses eat into a fund's return to investors and therefore lower ratios are preferred. These expenses usually include a fee paid to the fund's manager, record-keeping, custodial services, legal expenses, taxes, and auditing and accounting fees. A 12b-1 fee is included as well, which covers marketing, advertising, and distribution services.⁴⁹ Some of the robo-advisors in the table have ranges of expense ratios. These essentially represent the low and high ranges of funds' expense ratios within the portfolio. Charles Schwab Intelligent Portfolios, on the other hand, is an exception. Their account management fee is 0%, however, expense ratios still have to be paid. The reason for the range in ratios displayed is different. In fact, it is based upon how risky the portfolio is. Based on initial recommended portfolio allocations, a low risk, conservative portfolio has operating expense ratios, on average, of 0.06%. Moderate-risk portfolios have ratios of 0.15% and aggressive, high-risk portfolios charge 0.2%.⁵⁰ In Fidelity Go, these ratios are included in the account management fee.

In addition, there are separate account fees. These fees are incurred when accounts are opened, withdrawn from, or closed. If investments need to be transferred from one firm to the robo-advisor platform, then transfer fees could be charged as well. Account maintenance fees are also included in this category. Finally, transaction fees can also be included associated with the trading of funds. For Vanguard Personal Advisor, an annual \$20 service or maintenance fee is charged along with transaction fees. Rebalance IRA charges a \$250 account opening fee. FutureAdvisor does have varying account fees and these are primarily attributed to transaction fees that could be charged.

⁴⁷ "Everything You Need to Reach Your Goals." *Vanguard*

⁴⁸ O'Shea, Arielle. "FutureAdvisor Review 2018." *NerdWallet*, 28 Feb. 2018

⁴⁹ Nordmeyer, Billie. "Investment Expense Ratios." *Zacks*, 21 Nov. 2017

⁵⁰ Yochim, Dayana. "Schwab Intelligent Portfolios Review 2018." *NerdWallet*, 11 Jan. 2018

As discussed earlier, portfolio mixes largely consist of ETFs for robo-advisors. This is in fact the case here however there are exceptions. Vanguard Personal Advisor also holds mutual funds and Fidelity Go just holds mutual funds. In Wealthfront, ETFs are held but accounts with balances that exceed \$100,000 will have portfolios that also include individual stocks and their proprietary mutual fund.⁵¹ While Wealthsimple invests in ETFs, it also offers halal portfolios as a part of their product line which comply with Islamic law. These portfolios contain 100% equities, around 50 individual stocks that are screened by Shariah scholars, and are designed to track the broad market's performance. Interest-bearing assets like bonds are not invested in since they are not allowed under the law.⁵²

Next, the "Accounts Supported" section lists what types of accounts can be created under the specific robo-advisor platform. Most often, these types include Brokerage, IRA's, and/or Trust accounts. An explanation of each can be found in the previous subsection. For Wealthfront, however, the platform also supports 529 college savings plans. These accounts are tax advantaged designed to save and invest for college education expenses. Investments here grow federal income tax-deferred (taxes paid at a future date rather than in the period when they are incurred) and can be withdrawn federal income tax free when they are used to pay for the education expenses. State income tax deductions for contributions to the account may also be provided by some states.⁵³

Tax-loss harvesting, in this case, is automated selling of funds in a portfolio in order to incur losses that offset capital gains or taxable income.⁵⁴ Charles Schwab Intelligent Portfolios does not offer this service for free to all customers unlike other robo-advisors, rather requiring a minimum balance of \$50,000. Vanguard Personal Advisor is a hybrid robo-advisor and so tax-loss harvesting is not automatic, rather on a client-by-client basis.

Automatic rebalancing, discussed in "Underlying Mechanics", is usually market-based. However, Vanguard Personal Advisor utilizes calendar rebalancing by rebalancing only four times a year, or once a quarter usually. Furthermore, Rebalance IRA also undertakes calendar rebalancing by performing it twice a year. However, it also charges \$50-\$70 per rebalance compared to other robo-advisors who offer rebalancing for free. Finally, while Fidelity Go is considered to be primarily an automated robo-advisor according to Figure 16, there is a slight human element when it comes to rebalancing where a team of human advisors carry out this responsibility.

As far as customer support goes, assistance can be provided either through live chat, phone, or email for account-specific questions, understanding investment methodologies, and for tailored investment portfolios. On top of that, robo-advisors like Betterment offer their basic customers an

⁵¹ O'Shea, Arielle, and Andrea Coombes. "Wealthfront Review 2018." *NerdWallet*, 5 Jan. 2018

⁵² Yochim, Dayana. "Wealthsimple Review 2018." *NerdWallet*, 5 Jan. 2018

⁵³ "What Is a 529 Plan?" *Wealthfront Support*, 1 Mar. 2018

⁵⁴ "Robo Tax Loss Harvesting." *Investopedia*, 4 July 2018

informal financial advisor consultation through mobile messaging. Wealthsimple clients, in addition, may also get a 15-minute call for the standard service to gain a general overview of financial planning and ask any questions. Rebalance IRA provides a personal touch by offering a face-to-face meeting with a consultant annually as well. Sometimes, as in the case of Vanguard Personal Advisor, support can differ based on an investor's AUM. Access to a dedicated financial advisor can only be granted with AUM \$500,000 or more. On the other hand, balances lower than this amount will allow investors to have support from a team of advisors but not an individual advisor they will get to work with regularly. Regardless, the advisors help answer investment questions, adjust investments, help plan for major goals, and send quarterly progress reports.⁵⁵

At this point, it is appropriate to discuss the premium services some robo-advisor platforms offer. These robo-advisors, according to the visuals, are Betterment, Wealthsimple, and FutureAdvisor. Betterment Premium requires a significantly higher account minimum of \$100,000 compared to its standard offering. With Premium, a higher management fee of 0.4% is charged compared to the basic 0.25%. However, customers also get unlimited access to financial advisors through phone for guidance on life events such as retirement. They also receive in-depth advice on investments outside of Betterment such as real estate and individual stocks.⁵⁶ The premium service of Betterment is then primarily the reason why the robo-advisor is considered a hybrid according to Figure 16. Wealthsimple's premium offering is called Wealthsimple Black. As indicated earlier, clients enjoy a lower account management fee of 0.4% with a minimum balance of \$100,000 compared to a fee of 0.5% with balances between \$5,000 and \$100,000. They also receive free, automatic tax-loss harvesting without having to request the platform to perform this service (which applies to Wealthsimple Basic). Exclusive access to an expert advisor called a Money Coach is also given to assist with goal-based financial planning. Because travel is one of the main savings goals according to Wealthsimple's customers, the premium service also gives investors and another guest unlimited access to over 1,000 airline lounges in over 400 cities worldwide.⁵⁷ Again, the premium version of this robo-advisor is what also classifies it as a hybrid. Finally, FutureAdvisor Premium requires an account balance of at least \$10,000 and a management fee of 0.5% which offers services that go beyond its free portfolio analyses for customers. This includes direct management of investments, automated tax-loss harvesting, access to a financial advisor who monitors the client's portfolio, access to financial advisors via chat, email, or phone, and automated rebalancing.⁵⁸ While some hybrid features exist within this service, the overall robo-advisor platform is considered more automated primarily through its use of computer algorithms based on the Modern Portfolio Theory in its free service as well as the premium offering.

⁵⁵ O'Shea, Arielle, and James Royal. "Vanguard Personal Advisor Services Review 2018." *NerdWallet*, 5 Jan. 2018

⁵⁶ "PLANS FOR EVERY INVESTOR." *Betterment*

⁵⁷ "Wealthsimple Black." *Wealthsimple*

⁵⁸ "Pricing - Investment Management." *FutureAdvisor*

From this analysis, it can be seen that potential investors have a wide variety of robo-advisor platforms to choose from. Even more, the list of robo-advisors in this paper is not exhaustive meaning that there are other alternatives to consider as well.

Regulatory Framework

An in-depth discussion on robo-advisors cannot be complete without speaking about the regulatory and compliance aspects of the technology.

Robo-advisors are regulated under the Investment Advisers Act of 1940. The platform falls under this because it is considered an investment advisor. Section 202(a)(11) of the act defines an investment advisor as any person or firm in the business of providing advice or issuing reports on securities for compensation. Furthermore, the act is broadly interpreted by the SEC (or the Securities and Exchange Commission). In fact, any kind of economic benefit satisfies the compensation component of the definition. Therefore, it is clear to see why robo-advisors fall in this law's jurisdiction. Digital financial advice is given to clients using computer-based algorithms to ultimately provide a tailored investment portfolio containing a recommended allocation of securities (usually ETFs). From there on, automated management and optimization of the client's assets in the portfolio occurs. Until this point, it has also been discussed that robo-advisors receive compensation for their services as well primarily by charging an annual account management fee and investment expense ratios.

Under the act, registering with the SEC is required as well after meeting the defining requirements unless exemptions are met or the act restricts such registration. Small advisors generally have less than \$25 million in AUM and are regulated by at least one state, so SEC registration is restricted. Medium advisors have between \$25 million and \$100 million in AUM regulated by one or more states subject to regular examination by state agencies. However, it is only investment advisors with over \$100 million in AUM who are required to register with the SEC. In this paper, the top ten robo-advisors have been discussed in great detail. As it turns out, each one of these platforms holds over \$100 million in AUM as of now and are considered to be market leaders paving the way for future growth in the robo-advisor segment. Thus, all of these platforms hold SEC registration.

Upon registration, the advisor must meet many requirements such as contractual and recordkeeping requirements as well as administrative oversight by the SEC mainly through inspections. However, fiduciary requirements are particularly important which include a duty to provide suitable advice to clients. As a fiduciary, investment advisors are required to avoid conflicts of interest with investors and taking an unfair advantage of their trust. The fiduciary duties from the relationship between an advisor and a client are not explicit in the Investment Advisers Act of 1940, however its section 206 validates the SEC's authority to ensure that

satisfactory advice is given to clients. In order to fulfill this fiduciary duty, advisors must reasonably inquire about the client's financial situation, their experience with investing, what their investment objectives are, etc. with fitting, reasonable advice that takes into account these factors of the client. In 1994, a rule proposition by the SEC, though never adopted, offered further insight into this requirement. To expand upon the inquiry aspect, learning about a client's personal and financial information may be involved. This could include their current income, financial goals, assets and debts, marital status, etc. Risk profiles must also be considered. For instance, certain risky investment products should be recommended only to clients who are willing to tolerate the risks and believe their benefits are justifiable. However, advice is also considered suitable if risky investments are placed in a low-risk client's portfolio to help diversify and reduce a portfolio's overall risk. Based on this information then, robo-advisors must be able to provide suitable advice to their clients. This means enough information about clients must be known to provide personalized investment advice in the client's best interest.

As discussed earlier in the paper, robo-advisors learn about their clients through online questionnaires. The SEC, however, believes that the questionnaires offer only a limited interaction. Figure 16 showed that after analyzing five of the robo-advisor platforms, the assessment tool could only be generalized to contain an average of 10 questions before asking users to sign up and create an account. Even then, this means that on an individualized basis, the number of questions a robo-advisor asks and the way they are asked can fluctuate. To gain an understanding of the user's risk tolerance, a market downturn scenario can be presented and consequently, several options to select from would be given to understand how the user would respond (see Figure 24). The answers that could be provided to the question, however, are vague. For instance, this includes the client either selling all of their investments, selling some of their investments, doing nothing, performing reallocation, or buying more. If the sell some option was selected, there is no way for the user to specify the percentage of their investments they would sell. This evidence then is primarily why the SEC is concerned since it prohibits the investor to provide more details on their risk tolerance.

In 2016, the Financial Industry Regulatory Authority (FINRA) investigated how robo-advisors collected risk tolerance information. Their findings showed that there was a disparity in questionnaires based on the way they were framed, either based on a client's risk willingness or their risk tolerance. These two indicators are quite different from each other. For example, Figure 19 is once again displayed below, showing one of the questions that E-Trade Core Portfolios asks about the user's risk willingness. On the other hand, Fidelity Go tries to understand their risk tolerance (see Figure 34).

How much risk are you willing to take to try and beat inflation? ☺

Very low risk

Some risk

Moderate risk

High risk

Figure 19. Risk Willingness vs. Inflation Question. Source: E-Trade Core Portfolios Web Portal

Where would you be most comfortable placing yourself on the risk tolerance scale from 1 to 10?

Less Risk More Risk

1	2	3	4	5	6	7	8	9	10
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Minimize short-term losses Maximize total returns

Figure 34. Risk Tolerance Comfort Level Question. Source: Fidelity Go Web Portal

Furthermore, when clients provided contradictory answers in the questionnaire, some robo-advisors averaged the responses or recommended tailored portfolios based on the more conservative answer. This ultimately places the investor in a portfolio that does not match their risk tolerance. Other factors are ignored as well. First, the complex, different needs of potential clients are not taken into consideration. For instance, individuals of the same age could have different priorities that are not factored in. One could be investing to save for retirement, while the other could be investing to save for educational purposes. Second, the questionnaires do not take into account a client's level of confidence when providing answers to risk-based questions. How does this all connect? From this discussion, it can be interpreted that robo-advisors find it difficult to meet the suitability requirement, thus making it harder to satisfy regulators.

In late 2016, the SEC's Division of Investment Management released updated guidance for robo-advisors to meet the suitability standard which primarily focused on:

- How robo-advisor service offerings are disclosed to clients
- The obligation to collect client information to fulfill the duty of providing suitable advice
- Adoption of compliance initiatives to address concerns related to providing automated investment advice

To address questionnaire concerns, solutions were proposed in the guidance to implement features that alert a client if their responses are inconsistent or flag these responses for future review. Of course, if follow-up reviews are complicated, then an actual advisor might be needed to resolve the issue which would compromise the cost efficiency of the robo-advisor model.

Still, some representatives of robo-advisors are concerned that the regulatory framework itself is not capable of guiding them as they continue to grow. Rather than implementing regulations that apply to all investment advisors (human and automated), an oversight plan needs to be adopted which takes into account the unique features and practices of robo-advisors and assesses how the platform fits into the existing fiduciary foundation. In order to successfully provide

appropriate, personalized advice, ongoing guidance and the efforts of regulators are crucial in making sure that robo-advisors are compliant with the Investment Advisers Act of 1940 and collect the necessary information to provide suitable advice. This is still a regulation area not yet fully developed. As far as current SEC examinations go, methodologies also need to be modernized in order to better suit robo-advisors. Examinations done as of now by the SEC's Office of Compliance Inspections and Examinations are in no way differentiated between conventional investment advice and the new advising platform. Furthermore, the examination procedures themselves need to be more transparent, or clear, to robo-advisors.⁵⁹

Robo-Advisors vs. Traditional Financial Advisors

Pros and Cons of Robo-Advisors

After developing a strong foundational understanding of robo-advisors, research was further done to examine its benefits and downsides.

In addition to having a wide variety of robo-advisor platforms to select from as was discussed in "Robo-Advisor Offerings and Differences", the advantages of the technology have primarily been determined to be:

- Low Fees and Minimum Account Balances
- User-Friendly Experience
- Automated Asset Management and Rebalancing

Low Fees and Minimum Account Balances:

In the paper's earlier discussions, research showed that robo-advisors require low investment balances to open an account, usually starting from \$0 and ranging up to \$500. The previous section indicated that half of the top ten robo-advisors by AUM fit well into this range, including Betterment, Wealthsimple, Acorns, Fidelity Go, and Wealthfront. Compare this to traditional financial advisors. Some do not even take on clients with less than \$250,000. Relatively then, robo-advisors show more flexibility given that the highest minimum account balance according to Figures 32 and 33 is well below this number (at \$100,000).

As found in "Robo-Advisor Offerings and Differences", in terms of AUM fees, the top ten robo-advisors will range anywhere from 0% to 0.5%. In comparison, most financial advisory firms charge fees based on a percentage for ongoing portfolio management. An AdvisoryHQ study in 2017 found that for a \$1 million account, an average financial advisor would charge around 1.02%

⁵⁹ Carney, Caelainn. "ROBO-ADVISERS AND THE SUITABILITY REQUIREMENT: HOW THEY FIT IN THE REGULATORY FRAMEWORK." *Columbia Business Law Review* , Apr. 2018, pp. 591–607.

of AUM. This would cost the investor \$10,200 a year on AUM fees. As the account grows, asset-based fees will begin to slowly decrease, but this causes fees to be higher for investors with low account values. AdvisoryHQ found that the average AUM Fee for a \$50,000 account was 1.18%. This would be \$590 a year for AUM fees.⁶⁰ If an investor instead chose to use a robo-advisor, those fees would have been cut in half, saving investors potentially thousands of dollars.

In Figures 32 and 33, expense ratio fees were also found to range from 0.03% to 0.20%. These costs are lower than traditional financial advisors according to the Veres study of 2017, designed to help compare the financial advisor expense ratios for underlying investments used to create portfolios. The study found that the underlying expense ratios add another fee on top of the standard financial advisory fee. The highest expense ratio fee found in the top ten robo-advisors matched the lowest fee of average traditional advisors, showing the beneficial, low cost of robo-advisors. The blended

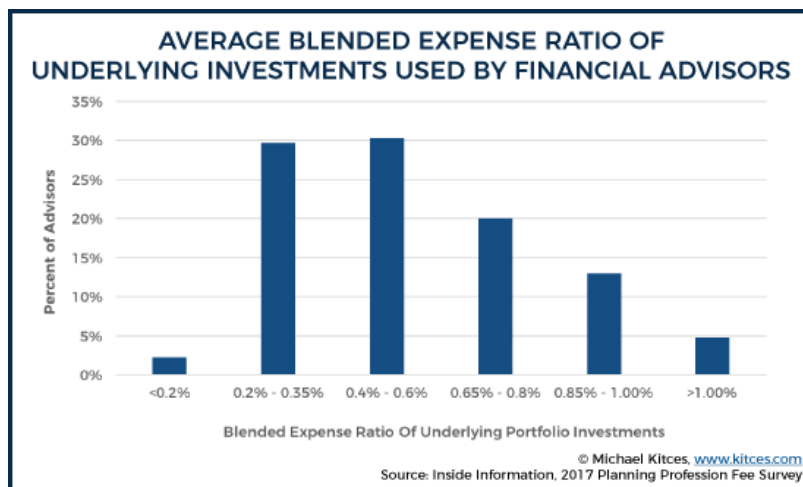


Figure 35. Financial Advisor Expense Ratio Ranges.

Source: <https://www.kitces.com/blog/independent-financial-advisor-fees-comparison-typical-aum-wealth-management-fees/>

expense ratios were found to mainly fall between 0.20% and 0.75% (see Figure 35). Both traditional advisors and robo-advisors trade ETFs, mutual funds, individual stocks, and bonds that all add to the expense ratio. Declining transaction fees for stocks and ETF trades during rebalancing and tax loss harvesting have additionally benefited financial advisors. In addition, the large account balance of most traditional portfolios cause these fees to have a smaller impact on a portfolio. Most advisors surveyed by Veres estimated their trading costs to be around 0.05% of AUM per year, with 15% of surveyors estimating 0.02% or less per year, and 6%—who were active traders—estimated transactions costs to be higher than 0.20% per year.⁶¹ On the flip side, it is important to note that transaction fees are usually waived by most robo-advisors for their users, thus completely eliminating this charge.

User-Friendly Experience:

Robo-advisors have an easy-to-use interface with layouts that flow naturally to provide better user engagement. For instance, based on the below visuals derived from the preliminary steps of Betterment account creation, it can be seen that clients are walked through the process in a clear and organized way (see Figure 36). This starts with the typical questions that would be found in a

⁶⁰ Stanek, Becca. "How Much Does a Financial Advisor Cost?" *SmartAsset*, SmartAsset, 2 Aug. 2018

⁶¹ "Independent Financial Advisor Fee Comparison: All-In Costs." *Nerd's Eye View | Kitces.com*, 8 May 2018

robo-advisor questionnaire leading all the way up to the “results” page. It is also designed to only take around 10 to 15 minutes to complete. Based on the graphics displayed, it can be concluded that users would need to have a minimal knowledge of investing, including an understanding of their investment goals and the amount they are willing to risk. Further evaluation of user interfaces will be discussed in Section 6, “Testing the Effectiveness of Robo-Advisors.”

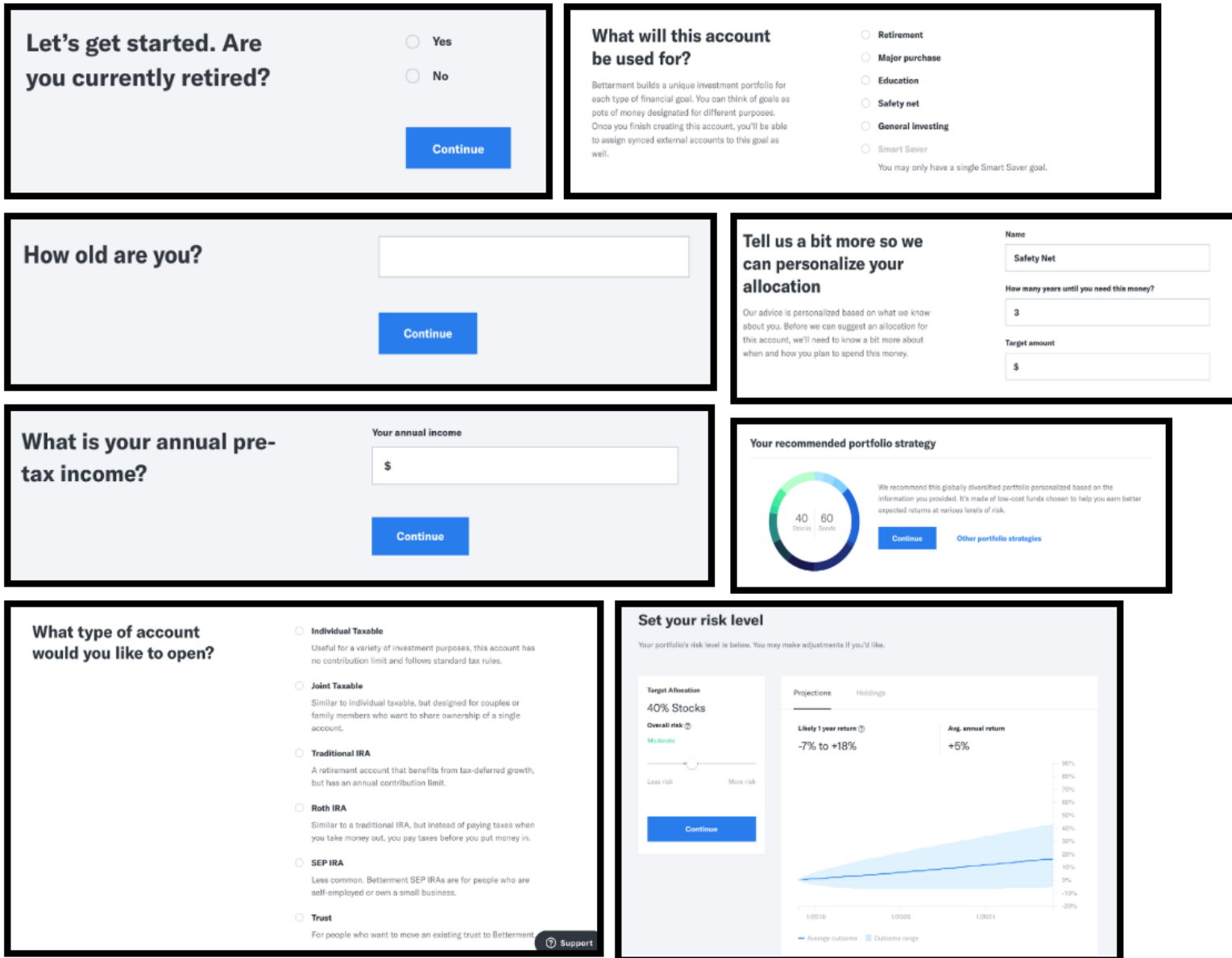


Figure 36. Betterment’s User-Friendly Platform. Source: Betterment Web Portal

Automated Asset Management and Rebalancing:

One of the biggest features of having a robo-advisor over a traditional advisor is its algorithm that is designed for the portfolio to be rebalanced so the original allocation plan is met (see earlier discussion under Adjustment in “Underlying Mechanics”). In addition, once the client completes the survey, the program will be able to create an effective portfolio personalized with the investor’s goals and risk, freeing the investor from the trouble of selecting investments.⁶²

What are the advantages of automated rebalancing compared to human counterparts? With no emotional investing behind a machine, robo-advisors are able to avoid tendencies that humans fall trap to. They often turn overconfident when investing in the market, an effect that causes investors to believe their own personal judgements are much greater than the data presented. This overconfidence makes investors hesitant when their assets bring high returns to the portfolio. In theory, these assets are the riskiest due to the volatility of a high risk, high reward stock. The riskiest of these are equities because without proper rebalancing, the investment portfolio will over time rely heavily on it. Overconfidence has been shown to be created by human biases such as herd mentality and recency bias. Herd mentality brings others to follow the popular trend and copy what others are doing; recency bias causes investors to base their future decisions on information learned recently. It is also important to take note that time and labor costs are incurred when financial advisors carry out rebalancing on behalf of their clients. This is directly not a concern for robo-advisors due to automated monitoring and consequently, most of the well-known platforms pass on the service as explained in “Robo Advisor Offerings and Differences” for free to their clients .

It needs to be noted that there is a difference between basic financial planning and asset management. Financial planning allows for the advisor to assess a client’s financial situation and understand future goals. In doing so, a financial plan is created that answers long-term money problems such as, how much should an individual save for a college fund? Asset management, however, focuses on building a well-planned portfolio, establishing proper asset allocation, and rebalancing when needed. Typically, these both would be done with multiple meetings with human advisors, but through an online survey, robo-advisors are able to both plan financially and automatically plan for asset management through advanced software. These services are offered at a much lower price than financial advisors; where human advisors would charge more or less for either financial planning/asset management, robo-advisors do both for less. In terms of financial planning, this could be done within one or two meetings so the advisors would charge an hourly rate or flat fee to answer any financial concerns. Hourly fees can rack up to \$150 to \$300 an hour, while a flat fee depending on the project could range anywhere from \$1,800 to \$5,000. A typical asset management fee could range from 0.5% to 2% of an investor’s portfolio. Compare this to one of the most popular robo-advisors, Vanguard Personal Advisor, which only costs 0.3% for account management. In terms of how the assets are managed, some financial

⁶² “The Pros and Cons of Robo Advisors.” *Rapport Financial*, 25 Apr 2018

advisors attempt to make their clients money by attempting to “outsmart” the market while most current robo-advisors focus on matching market gains over time with passive investment strategies. The software is able to constantly monitor the market and select assets that mirror the highs and lows of the market; these assets chosen are often low-cost ETFs. This strategy works well for long-term capital gains compared to human advisors who attempt to guess what investments will exceed the market.⁶³

Despite the stated benefits of choosing this new form technology to manage funds, there are also a number of disadvantages to using the platform. While some of these disadvantages have been identified earlier such as providing unreliable hypothetical expected portfolio returns, problems that will be focused on here include:

- False Cost Claims Against Financial Advisors
- Less Personalization
- Modern Portfolio Theory Problems

False Cost Claims Against Financial Advisors:

The big pitch for robo-advisory firms is that their method is much cheaper, more specifically, a better deal than traditional financial advisors. They often accuse them for charging much too high of an investment price by claiming all traditional advisors can charge up to 2% or even higher of an investor’s AUM annually as an account management fee. While this is true, it is also important to realize that there are some financial advisors that charge significantly less, all the way down to less than 0.25% of AUM as seen in Figure 37. This is well within the range of AUM fees for robo-advisors as mentioned earlier (between 0% and 0.5%). Of course, these fees do decline with increasing portfolio sizes but it is important to mention that there are financial advisors out there that are just as cost efficient as robo-advisors. Financial advisors could also give investors the option to be charged an hourly/flat fee or even a one time meeting to figure out finances. What are the benefits of this? Consumers are ultimately given more control to manage costs related to investment management rather than having a set annual fee not responsive to the actual amount of time devoted towards providing tangible advice and planning. A further discussion of these kinds of fees have been discussed earlier in “Automated Asset Management and Rebalancing.”

It is wrong for robo-advisors to bash all financial advisors since the field is so broad. Not every form of a financial advisor is expensive and some even have fees that could be comparable to robo-advisors on the market today. Unlike robo-advisors, some human advisors have price flexibility on how often they are needed. An example of a form of financial advisors that is more cost efficient is a fee-only financial planner that does not receive any compensation on product sales. Due to the lack of commission-based earnings, these planners are able to provide better advice by focusing on the client’s best interest. These planners are often freelance workers who are able to touch on a variety of financial plans. A common method of payment for their services

⁶³ “What’s Better: Automated Investing or a Traditional Investment Advising?” *Automated Investing vs. Traditional Investment Advisor* | *Wealthsimple*

is an hourly rate which ranges from \$150 to \$300, or a monthly rate that can accrue to \$1,000 to \$3,000 annually.⁶⁴ Compare these prices with a robo-advisory firm that charges on average a 0.30% advisory fee on an account worth \$1,000,000. This would be about \$3,000, a price similar to a fee-only planner. It must be noted however that these planners often work with high net worth (or wealth) clients compared to robo-advisors having the ability to work with clients of any financial position.

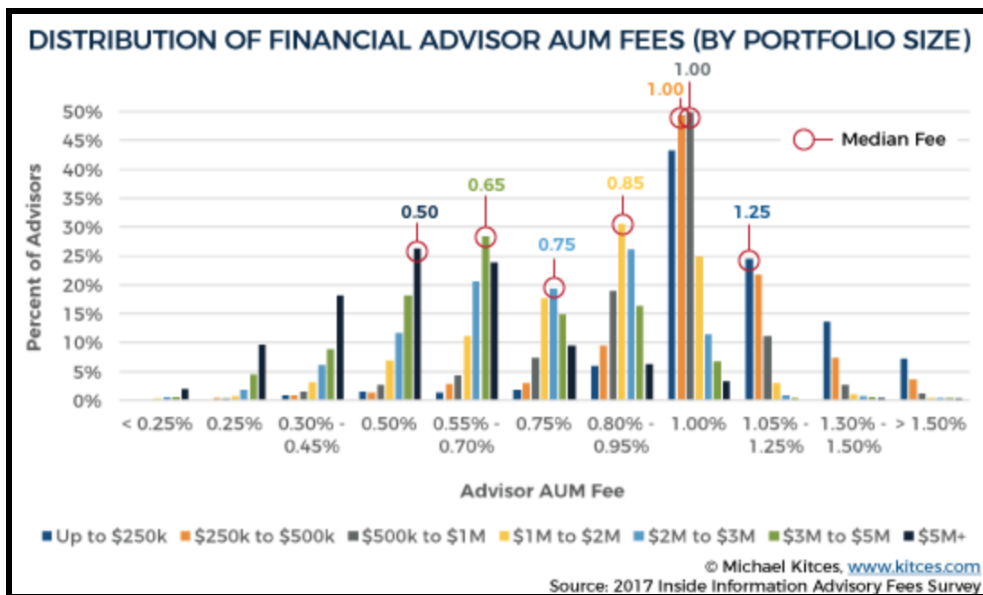


Figure 37. Financial Advisor Account Management Fee Spectrum.

Source: <https://www.kitces.com/blog/independent-financial-advisor-fees-comparison-typical-aum-wealth-management-fee/>

Less Personalization:

A good financial planner will go beyond portfolio construction and tax loss harvesting. They get to know you personally and provide a full suite of advisory services to address your entire financial picture whether it is concerning retirement, stock options, college savings, etc.

This is investment management, not financial planning. In the current state, robo-advisors are very limited in their ability to give *complete* planning that allows for clients to save for the future. This automation is currently designed to be a solution for investment management. It's difficult to plan an individual's future based on a 10 minute survey. This is due to a lack of regulation policies for robo-advisor questionnaires, causing robo-advisor firms to simplify the questions to make it easier for clients. As discussed earlier in *Regulatory Framework*, robo-advisors are regulated under the Investment Advisers Act of 1940, which was meant to be used to regulate human financial advisors. The SEC requires advisors to fully understand their client's financial position

⁶⁴ Smith, Liz. "What Is a Fee-Only Financial Planner?" *SmartAsset*, SmartAsset, 2 Aug. 2018

and goals; this is traditionally done with one or a number of client meetings to learn about current income, assets and debts, marital status, and most importantly, learn risk profiles. As discussed before, a large disadvantage that stand-alone robo-advisors have is only learning about their clients through online surveys. Financial advisors, on the other hand, would meet with a client for hours to fully grasp and understand how their portfolio should be built. Meanwhile, robo-advisors have tried their best to simplify the process with an average of 10 survey questions to create a portfolio. This is unfathomable. The vagueness of surveys is a big issue and the SEC attempted to tackle this problem with updated guidelines---but that is the problem, they are just guidelines. As previously stated, an oversight plan must be created and adopted in order to regulate the robo-advisors as there are too many differences between actual human advisors and the automated platform.

When finances are fully automated, there is also a risk. Simply put, life moves fast and there is always constant change. Thus, with varying circumstances, there is a benefit from an advisor providing consultation services to a client during times of transition or uncertainty. It is common that investors are more likely to panic and sell their stocks at a loss given declines in their portfolio. However, financial advisors are able to reassure their clients and talk to them through market troubles, re-establish portfolio plans, and keep them from selling low. During the 2008 financial crisis, many investors in panic sold their stocks while they were declining. By the time they bought back in their stocks, they missed out on huge amounts of potential gains due to sheer impatience.

A robo advisor's lack of human touch could push potential customers away which is primarily the reason why the concept of hybrid robo-advisors which use both robo-advisors and financial advisors is gaining traction. Older generations, especially, seek a personal touch and love face-to-face meetings. Building relationships is therefore important for some individuals and consequently, a product offering that does not have this capability can falter by losing opportunities to grow its customer base.

Due to this, there is a possible ceiling to robo-advisory clientele. Anthony Stich, COO at Advicent, a financial technology provider to advisors based in Milwaukee, warns against a "robo threshold"--when customers exit the robo-only platform and move to a traditional advisor. Robo-advisors without human advisors may be acceptable for investors with a low net-worth whereas high net-worth clients could be more fearful of losing money and switch to get a more personal touch.

Modern Portfolio Theory Problems:

Until now, it has been seen that one of the touted, distinguishing features of robo-advisors has been their use of automated algorithms. In *Selection* under "A Closer Look at Robo Advisors", research indicated that there were three primary theories that robo-advisor algorithms are typically based off of (Modern Portfolio Theory, Full Scale Optimization, and the Black-Litterman

Model). Before and after removing non-respondents to the question posed in Figure 29, however, it was seen that many robo-advisors (41%-60%) implement the Modern Portfolio Theory approach. As discussed earlier, there are drawbacks to this theory which can be a cause for concern. For instance, the utilization of mean-variance optimization completely ignores that historical returns can vary in certain time periods and the fact that the distributions of returns are skewed in reality. Furthermore, false assumptions such as investor indifferences to gains and losses are ingrained in the theory when in fact, loss aversion exists with varying degrees. Finally, it was seen that there were major issues when it came to determining asset weights in a portfolio by heavily weighting only a couple of securities. This ultimately prevents the full set of diversification benefits from being offered in the long run. While Full Scale Optimization and the Black-Litterman Model do address these issues, the reality is that very few robo-advisors actually implement these strategies (2.3% - 3.4% and 4.5% - 6.6% of robo-advisors respectively). Granted, Full Scale Optimization has been considered to be rather computationally intensive to run until recently and the Black-Litterman Model does have challenges such as identifying the market portfolio as a part of its methodology. However, these two approaches signify improvement opportunities and shouldn't be taken lightly since the use of algorithms is one of the primary features which make robo-advisors highly attractive.

On top of this, robo-advisors even have the audacity to boast about the Modern Portfolio Theory as if it is the newest and best way to maximize investment opportunities. The truth is that this approach is conventional and overused, given that it has been in practice since 1952 and widely practiced by many investors for years and years. Robo-advisors have the ability to successfully market this theorem to investors who are unfamiliar with the finance field to further show how more much advanced the software is compared to a human advisor. This, in fact, could very well be considered deceptive. For example, Wealthsimple is one robo-advisor which boasts about this particular theory on their website by stating only its benefits while ignoring its downsides. Wealthsimple does believe the biggest risk involving the Modern Portfolio Theory is that individuals have been implementing the theory incorrectly, leading the consumer to believe that it may not be worth performing detailed research to fully understand the theory and its complicated mathematical components. Therefore, it may seem rational for them to instead place this burden on professionals---in this case, Wealthsimple's robo-advisor system.⁶⁵

Although certain aspects of robo-advisors can clearly be distinguished as a particular advantage and disadvantage, there are other areas that can comprise both sides. These are:

- Investment Strategies
- The Hybrid Model
- Tax Loss Harvesting

Investment Strategies:

⁶⁵ "Modern Portfolio Theory." *Wealthsimple*

Robo-advisors are beginning to expand their investment strategies from primarily using ETFs to playing a role in active management and utilizing niche assets as a part of their offerings.

Compared to the standard robo-advisor strategy of buying ETFs and focusing on long-term goals, robo-advisors are beginning to take part in active management, otherwise known as active investing. The standard robo-advisor strategy is a form of passive investing, where clients will invest in lower risk stocks as well as ETFs and then hold their investments for a long period of time. Active management is a strategy in which the robo-advisors will make specific investments with the goal of outperforming an investment benchmark index. Generally speaking, active managers try to beat the market.

For example, a smaller robo-advisor known as Building Benjamins provides "unique wiser diversification" by offering funds that have exposure to private real estate, timberland, infrastructure, alternative lending (see "Industry Analysis"), reinsurance, and other unique asset classes.⁶⁶ These are unique funds compared to the standard ETFs. Reinsurance is a form of insurance protecting against large losses allowing parties to form an agreement to share insurance obligations by transferring portions of risk portfolios to another party. Timberland primarily focuses on investments in tree farms and natural forests. Therefore, this is unlike many of the top ten robo-advisors researched where their main investment strategy was passive investment with the use of ETFs. For example, the top seven funds held in a Vanguard robo-advisor portfolio are all considered as these types of funds. Examples include Vanguard Total Stock Market Index Fund Admiral Shares, Vanguard Total International Stock Index Fund Admiral Shares, Vanguard Total Bond Market Index Fund Admiral Shares, etc. These are all low-cost Vanguard index funds that contribute to the passive investment strategy commonly used by robo-advisors. This form of limited diversification is also shown in one of the top robo-advisors, Betterment. Their core portfolio is mainly composed of both stock- and bond-based ETFs. Betterment promises to optimize investor's portfolios to give the best performance despite the limitations of only using ETFs and low-risk stocks. This is one of the main problems of many robo-advisors---high performances are promised, however only low-risk, low-return stocks are invested in. Compare this to traditional financial advisors who are more creative with their investment strategies by investing client funds in a greater variety of sectors ranging from blue-chip stocks like Apple to real estate.

Currently, the standard robo-advisor as discussed earlier utilizes passive management investing mainly in ETFs. However, looking ahead, investors will be able to select automated platforms that give them multiple options to diversify their strategies. Integrated with current competitive advantages such as greater cost efficiency, robo-advisors then have the potential to be considered an even more viable option compared to financial advisors with larger fees which arise from their use of sophisticated investment strategies.

⁶⁶ Friedberg, Barbara. "6 Of the Newest Trends in Robo Advisors." *U.S. News & World Report*, 27 June 2018

In the future, popular investment factors will be co-opted with robo-advisors which include beta ETFs (special types of ETFs which construct indexes differently), value, momentum (current company trends), and other factors that are chosen from market expectations. Robo-advisors will have the unique ability to add these investment strategies with active management in addition to algorithmic enhancement and traditional index ETF investments.

The Hybrid Model:

Financial advisor firms and larger robo advisors are beginning to buy out and take over smaller independent robo-advisors, resulting in the creation of more and more hybrid robo-advisors. Since consumers are still scared of the thought of a machine having full control over their future finances, human advisors are being added to formerly tech-only robo-advisors so that investors have more guidance and feel more comfortable. By adding a human then, limits are placed on the extent to which a software is able to fully make financial decisions for an investor. One recent example of a financial firm and robo-advisor teaming up is Fifth Third Bancorp's securities unit and Fidelity. This is one of about a half-dozen partnerships in the last two years that involve big banks, asset managers, and online-only platforms (see Figure 38).⁶⁷

Due to the public's fear of a machine handling all of their finances, robo-advisors are becoming less of a method of investment and also more of a supplemental tool for financial advisors to offer cost-effective plans to investors who have a smaller net worth and to aid in investment management by leveraging the value of automated software. Traditional financial advisor firms such as Vanguard have recognized this. In order to compete effectively with larger, independent robo-advisor firms while maintaining their core philosophy of providing a personal touch to financial planning, services such as Vanguard Personal Advisor have been offered to the public as an offshoot to conventional advising practices to offer the best of both worlds. The future is also beginning to move away from stand-alone robo-advisors to adding human counterparts in order to make it slightly more personal to consumers.⁶⁸ Previous automated advisors such as Betterment and WealthSimple have acknowledged these opportunities by adding human financial advisors to create hybrid advisors, largely reflected in Betterment Premium and Wealthsimple Black as discussed in "Robo-Advisor Offerings and Differences".



Figure 3B. Notable Bank-Asset Manager-Online Platform Partnerships 2016-2017
Source: <https://www.americanbanker.com/news/fifth-third-securities-and-fidelity-partner-on-automated-advice-for-small-investors>

⁶⁷ Yurcan, Bryan, and Suleman Din. "Will Cheap Advice Turn off Wealthy Customers?" *American Banker*, 5 June 2018

⁶⁸ Friedberg, Barbara. "Are There Too Many Robo Advisors?" *U.S. News & World Report*, 15 Aug. 2018

Furthermore, competition has been so fierce that it has begun to weed out large players such as Hedgeable, with \$80 million in AUM and over 1,700 clients. Hedgeable was early to the robo-advisory market, but did not stand out enough to fully compete with other firms. The customer-acquisition costs were too high for the firm and they could not compete with financial giants such as Vanguard, Fidelity, and Charles Schwab. Unlike other robo-advisors, Hedgeable decided to close their doors instead of being bought out. This is a bad sign for smaller robo-advisors who want to compete using only automation. The cost of a new company acquiring a new client is at least \$100, causing many small robo-advisor firms such as FutureAdvisor to have no other choice but to sell themselves to financial advisory firms and banks rather than compete in the market.⁶⁹

The outlook for hybrid robo-advisor growth, therefore, has been more optimistic compared to automated robo-advisors as discussed earlier in “Future Advisors.”

Tax Loss Harvesting:

Tax loss harvesting has very conflicting advantages and disadvantages for investors. The benefit is that they can proactively take losses to offset gains in your taxable account. However, this is where things get interesting. This automated tax loss harvesting feature possesses risks and may not be as valuable as it seems. The drawback here is that the automated tax loss harvesting exposes you to wash sales that wipe away the benefits of tax loss harvesting. Tax loss harvesting is both a pro and a con for investors. The program will proactively take losses to offset gains, allowing investors to pay the lowest taxes possible and is only available for taxable accounts such as brokerage accounts. What does this look like? Suppose an investor has a capital gain of \$20,000 from a rise in the value of a fund in his/her investment portfolio. Additionally, assume the tax bracket under which they fall under requires them to pay 15% on this gain. Thus, the capital gains tax that will have to be paid would be 15% of \$20,000 or \$3,000. With tax-loss harvesting however, other fund or funds in the portfolio will be sold at a loss to offset some or all of this gain. For instance, total losses incurred could hypothetically be \$7,000. Now, the capital gains tax paid would be 15% of \$20,000-\$7,000 or \$13,000. The tax is now \$1,950 or \$1,050 lower. However, this practice does not eliminate taxes from an investor---it merely defers taxes. Tax-loss harvesting is analogous to receiving an interest-free loan from the federal government, where a tax deferral is similar to paying off a loan in the future.

Tax loss harvesting is traditionally done manually at the end of the year, while robo-advisors automate it almost daily. A common problem that arises when humans perform this service is that manual harvesting might accidentally turn low-tax long-term gains into higher-tax short-term gains. Furthermore, robo-advisors will advertise that harvesting will deliver increased annual performance from anywhere between 0.72% to 2.6%, however critics of robo-advisors believe these numbers are overstated and the gains are based off of flawed math. One of the top ten

⁶⁹ Barrons. “What’s Killing the Robo Advisors?” *Barron’s*, Barrons, 17 July 2018

robo-advisors, Wealthfront, has been found to ignore the fact that taxes are deferred (must be paid later) and that the maximum write-off (deduction in value) for any one year is \$3,000. This ultimately causes the advertisement of automated tax loss harvesting benefits to be misleading.⁷⁰

Harvesting still provides benefits despite some of its drawbacks: it allows for tax breaks now so that investors can plan to save for the future. The biggest winners are investors who never sell their investments so they can defer their taxes forever. This means they will always have capital gains. Investors can either donate their investment to charity or wait until death to pass the investment down to their children. Consequently, this increases the investment's cost basis (original value) and provides a tax benefit to future generations. Since investment is commonly used for retirement, these options might be unlikely but it is worthwhile mentioning that the government will ultimately collect taxes much later while investors relax during retirement.

Pros and Cons of Financial Advisors

What is a Financial Advisor?

“Financial advisor” is a very broad term used to define certified professionals that assist individuals through their financial planning. They can be used to design a retirement saving plan or can simply answer a basic finance question (e.g. about life insurance). Since the field is broad and unregulated, anyone is able to sell financial advice and planning without any credentials. There are certain fields of financial planning such as investment advice, security trading, and insurance selling that are all regulated. The core component of financial planning, however, financial advice, is not directly regulated at either the federal or state level.⁷¹ However, there are about 80,000 certified professionals known as Certified Financial Planners (CFPs) that have achieved the highest level of financial qualifications. To achieve this title, CFPs must go through hundreds of hours of training and studying to pass the CFA exam plus have 3 full-time years of qualifying work experience.

What services do CFP's provide their clients? They can meet with a client to assess their current financial situation and goals, develop a comprehensive plan that addresses major areas of concern (retirement, college planning, insurance, avoiding estate tax, etc), coach them as difficult financial issues appear, and help them avoid major mistakes that derail life plans.⁷²

With a broader, deeper knowledge of money management, financial advisors are very beneficial for individuals who need help investing and financial planning. Financial advisors are often most popular for planning saving strategies, retirement options and overall retirement plans.

⁷⁰ Royal, James. “How Valuable Is Tax 'Harvesting'?” *NerdWallet*, 31 Aug. 2018

⁷¹ “Regulation of Financial Planners.” Financial Planning Coalition

⁷² “Pros and Cons of Hiring a Financial Advisor.” *RothIRA.com*, 17 Oct. 2018

Robo-advisory services are an alternative to the traditional advisory method, and research was done to understand their benefits and downsides.

Financial advisors are able to provide a unique set of advantages to investors that robo-advisors lack. These include:

- Convenience and Specialization
- Personalized Planning
- Hybrid Model Conversion Benefits

Convenience and Specialization:

Managing your financial future by yourself requires you to constantly monitor your portfolio and have the capability to adjust during different market conditions. However, financial advisors can intercept emotional investing especially when the markets are volatile. There is absolutely no need for research as the investor will select a client's investments and help them meet their financial goals.

Human financial advisors are extremely beneficial for individuals that are in a financial crisis and require guidance. Imagine not having a great understanding for finance and running into trouble with student loans, credit card debt, or mortgage problems and needing financial guidance. Financial advisors are able to answer all questions that a client may have with their financial expertise unlike robo-advisors that are primarily used to assist clients in creating a investment portfolio. A human can sit down with a client and study the fine print of any business transaction and relay the information in a simple way for the client to further understand. There is a lot of information that could be misinterpreted which would end up being costly for an individual in the long-term if a term was misunderstood or misread due to lack of knowledge. Instead of researching online for hours and hours to learn financial terms and better understand their own financial situation, an individual has a better option of meeting with a human advisor. This option of specialization and free-lance work done by financial individuals cannot be met with the current form of robo-advisors that lack the ability to teach finance.⁷³

A common financial problem that many individuals have is a large amount of student loan debt. To better understand the advantage human advisors have over robo-advisors in this scenario, student loan repayment will be discussed. Since student debt is a large crisis in the United States, consultants exist to offer a number of services such as recommending repayment strategies, offering personalized guidance based on different financial situations, and giving recommendations on what actions need to be taken if a client's life unexpectedly changes. As noted before, these consultants are able to explain the fine print of student loan terms in a simple way, eliminate the time that would have been spent researching the loan details, and can even call lenders on a client's behalf. A student could open a robo-advisor portfolio while in college to

⁷³ "Pros and Cons of Using an Independent Financial Advisor." *Dumb With Money*

potentially invest some of their funds to generate savings to pay off student debt, but at its current form, robo-advisors cannot specialize extensively in areas such as student loan debt. The advantage of a human over a machine then is the time and research saved on specific financial problems and the ability to talk to another individual.⁷⁴

Personalized Planning:

While robo-advisors have a quick survey that will create a portfolio in minutes, financial advisors can sit down with an investor to talk about all aspects of their lives and goals. By having a personal touch, financial advisors are able to really get to know their clients before creating a plan. Meetings could take as long as a few hours but can also be held more than once over a period of time. All of this is done so that significant planning can be conducted before investment.

After a discussion of risk and financial/life goals, advisors create a plan and assure their clients they will always be there if any questions or concerns arise. By having a physical financial planner, individuals will be less anxious about their finances by knowing that short and long term financial goals will be met in future. This allows for people to focus more on their day-to-day lives rather than stress about finances.

Currently, most robo-advisors advertise retirement savings or college fund savings through passive investments. Human financial advisors have a big advantage in being able to break out of that field and assist individuals with specialized services such as estate planning. An online questionnaire would be too broad to gather enough data for specialization whereas a human has the ability to ask specific questions such as “Based on your financial plan, it’s possible that you’ll leave substantial assets when you pass away. What would you like to see happen with this money? Have you thought about the legacy you will leave your children, grandchildren, or community?” Most importantly, human counterparts can ask if the client has any concerns (which is most likely yes when dealing with a large amount of money).⁷⁵ Another popular field that human advisors still have the edge over robo-advisors is the insurance field. Whether it be life or health insurance, there are an abundance of financial advisors willing to help you select an optimal plan. More specifically, not a lot of younger millennials actively look for life insurance as the thought of passing away does not come across their mind as often as it does with older generations. Older generations tend to lean more towards human advisors when they are not as tech-savvy as well.

Hybrid Model Conversion Benefits:

With the growing number of human financial advisors adding robo-advisors in order to speed up onboarding and asset selection, business opportunities are increasing for both financial firms and robo-advisor firms. When Invesco (financial firm) acquired Jemstep Advisor, a former business to

⁷⁴ “Student Loan Repayment: Is Hiring a Consultant Worth It?” *Student Loan Hero*, 8 May 2018

⁷⁵ Duft, Justin C., et al. “The Advisor’s Role in Estate Planning (It’s Not Just for Attorneys).”

consumer robo-advisor in 2016, it began a trend of business-to-consumer digital investment advisors moving toward business-to-business models. Taking a look at Invesco's 2017 10K (annual company performance summary), their total assets spiked from \$25.7 million to \$31.7 million during 2016 to 2017. With the new addition of a robo-advisor platform, the net revenue also saw a large increase from \$3,393.2 million to \$3,754.9 million. Obviously, it cannot all be attributed to the addition of a robo-advisor firm, but these numbers do show the value of adding a fintech program to a traditional firm. From 2015 to 2016, Invesco actually had their net revenue decrease from \$3,643.2 million to \$3,393.2 million, so this acquisition was risky for the company, but was clearly a step in the right direction.⁷⁶

This is very beneficial to human advisor firms as it allows for advisors to speed up their process and add to their revenue stream by attracting younger clients without changing their current operating model. Financial advisors are jumping on the opportunity of using robo-advisors in addition to their integrated personal offerings to improve customer experience, reduce costs, and better inform investors on their holdings. The main reason for financial firms increasing their spending in fintech is to ultimately better target younger generations who are more accustomed to modern technology. Figure 39 shows the extreme spike in fintech funding during the past year. According to the EY Fintech Adoption index, one in three consumers use fintech solutions for their financial portfolios due to the convenience of the platform. Traditionally, financial firms would target middle-aged adults who seek to generate retirement/college funds. However, younger clients seek solutions for their investment goals and financial hardships as well. Creating a low-cost system is great for this new tech-savvy generation, but this doesn't mean that they seek to stray away from human advisors altogether. A survey from a fintech provider, Broadridge, found that two thirds of millennials believed face-to-face interactions were a crucial component when it came to financial planning.⁷⁷

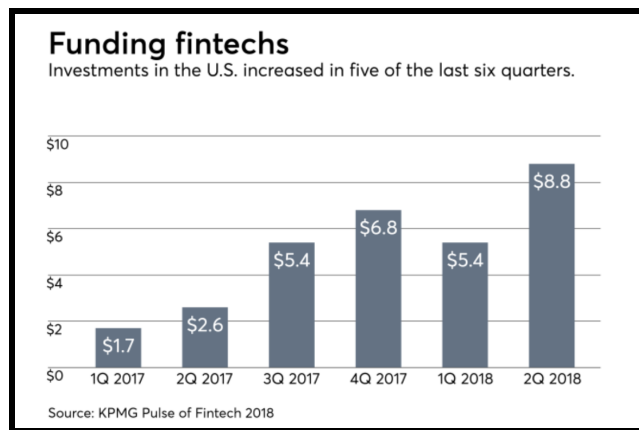


Figure 39. Fintech Quarterly Funding 2017 - 2018.
Source: <https://www.financial-planning.com/news/ai-artificial-intelligence-alpha-for-investment-products>

There is always a risk of hiring an incompetent advisor that will end up losing you money. Financial advisors are not perfect and therefore there are also disadvantages such as:

- Churning Investments
- Poor Advice
- Lack of Cost Control

⁷⁶ Invesco - Investor Relations - SEC Filings

⁷⁷ Allocca, Sean. "How Robos Are 'Cutting out the Fat' for Fintech Services." *Financial Planning*, 29 Oct. 2018

Churning Investments:

Churning is a practice that allows the advisor to generate higher commissions by getting clients to buy and sell more than necessary. The financial advisor will trade an excessive or unnecessary amount of stocks, mutual funds, and annuities (pay out a fixed amount of payments to an individual) and try to convince the investor that it will benefit him or her. Churning can be detected when there have been a large amount of trades in the portfolio with no noticeable portfolio gains. This activity is unethical and illegal, but there is still a risk that a financial advisor may be doing it.

Another form of this would be reverse churning where financial advisors would place an investor's funds in a fee-based account for no reason other than to collect fees. This forces the client into a position where they must pay a regular, fixed fee to the firm while in return receiving very little trading advice. Simply put, the advisory firms are able to generate more revenue while the customer does not receive any recognizable benefits.⁷⁸ This is also illegal and unethical in the eyes of the SEC. A recent example of this was shown when Edward Jones was sued by four investor clients who believed the firms' advisors were "unlawfully shift[ing] their commission-based accounts to a fee-based program" over the last five years. The suit is still ongoing during the writing of this report, but the lawsuit stated that the four investor clients lost around \$20,000 in fees alone to the company. Even worse, there is a possibility that these are not the only four victims to this crime.⁷⁹

Financial advisors who perform these malpractices may receive serious legal ramifications, be terminated from their company, and become an industry outcast. The offender could also receive fines that range from \$5,000 to \$110,000 per offense by the Financial Industry Regulatory Authority (FINRA). A broker could also be suspended from practice ranging from 10 business days to an indefinite amount of time depending on the severity of the case.⁸⁰ To show the ramifications of reverse churning, this paper will show the charges on three American International Group advisory firms that settled federal civil charges from 1,000 mutual fund clients. Results of the case indicated that they were to pay the SEC a total of \$9.5 million to settle the issue as well as an additional \$1 million to refund the clients who had reverse churning done on them.⁸¹

Poor Advice:

Since the financial advisory field is broad and unregulated, any individual can choose to sell financial advice. Due to this, there is a possibility that investors could select a poor financial advisor who ultimately doesn't know how to properly manage a portfolio. Bad advisors will show different signs which indicate that they don't know what they are doing. For instance, poor

⁷⁸ Dragonette, Laura. "Reverse Churning." *Investopedia*, Investopedia, 19 Aug. 2016

⁷⁹ Levaux, Janet. "Edward Jones Sued Over Alleged Fee-Based 'Churning Scheme!'" *ThinkAdvisor*, 5 Apr. 2018

⁸⁰ "Churning." *Investopedia*, Investopedia, 3 Aug. 2018

⁸¹ Poppick, Susie. "SEC Fines AIG Advisors \$9.5 Million." *CNBC*, CNBC, 15 Mar. 2016

planners will create an unrealistic financial plan with an unclear course of action. Well-planned portfolios, on the other hand, are flexible given changes in the economy, interest rates, etc. Poor communication towards clients is yet another factor that distinguishes inept financial advisors. When problems arise, it clearly is not helpful when a financial advisor stops responding to the needs of customers. Timing is important for many financial and investment situations and thus, clients need an advisor that will quickly respond when needed.⁸²

While robo-advisors may focus on buying low-cost ETFs in order to passively gain money over a long duration of time, some human advisors believe that they can beat the market. This can result in many advisors and investors having a higher risk tolerance resulting in portfolios being made

with too much equity risk. March 9, 2009 is a day that no one on Wall Street will forget; this was the day the Dow was on the fourth straight week of losses and stocks bottomed out. After that, however, a bull market was soon formed (a market where stock prices are rising, encouraging everyone to buy). The Vanguard Total Stock ETF (VTI) currently measures the

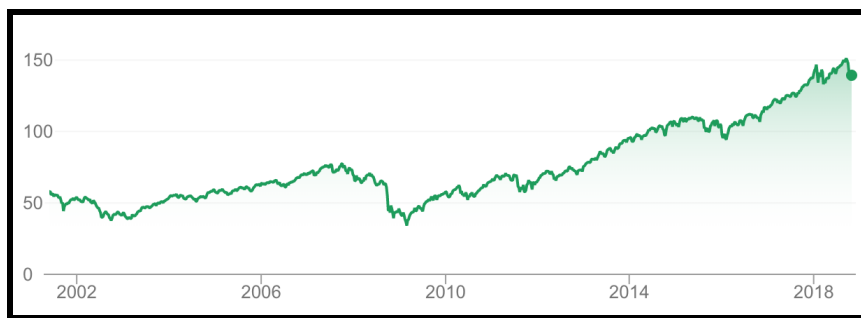


Figure 40. VTI Fund Price Performance 2001 - 2018.

Source: https://www.google.com/search?q=NYSEARCA:VTI&tbm=fin#scso=_mWOMXOncKpOIBAPqnpWICQ2.0

total return of U.S stocks and its price has risen more than 400% since the March 9, 2009 trough (see Figure 40). As markets continue to rise, human advisors show overconfidence in their portfolios, taking more and more risk. At the market high in 2007, advisors took on more risk than they could handle with portfolios that only held 26% bonds and cash before the Great Recession began shortly thereafter. Currently, market highs indicate that clients could be willing to take on more risk by being infatuated with the ongoing bull market and therefore can cause their human advisor to create an aggressive, risky portfolio.⁸³

Clients may have control over certain aspects of robo-advisors, however full scale automation is a distinguishing feature of the platform. In general, the client can relatively trust that modern technology will make the right decision. On the other hand, a human financial advisor can have a difficult client who pressurizes them to build a portfolio with high equity exposure or containing high-yield (return) bonds even if it may not be the wise thing to do. Because building client relationships are such a central component of a financial advisor's regular duties, pitfalls ultimately arise when these advisors go along with requests and demands (no matter how ridiculous they are) to prevent losing clients rather than giving sound financial advice.

Lack of Cost Control:

⁸² "Pros and Cons of Hiring a Financial Advisor." *RothIRA.com*, 17 Oct. 2018

⁸³ Roth, Allan. "The Ten Worst Mistakes Advisors Make." *Advisorperspectives.com*, 23 Oct. 2017

While financial advisors view client satisfaction as a top priority, the truth is that most financial advisors have competing interests as well such as trying to make money off their provided services. Because of this, there is also a possibility that advisors will push investors to purchase unnecessary securities in order to receive profits.

Consider a hypothetical example of an expected portfolio's return before fees in 2017. A portfolio following the 60/40 rule of investing (holding 60% stocks and 40% bonds) returned approximately 4.9% annually before any incurred costs. According to the Barclays U.S. Aggregate Bond Market Index, yields were 1.2%. As for equity, US large-cap stocks returned 7.4% in the same time period.⁸⁴ However, fees relating to these two asset classes would also need to be added in order to realize any true earnings. The average expense ratio for large-cap funds is 1.25% per year.⁸⁵ In addition, expense ratios are typically 0.1% on average for funds tracking the Barclays U.S. Aggregate Bond Market Index.⁸⁶ A weighted average expense ratio would then amount to 0.79% a year. On top of this, the financial advisor fee is typically around 1.02% a year on the first \$1 million in AUM (assume an investor's account here is worth this much)---this number does change with every advisor. Adding these two fees together will come to 1.81% annually for a client. By dividing 1.81% in fees by the 4.9% expected market return, the true cost of a human advisor begins to unveil itself. These fees account to nearly 37% of total portfolio gains leaving the client with around 3.09% in *actual* portfolio gains. Keep in mind that transaction fees, taxes, etc. can still be incurred, thereby diminishing net returns even further.

In order to find evidence that actual harm is happening to real financial clients, an article writer, Bob Veres, interviewed a number of fiduciaries and questioned if they encountered financial advice that was suitable and provided in the client's best interest. William Carrington, founder of an independent RIA, stated that he consistently saw clients' portfolios set up by an advisor were not following fiduciary standards. For instance, portfolios created with low-expense-ratio funds and ETFs were so rare and unknown that it constituted a concerning anomaly.

A real life example of a financial advisor who took advantage of their client comes from Bret Kaye, a member of AEPH Wealth Strategies, who met a 60 year old woman with \$1.5 million in her 401(k) (a retirement savings plan) and still earned \$250,000 annually. This woman found another advisor who recommended she buy an equity-indexed universal life policy (a type of permanent life insurance policy with cash value growth tied to equity index performance, usually of the S&P 500) despite the woman's lack of life insurance need. The main appeal of these policies are the "low premiums" or fees, but Kaye still believed it was a poor decision. Nevertheless, she still went along with it by buying a \$1.5 million Minnesota Life policy with premiums for the first three years

⁸⁴ Robbins, Christopher. "A 60-40 Portfolio Could Return Less Than A Savings Account." *Financial Advisor*, 30 June 2017

⁸⁵ Maverick, J.B. "When Is an Expense Ratio Considered High and When Is It Considered Low?" *Investopedia*, 11 Oct. 2018

⁸⁶ Thune, Kent. "What Is the Barclays Capital US Aggregate Bond Index?" *The Balance*, 7 Apr. 2018

of \$100,000 from her 401(k). Shortly after agreeing to this, the premium rose to \$133,000 due to the client not receiving a top rating from the insurance company's underwriters (who evaluate risks of insuring individuals). The original plan was for her to receive distributions after three years and since she was in the top tax bracket, the distributions were taxable. The advisor then offered on withdrawing \$200,000 annually for three years so there would be an additional \$66,000 to pay off in distribution taxes. It turned out that she lived in New Jersey with higher state taxes, meaning that taxes would actually be closer to \$80,000. Before she met the financial advisor, this woman had \$1.5 million for retirement which was a fine amount of money to be living off with after retirement. With this plan, she could potentially run out of money while the advisor would still receive commission.⁸⁷ This is therefore an unethical form of financial advice. When selecting a financial advisor, it is important to note then that some advisors may in fact be salesmen out to profit off of clients.

Case Studies: An In-Depth Look Into a Robo-Advisor and Traditional Financial Advisor Firm

In order to validate our research, interviews were conducted with one representative of a robo-advisor platform and a traditional financial advising firm. A full list of interview questions for each individual can be found in the Appendix.

Charles Schwab: Raymond Siu, Financial Consultant



Originally graduating in 2013 from the University of Arizona, Raymond Siu began his financial career at Vanguard, discovered his passion in portfolio management, and eventually received his CFA (Chartered Financial Analyst) certification. Next, he moved to Fidelity and worked there for almost three and a half months before moving to Charles Schwab. Charles Schwab is a bank and brokerage firm. Their brokerage firm is able to offer a number of services such as wealth management, investing, portfolio analysis, college planning, and more. Charles Schwab has created their own robo-advisory service called the Charles Schwab Intelligent Portfolio. Raymond Siu is currently a Charles Schwab wealth manager who helps clients understand their needs, future goals, and current financial situation. In doing so, he helps them create a wealth

⁸⁷ "The Real Cost(s) of Suitability." *Inside Information*

management plan. Raymond does not manage actual money, but rather pushes his clients into different investment vehicles to meet their personal needs.

A big question that concerned our research was how much money is considered a good start for a robo-advisor portfolio to show significant returns. After interviewing with Raymond, we learned that he believed this number was \$5,000 and even believed that anything above \$0 is a great start. He reminded us that an investor must be cognizant of fees, but investing as early as possible is important to save and continue to invest. Since the financial crisis, Raymond believes that millennials are skittish towards getting into the market and so robo-advisory services are a good beginning step.

Raymond believes that while robo-advisors are beneficial, they lack in other fields that a traditional advisor could fill. Human advisors are able to understand the complexities of a client's life such as tax complexities. Humans are able to understand the situations clients are dealing with, for example, they might be working out a second marriage and need financial advice. Traditional advisors are able to add the most value in other aspects such as timing the selling of certain stocks and titling trusts. They could also potentially make you more money by actively trading versus passive investing, the main strategy of robo-advisors. Most importantly, traditional advisors are able to listen and understand why clients are upset when there are losses in their portfolio. Raymond's strategy for unsatisfied customers is to listen to them, understand why they got into a certain investment in the first place, understand their needs, and make a recommendation from there.

In our research, we found the average all-in cost for robo-advisory services to be ~0.35% (shown in "Cost Benefit Analyses for Each Approach" later on). Raymond was able to confirm this part of our research by saying that the all-in cost of robo-advisory services in fact ranges from 0.3% to 0.4%. Every robo-advisory firm charges different things that contribute to the cost. For example, Charles Schwab has no advisor fees but instead create revenue through using underlying Charles Schwab ETFs, charging their operating expenses, and loaning out cash in client's portfolios as well. He was also able to confirm that there are only two common types of fees: account management fees and expense ratios.

We discovered that around 50% of Raymond's clients are categorized as millennials and Gen X individuals. In robo-advisory firms, most clients are actually younger but most of the money the firms work with come from baby boomers who have more money to invest. Therefore, the average account size would be larger with older clients. Furthermore, Raymond does understand the limitations of robo-advisors. They are for very generic goals and not too customizable. However, saving for retirement is a common need and robo-advisory services can satisfy this well.

As for the future of robo-advisors, Raymond believes that the hybrid model will eventually be integrated into the traditional financial advisor model. In the future, this hybrid model will become the normal way of investing. Charles Schwab has a hybrid version of their robo-advisory service called the Charles Schwab Intelligent Advisory Intelligent Portfolio that has a 0.28% management fee, access to financial advisors, and is more comprehensive. Raymond sees the future of this service to be more active management with the sustainment of low fees. Moreover, there will continue to be human oversight in the operation of robo-advisors in terms of asset allocations and the selection of different investments.

There are many advantages to robo-advisor automated rebalancing and asset management such as lower costs and automated strategies which usually follow the Modern Portfolio Theory to help diversify portfolios. Clients might want concentrated investment strategies, and thus Raymond recognizes that a con for robo-advisors is that low costs could mean less customization. While most traditional advisors will rebalance portfolios, the main advantage that robo-advisors, however, do provide is cost-efficiency and simplicity. Regarding the Modern Portfolio Theory, Raymond agrees with our research that there are disadvantages to using it. In his opinion, one of the main flaws is that it targets a specific range of returns in an attempt to minimize unnecessary risk so the client remains invested even through market downturns. He believes that the biggest reason people still use the Modern Portfolio Theory though is because it has been tested and proven to work in helping people where they need to be and to continue to keep them invested. Additionally, the theory is based on the idea that people are irrational. So, by giving investors discipline, downside risk is mitigated, upside potential is captured, and clients remain invested for the long term.

To further understand tax-loss harvesting, we asked Raymond to clarify the advantages. Robo-advisors are able to offset gains in a portfolio which has been found to generate 1% to 2% of alpha over the long run---very helpful for clients in higher tax brackets. Alpha is the additional value or return that an advisor could generate with past indexes that were tracked and is another way to generate income. Even though robo-advisors are able to automate this system, the results are essentially the same compared to traditional financial advisors. Another benefit of a traditional advisor is that they are able to create a full tax strategy that they can plan around the client's entire financial picture compared to just minimizing taxes.

Raymond was very beneficial to this report due to the fact that he was able to see both sides of the coin. He is a traditional advisor in a sense, but is still able to offer robo-advisory services to his clients.

Ameriprise Financial Services: Vikram Kohli, Financial Advisor



Vikram Kohli works as a financial advisor for Ameriprise Financial Services. Ameriprise is a financial services company which provides financial planning as well as services such as wealth management, estate planning, and asset management for its clients. Vikram's main areas of focus include: investments, family finances, retirement planning strategies, insurance, wealth preservation strategies, and tax planning strategies. He is a Certified Financial Planner (CFP), Chartered Retirement Planning Counselor (CRPC), and an Accredited Portfolio Management Advisor (APMA).

During the interview, we learned that Vikram generally viewed investments as necessary because they provide value to investors. While our research suggested that financial advisors could commit malpractice by influencing their client to purchase high expense ratio investments or could engage in activities such as churning, his experience suggests that most financial advisors are ethical. However, he does warn that some sales agents for various investment products call themselves financial advisors when in fact they have a limited understanding of financial planning. Furthermore, while Vikram does rebalance his client's portfolios back to target asset allocation percentages, he believes that there is no material impact to the client whether it is done manually or automatically. Despite this, he does think that automated rebalancing is a great marketing strategy to entice clients to invest their funds with his firm. Vikram, however, does not use automated tax loss harvesting and hasn't had much experience with its impact and its mechanics. The essential concept of tax loss harvesting is something he is familiar with but believes that the idea of minimizing taxes paid isn't beneficial to the IRS (Internal Revenue Service, the national tax collection agency). He rather prefers win-win strategies.

With regards to robo-advisors, Vikram believes this technology can make traditional financial advisor tasks much less complicated through the use of algorithms. On the other hand, a true advisor in his mind is one that can obtain and interpret data to offer suitable financial advice. Thus, robo-advisor features such as automated rebalancing aren't exactly considered tangible advice. They do not offer personal plans and a personal touch to clients unlike human advisors. He compared robo-advisors to using cheap public transportation where it may be less costly but at the same time, is considered largely inflexible to client needs. Although the technology is

considered an upgrade from DIY (do-it-yourself) investments and losing money in the market, there is an absence of the establishment of a long-term relationship between an advisor and a client/family. Furthermore, while robo-advisors are considered very cost efficient with regards to its fee structures, the pressure added to financial advisors to pass on low costs to clients in a similar manner is non-existent. This is primarily because having a cheaper service does not always guarantee quality in most industries, especially the finance industry.

When it came to understanding what were the most common, specific needs and concerns his clients had, he responded by saying that he touched on all aspects of their finances including education, retirement, estate, debt, taxes, protection from unforeseen consequences, etc. Ameriprise caters itself towards unique profiles for all its clients - young and old since they work with clients personally one at a time. To earn most compensation for the services he provides to his clients, financial planning and money management fees are generally charged. In some cases, commissions may be paid on any products that are purchased by clients but are well disclosed to the client prior to any actions that are taken. Thus, he is considered mainly a fee-only advisor. The commission-only advisor model, in his opinion, is more transaction based (like in real estate) but fee-only advisors are more relationship based and focus on maintaining existing relationships.

After discussing the portfolio theories robo-advisors typically based their algorithms off of (Modern Portfolio Theory, Black-Litterman Model, and/or Full Scale Optimization), we learned that Vikram is familiar with all three of these theories. He has used Modern Portfolio Theory ever since he became a financial advisor and does believe that this strategy can benefit with some customizations which are provided by the Black-Litterman Model and Full Scale Optimization according to our research. When building a client's portfolio, Vikram usually splits funds between ETFs, mutual funds, individual equities, and individual fixed income securities and other types of securities. He believes each asset class has its own benefits (e.g. an ETF allows for the ability to track a benchmark).

Vikram offers an initial complementary consultation with potential clients of up to two hours. He notes, however, that building a comprehensive financial plan does depend on the urgency and circumstances of each client. In order to build a detailed plan, it typically takes several meetings and discussions, taking up to as much as a month. To attract new customers, Ameriprise largely relies on references. In addition, potential clients also do learn on their own without any guidance that a professional would be better to consult with rather than trying to build up a strong finance foundation for their life plans by themselves. In terms of dealing with clients, he says that Ameriprise has experienced some clients liquidating (selling) their portfolios whenever there were losses. However, he has never personally lost any of his client's money unless a specific need caused portfolio selling at the wrong time. Even then, however, almost all of his clients have made profits off their investment. The rest of his clients who didn't make profits notably come from the Great Recession who lost a lot of money when the markets crashed (stocks losing on average 60% 1.5 years after the beginning of the downturn). Despite Vikram's best efforts, it was

the clients who sold during this period and therefore booked losses. Now, with the market having recovered, he notes that investors have lost out on opportunities since they sold their assets. Vikram notably adds that financial advisors do have the capability to support clients and help them manage their emotions.

When we asked whether he knew or heard of financial advisors becoming overconfident and taking on more risk especially during a bull market, we were surprised when he responded that he heard of robo-advisors doing this. In order to provide clients with high returns, robo-advisors, he explained, can get quite aggressive and risky in terms of managing portfolios. He provides one example of a current client of his. More than 60 years old, the individual had a child going to college and invested with a robo-advisor recommending a risky portfolio of 50% large-cap stocks, 25% foreign developed stocks, and 25% emerging market stocks. As of now, their investments are not doing very well and are losing lots of money. Finally, Vikram mentioned that he does see a problem where clients may pressurize financial advisors to build a portfolio with certain exposures and risks even if it may not be wise. Many times, investors tend to chase returns and forget its associated risks. They tend to overlook what may go wrong since they are blinded by potential returns. To mitigate this issue, he recommends possibly discussing expected return probabilities.

It is important to note that Vikram has told us his responses are biased towards traditional financial advisors since he does work in this field currently. Regardless, his feedback helped greatly with the validation of our research and understanding his own insights on the role of financial advisors compared to robo-advisors.

Concluding Thoughts

These interviews are beneficial to confirm our research but at the same time also contradict some of our information. In our original research, we found that the average age of a robo-advisor investor was between 40 and 50 years old. However, an interview follow-up led to Raymond providing us a very recent Charles Schwab robo-advisor report which actually mentioned that only around 11% of robo-advisors' clients are baby boomers and 23% are Gen X individuals while a large number of clients (60%) are more tech-savvy millennials (see Figure 41) . Looking at demographics further, around 77% of users have an income less than or equal to \$99,000. It is safe to assume that a large majority of these people are millennials and Gen X clients. On the other hand, baby boomers are able to contribute the most to the portfolios with incomes larger than \$100,000.⁸⁸

⁸⁸ "The Rise of Robo: Americans' Perspectives and Predictions on the Use of Digital Advice." *Charles Schwab*, Nov. 2018.

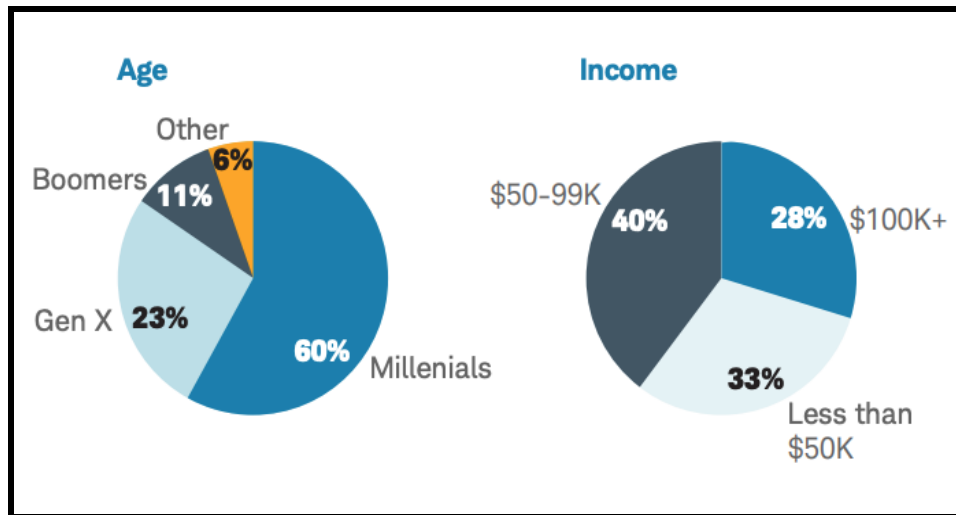


Figure 41. Robo-Advisor User Demographics by Age and Income
 Source: https://www.aboutschwab.com/images/uploads/inline/schwab_rise_of_robo_report_2018_findings.pdf

These interviews were important by showing the biases of the two interviewees towards the robo-advisory industry. Raymond worked previously as a traditional advisor and now works as a hybrid advisor along with his traditional work. Raymond is hopeful for the future of robo-advisory services and believes that it will become the normalized way of investing. As technology advances, robo-advisors will be able to move past their passive management strategy and actively trade for a cheap cost. However, there will always be a human along the way so the future for the stand-alone robo-advisor might not be as likely. Vikram believes the technology is a cheaper alternative to a traditional advisor. As a traditional advisor himself, he has a bias towards his own industry and while he believes the technology can make his own tasks much less complicated, Vikram believes a true advisor can obtain and interpret data themselves to offer the best advice. In his mind, traditional advisors will not be beat out by the machine despite Raymond believing it to be the future. The two conflicting sides are a result of the biases of the two forms of advisory. However, each interviewee's age and experience could also explain these polarized stances. Raymond is young and recently joined the financial services industry. On the other hand, Vikram has been in the industry for most of his life (15 years). Raymond is more optimistic for this technology to evolve while Vikram has worked a long enough time using traditional means that he believes his own experience is superior to the new technology. It is common that younger generations will and are willing to learn new technology but older generations choose to stick with what they know and are reluctant to learn new things since there is a resistance to switch over from conventional ways of thinking and operating.

Cost Benefit Analyses for Each Approach

While online research earlier in the paper gave insight towards understanding the costs and benefits of both robo-advisors and traditional financial advisors, personal cost-benefit analyses were also performed and confirmed by both our interviewees for further validation and accuracy.

Robo-Advisors:

Cost Analyses:

To perform the robo-advisor cost analyses, a specific investor profile was focused on. Thus, assumptions were made that the amount of funds invested into the platform was \$1,000,000. \$1,000,000 was selected primarily because this would allow accurate, scaling comparisons to be made between robo-advisors and traditional financial advisors (often requiring very high account balances). Furthermore, it was also assumed that the investor created a taxable account with the firm. To carry out the actual cost analysis, the top ten robo-advisors and their respective fees from Figure 16 were utilized. Next, by using Figures 32 and 33, fee categories which implied charges to clients were extracted. These are annual account management fees, investment expense ratios, account fees, and automatic rebalancing fees. For each robo-advisor then, fees in the form of percentages were placed in the figures and determined specifically by the investor's profile. If a fee from Figures 32 and 33 was not originally in percentage format (e.g. Rebalance IRA's automatic rebalancing annual fee of \$50-\$70 twice a year or, on average, \$120), then it was converted by dividing the actual annual fee by \$1,000,000 ($\$120/\$1,000,000$ which equates to 0.012%). In order to develop a more accurate measure of what robo-advisor segment industry fees were for each fee category, a weighted average was conducted by multiplying the market share of each robo-advisor relative to the other nine top robo-advisors by its respective annual fee (noted as a contribution) and then summing all ten results. By performing this process for each fee category---account management fees, investment expense ratios, account fees, and automatic rebalancing---were determined to be 0.26%, 0.10%, 0.00135%, and 0.00004% respectively for a total of ~0.35% annual fees or \$3,547 (see Figures 42 and 43). It is important to note, however, that this analysis is applicable only for the first year of investing. A second analysis ended up being performed which focused on total annual costs for the second year of investing and onwards. Why is this? As it turns out, Rebalance IRA charges a \$250 first time setup fee per account and consequently, later years would exclude this fee. The results, however, are negligible. Total annual fees now amount to \$3,546. While these outcomes do seem restricted to investors having only a taxable account, fees associated with setting up other types of accounts such as a retirement account aren't much different. A quick recalculation for a retirement account, for instance, suggests that fees of \$3,546 and \$3,545 are for the first year of investing and second year of investing and onwards respectively.

Note: Taxes are not included in this analysis because these expenses are not directly connected to robo-advisor services. Additionally, for better comprehension, it is assumed that the account balance of \$1,000,000 is constant and will not be added to through scheduled account deposits or any portfolio returns (for now) over the years.

Robo-Advisor	AUM	Market Share	Account Management Fee	Contribution to Account Management Fee	Investment Expense Ratios	Contribution to Investment Expense Ratios
Vanguard Personal Advisor	\$101,000,000,000	63%	0.30%	0.19%	0.08%	0.05%
Schwab Intelligent Portfolios	\$27,000,000,000	17%	0%	0.00%	0.15%	0.03%
Betterment	\$13,500,000,000	8%	0.40%	0.03%	0.13%	0.01%
Wealthfront	\$10,200,000,000	6%	0.25%	0.02%	0.08%	0.01%
E-Trade Core Portfolios	\$3,900,000,000	2%	0.30%	0.01%	0.07%	0.00%
Wealthsimple	\$1,500,000,000	1%	0.40%	0.00%	0.10%	0.00%
FutureAdvisor	\$1,100,000,000	1%	0.50%	0.00%	0.15%	0.00%
Acorns	\$545,100,000	0.34%	0.00%	0.00%	0.10%	0.00%
Rebalance IRA	\$525,100,000	0.33%	0.50%	0.00%	0.15%	0.00%
Fidelity Go	\$186,000,000	0.12%	0.40%	0.00%	0%	0.00%
Total	\$159,456,200,000	100%		0.26%		0.10%

Robo-Advisor	Account Fees (First Year)	Contribution to Account Fees (First Year)	Automatic Rebalancing	Contribution to Automatic Rebalancing
Vanguard Personal Advisor	0.002%	0.0013%	0.000%	0.00000%
Schwab Intelligent Portfolios	0.000%	0.0000%	0.000%	0.00000%
Betterment	0.000%	0.0000%	0.000%	0.00000%
Wealthfront	0.000%	0.0000%	0.000%	0.00000%
E-Trade Core Portfolios	0.000%	0.0000%	0.000%	0.00000%
Wealthsimple	0.000%	0.0000%	0.000%	0.00000%
FutureAdvisor	0.000%	0.0000%	0.000%	0.00000%
Acorns	0.000%	0.0000%	0.000%	0.00000%
Rebalance IRA	0.030%	0.0001%	0.012%	0.00004%
Fidelity Go	0.000%	0.0000%	0.000%	0.00000%
Total		0.00135%		0.00004%

Total Costs Annually (First Year)	
Account Management Fee	0.26%
Investment Expense Ratios	0.10%
Account Fees	0.00135%
Automatic Rebalancing	0.00004%
Total Fees (%)	0.35%
Total Fees (\$)	\$3,547

Figure 42. Robo-Advisor Cost Analyses (First Year). Source: Author Generated

Robo-Advisor	AUM	Market Share	Account Management Fee	Contribution to Account Management Fee	Investment Expense Ratios	Contribution to Investment Expense Ratios
Vanguard Personal Advisor	\$101,000,000,000	63%	0.30%	0.19%	0.08%	0.05%
Schwab Intelligent Portfolios	\$27,000,000,000	17%	0%	0.00%	0.15%	0.03%
Betterment	\$13,500,000,000	8%	0.40%	0.03%	0.13%	0.01%
Wealthfront	\$10,200,000,000	6%	0.25%	0.02%	0.08%	0.01%
E-Trade Core Portfolios	\$3,900,000,000	2%	0.30%	0.01%	0.07%	0.00%
Wealthsimple	\$1,500,000,000	1%	0.40%	0.00%	0.10%	0.00%
FutureAdvisor	\$1,100,000,000	1%	0.50%	0.00%	0.15%	0.00%
Acorns	\$545,100,000	0.34%	0.00%	0.00%	0.10%	0.00%
Rebalance IRA	\$525,100,000	0.33%	0.50%	0.00%	0.15%	0.00%
Fidelity Go	\$186,000,000	0.12%	0.40%	0.00%	0%	0.00%
Total	\$159,456,200,000	100%		0.26%		0.10%

Robo-Advisor	Account Fees (Second Year Onwards)	Contribution to Account Fees (Second Year Onwards)	Automatic Rebalancing	Contribution to Automatic Rebalancing
Vanguard Personal Advisor	0.002%	0.00130%	0.00%	0.00000%
Schwab Intelligent Portfolios	0.000%	0.00000%	0.00%	0.00000%
Betterment	0.000%	0.00000%	0.00%	0.00000%
Wealthfront	0.000%	0.00000%	0.00%	0.00000%
E-Trade Core Portfolios	0.000%	0.00000%	0.00%	0.00000%
Wealthsimple	0.000%	0.00000%	0.00%	0.00000%
FutureAdvisor	0.000%	0.00000%	0.00%	0.00000%
Acorns	0.000%	0.00000%	0.00%	0.00000%
Rebalance IRA	0.000%	0.00000%	0.012%	0.00004%
Fidelity Go	0.000%	0.00000%	0.00%	0.00000%
Total		0.00127%		0.00004%

Total Costs Annually (Second Year Onwards)	
Account Management Fee	0.26%
Investment Expense Ratios	0.10%
Account Fees	0.00127%
Automatic Rebalancing	0.00004%
Total Fees (%)	0.35%
Total Fees (\$)	\$3,546

Figure 43. Robo-Advisor Cost Analyses (Second Year and Onwards). Source: Author Generated

Benefit Analyses:

The metric used to quantify the benefits of robo-advisors were the annual portfolio returns of the same investor with \$1,000,000, a taxable account with the platform, and a recommended 60/40 stock/bond portfolio asset allocation. Why was the 60/40 portfolio chosen for this analysis? This allocation is considered to be the most common among investors and known to serve as a great tool for portfolio discussion and analyses. It has also been considered a primary strategy used by passive investors which fits in well with the robo-advisors' philosophy of passive investing.⁸⁹ To

⁸⁹ "Classic 60-40." *Portfolio Charts*, 2018

determine average robo-advisor segment portfolio returns, 60/40 specific holdings and their respective weights for each robo-advisor platform if available were first used. A complete list of the holdings and their weights within each robo-advisor can be found in the Appendix. From there, portfolios were created and back-tested (applying a model to historical data in order to generate past, hypothetical performances) using the Portfolio Visualizer tool to determine each platform’s hypothetical historical returns.⁹⁰ Initially, returns were sought out for the past ten years. However, after contacting robo-advisor representatives, doing research to extract ticker symbols for each portfolio with their respective weights, and then placing findings into the Portfolio Visualizer, this time frame was cut down to 8 years with available information. Still, it is believed that this is considered a large enough horizon for readers to fully understand how returns have changed over time and to provide enough data for a side-by-side comparison to traditional financial advisors. It is also important to note that returns were retrieved from all top ten robo-advisor platforms except Rebalance IRA (see Figures 44-52). This was due to the lack of available resources and personnel to help out with the request for understanding portfolio tickers and their weights under asset classes given time constraints. Still, exclusion of this robo-advisor platform will not significantly affect final results since its market share is determined to be only 0.33% relative to other robo-advisors. Returns calculated continue to assume that no contributions and withdrawals occur in the account but add in rebalancing based on the type of robo-advisor (earlier in the paper) and the reinvestment of dividends (using periodic payouts paid to clients which are used to then purchase additional shares or units of ownership of funds).

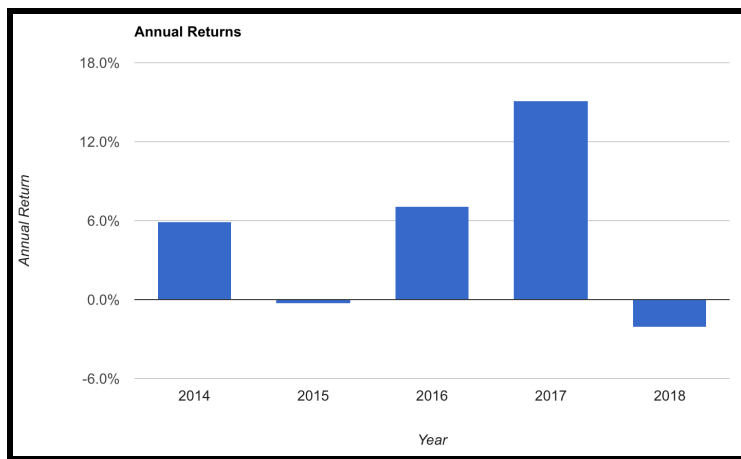


Figure 44. Vanguard Personal Advisor % Annual Returns 2014-2018. Source: Portfolio Visualizer

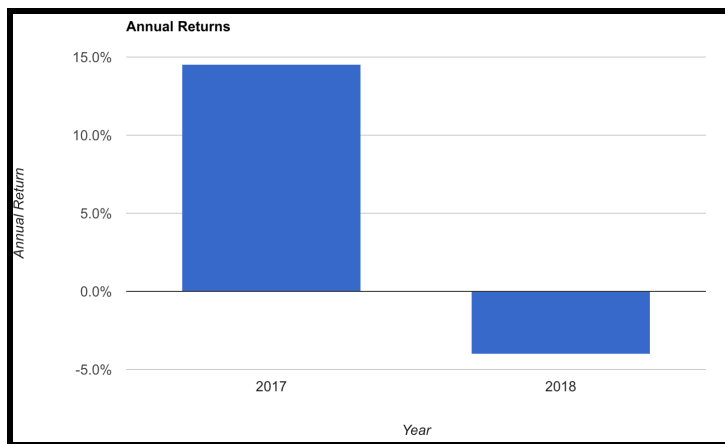


Figure 45. Schwab Intelligent Portfolios Annual % Returns 2017-2018. Source: Portfolio Visualizer

⁹⁰ “Backtest Portfolio Asset Allocation.” *Portfolio Visualizer*, 2018

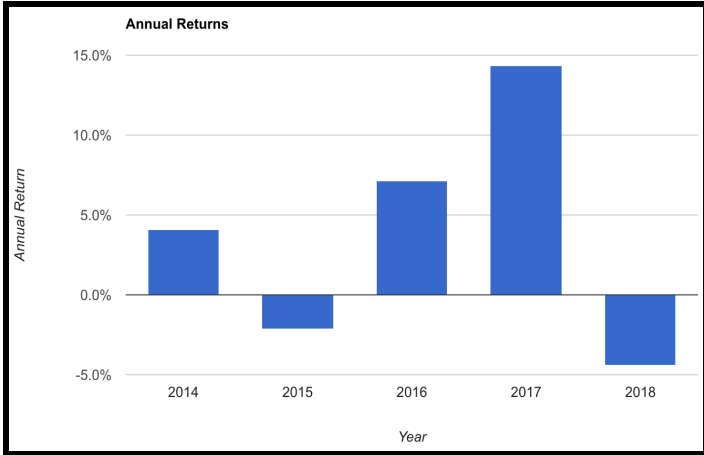


Figure 46. FutureAdvisor Annual % Returns 2014-2018. Source: Portfolio Visualizer

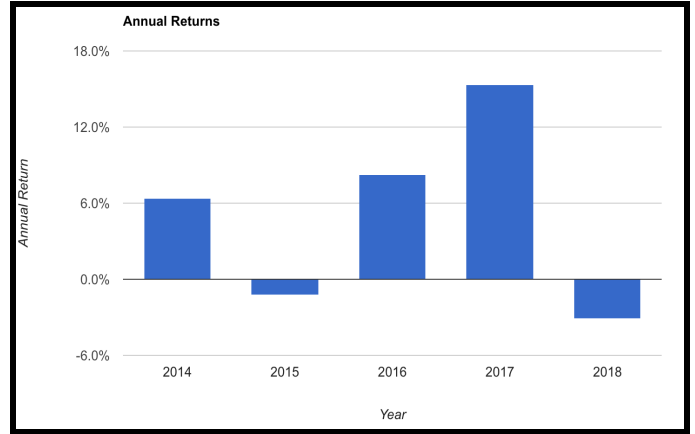


Figure 47. Betterment Annual % Returns 2014-2018. Source: Portfolio Visualizer

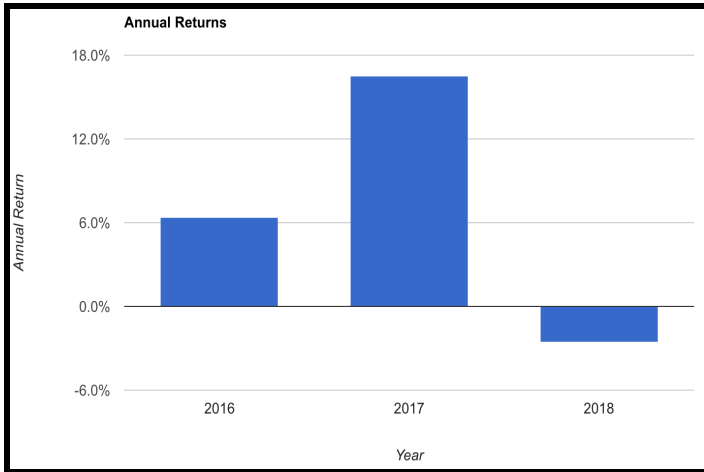


Figure 48. Wealthfront Annual % Returns 2016-2018. Source: Portfolio Visualizer

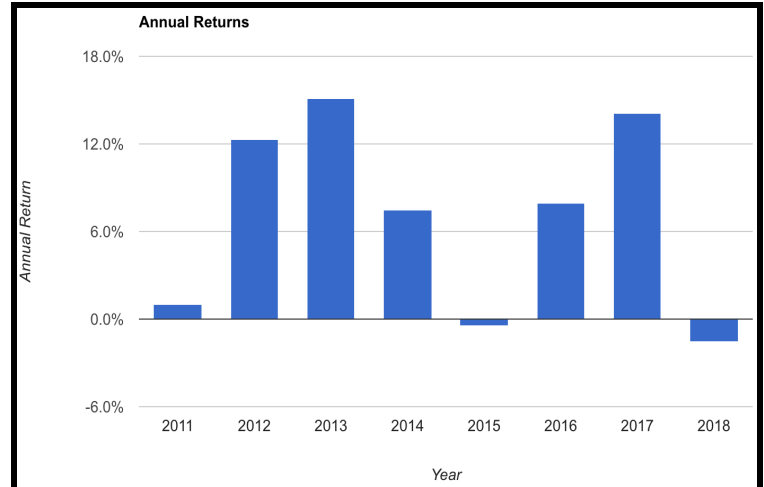


Figure 49. Acorns Annual % Returns 2011-2018. Source: Portfolio Visualizer

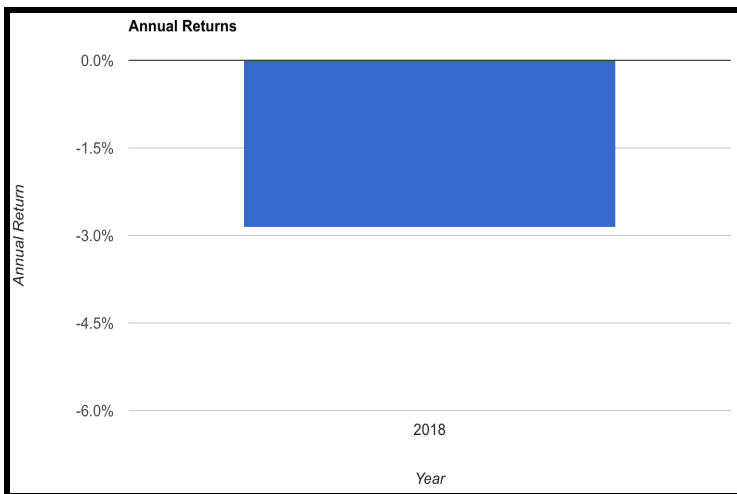


Figure 50. E-Trade Core Portfolios Annual % Returns 2018. Source: Portfolio Visualizer

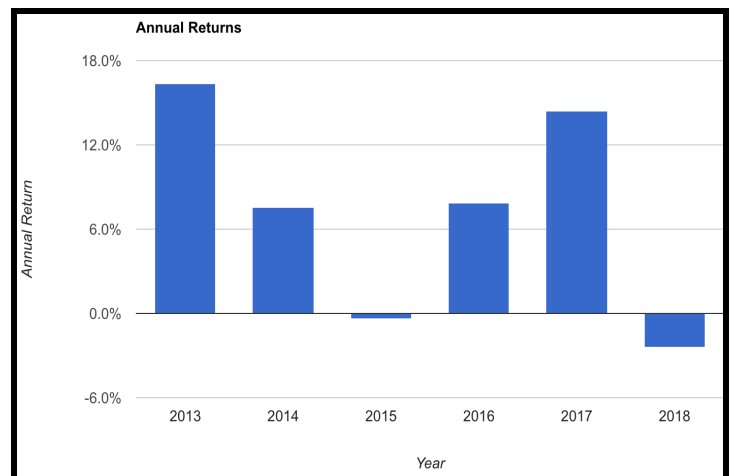


Figure 51. Wealthsimple Annual % Returns 2013-2018. Source: Portfolio Visualizer

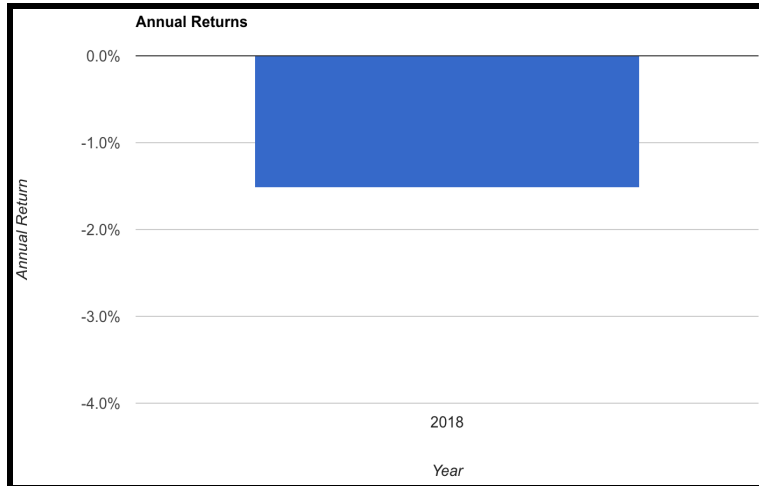


Figure 52. Fidelity Go Annual % Returns 2018. Source: Portfolio Visualizer

After determining returns for each robo-advisor platform, a weighted average was taken for each year's return based on robo-advisor market shares. If certain years had only one available robo-advisor return, then that return was deemed to be the best estimate for those years. Likewise, if there were only some robo-advisors providing returns for particular years, then market shares were re-evaluated to include only the appropriate platforms. Figure 53 shows robo-advisor annual portfolio returns in %'s. Next, given an initial \$1,000,000 investment in 2010, dollar gains and losses were converted from % returns (see Figure 54).

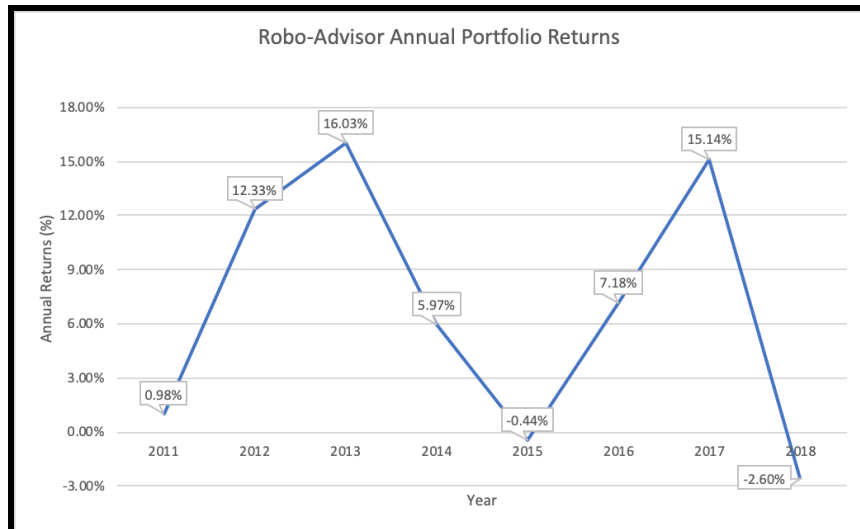


Figure 53. Robo-Advisor Annual Portfolio % Returns 2011-2018. Source: Author Generated

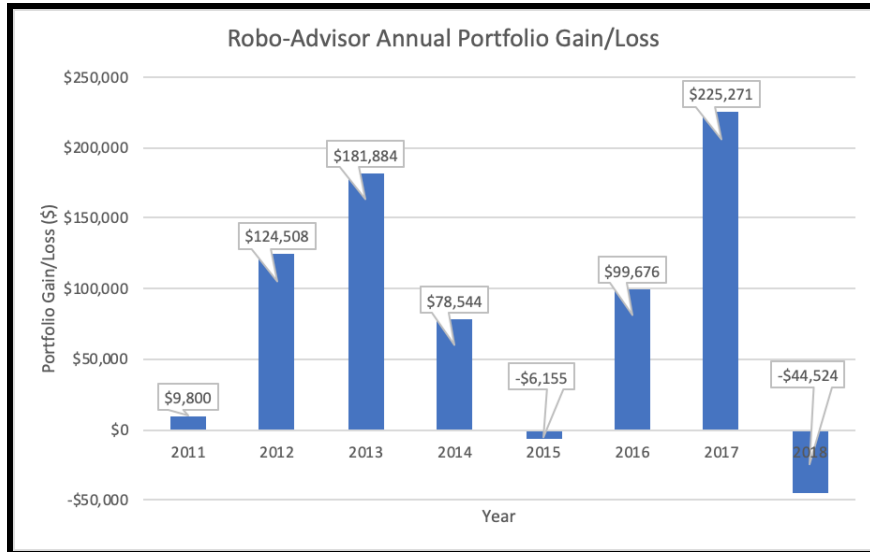


Figure 54. Robo-Advisor Annual Portfolio Gains/Losses in \$ Terms 2011-2018. Source: Author Generated

Finally, taking into account both annual costs from earlier and portfolio returns, a cumulative graph was developed detailing the net benefit/loss if a client used a robo-advisor. It's important to note that although annual costs of \$3,547 and \$3,546 were calculated for the first year and second year onwards, the portfolio value does change year by year. Therefore, annual portfolio return %'s were subtracted from the annual cost %'s of approximately 0.35% and then multiplied by the previous balance calculated each year (see Figure 55).

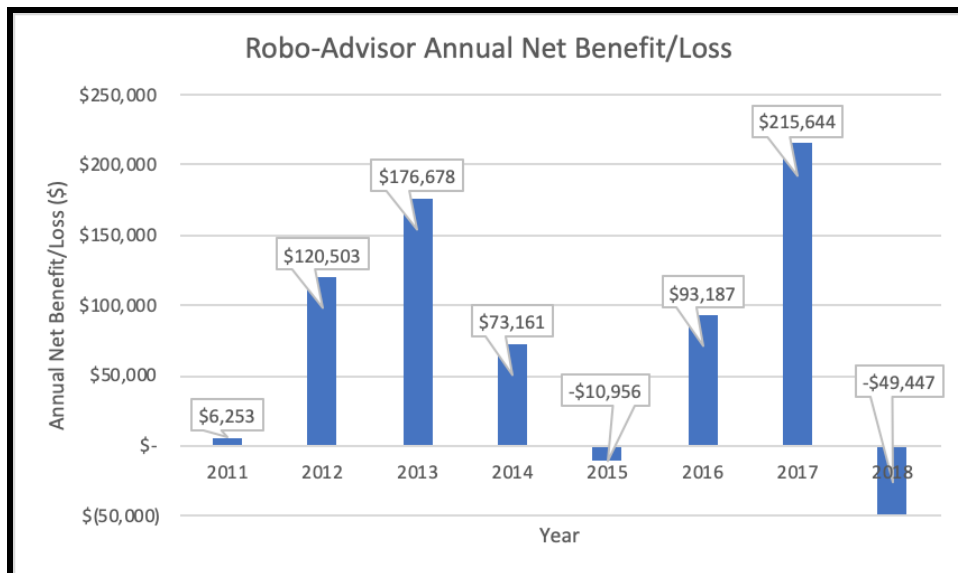


Figure 55. Robo-Advisor Annual Portfolio Net Benefits/Losses in \$ Terms 2011-2018. Source: Author Generated

Financial Advisors:

In addition to answering our interview questions, Vikram Kohli provided us some great resources to help out with the cost-benefit analyses of financial advisors. Initially, there was some difficulty determining the costs and benefits of financial advisors since so much variation was identified with the different financial service firms as well as the type of clients financial advisors work with. To remedy this issue, he recommended us to use five funds with holdings (NBIAX, MALOX, JDBAX, FBALX, and JALGX) which match the classic 60/40 stock/bond portfolio used in the analyses for robo-advisors. According to him, these funds are great representations of the portfolio returns a financial advisor usually generates for their clients as well as their typical expenses incurred by clients.

Cost Analyses:

First, annual expenses for each fund represented as a % were extracted from Morningstar, an investment research firm.⁹¹ Next, based on AUM for each fund, a weighted average was taken by multiplying market shares by each fund's total annual fee to determine the contributions to total annual fees. A summation of the contributions gives 0.82% in annual fees that would typically be charged by financial advisors (see Figure 56). Once again, taxes are not included in this analysis. After sharing these results to Vikram, he confirmed that this number was a good, reasonable estimate as well.

Funds:	AUM	Market Share	Total Annual Fees (%)	Contribution to Total Annual Fee
NBIAX	\$2,000,000,000	2%	1.15%	0.03%
MALOX	\$30,900,000,000	34%	0.84%	0.28%
JDBAX	\$15,800,000,000	17%	0.94%	0.16%
FBALX	\$32,000,000,000	35%	0.53%	0.18%
JALGX	\$11,200,000,000	12%	1.35%	0.16%
Total	\$91,900,000,000	100%		0.82%

Figure 56. Cost Analysis of Financial Advisors. Source: Author Generated

Benefit Analyses:

Just as with the benefit analyses for robo-advisors, the metric used to quantify the benefits of financial advisors were the annual fund (portfolio) returns of an investor with initial funds of \$1,000,000 and holding a taxable account. To ensure consistency with previous analyses, returns extracted covered 8 years as well, starting from 2011. Unlike the data unavailability with robo-advisors however, returns for all five funds starting from 2011 were all available (see Figures 57-61).

⁹¹ "Morningstar | Independent Investment Research." *Morningstar*

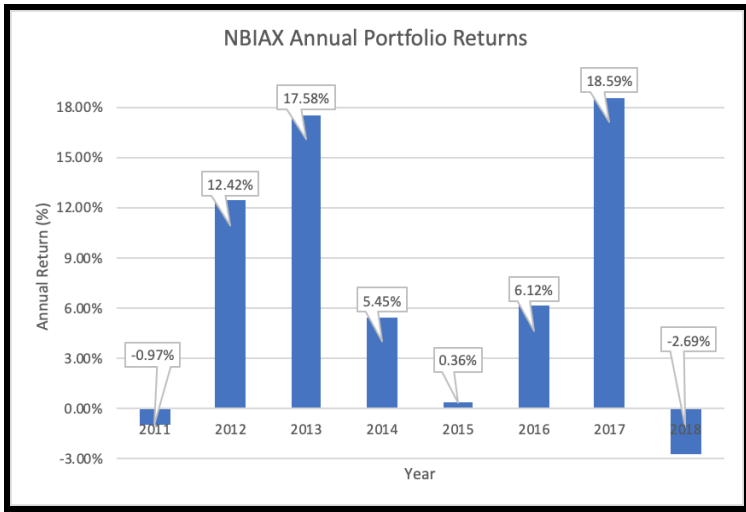


Figure 57. NBIAX Annual Portfolio % Returns 2011-2018. Source: Author Generated

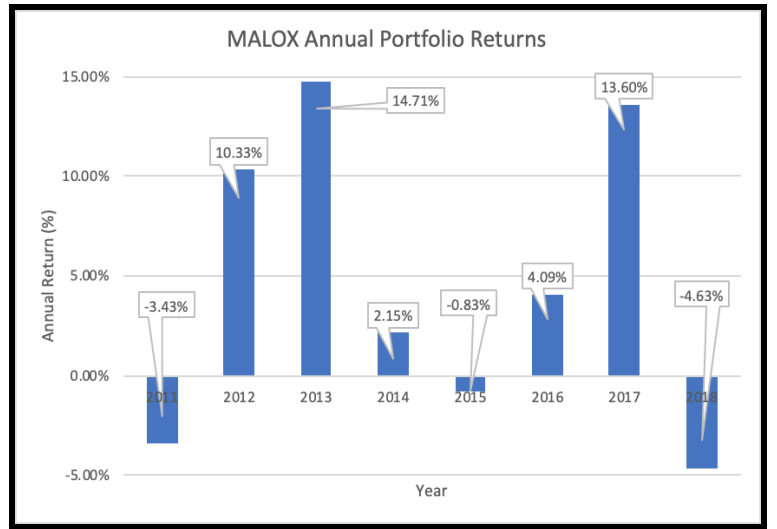


Figure 58. MALOX Annual Portfolio % Returns 2011-2018. Source: Author Generated

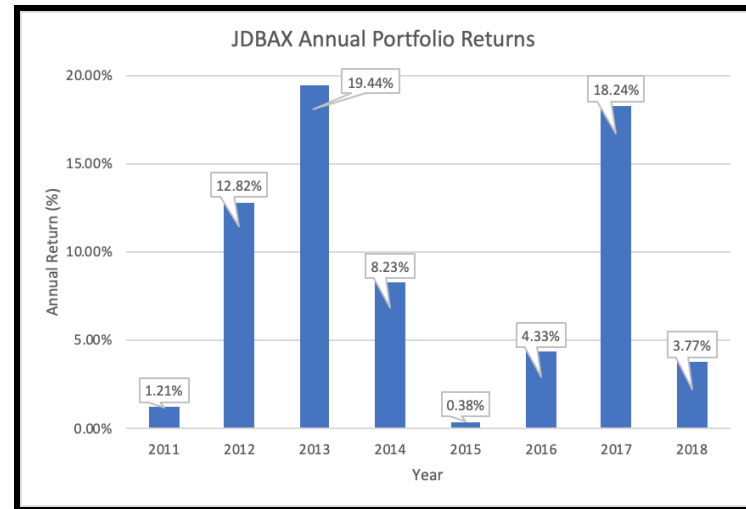


Figure 59. JDBAX Annual Portfolio % Returns 2011-2018. Source: Author Generated

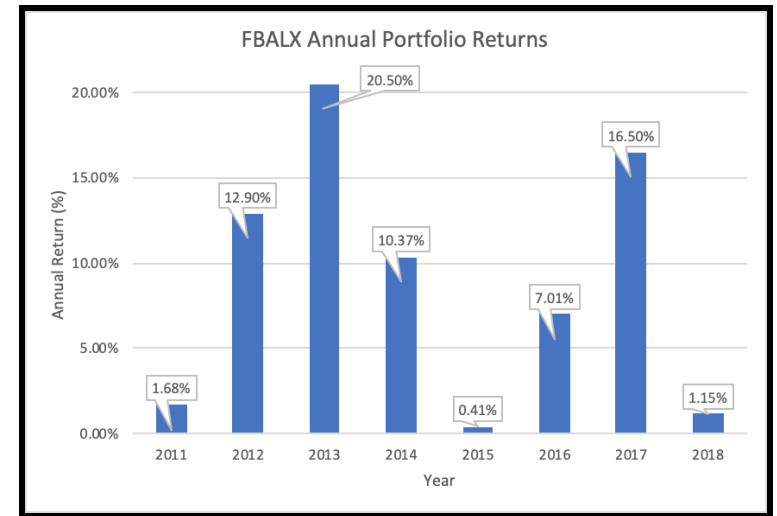


Figure 60. FBALX Annual Portfolio % Returns 2011-2018. Source: Author Generated

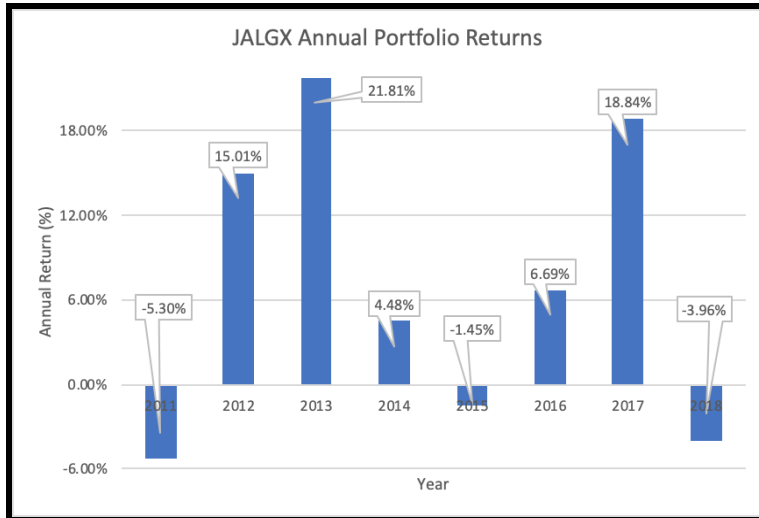


Figure 61. JALGX Annual Portfolio % Returns 2011-2018. Source: Author Generated

After determining returns for each of these funds, a weighted average was taken just like last time by multiplying each fund's yearly return by its market share to calculate weighted returns for each year from 2011-2018. Because there was no missing data as mentioned earlier, market shares stayed the same when using this calculation method. Figure 62 thus shows yearly annual portfolio returns when using a financial advisor in %'s. Given a \$1,000,000 investment in 2010, these portfolio returns were once again converted to portfolio gains and losses in dollar terms from % returns (see Figure 63).

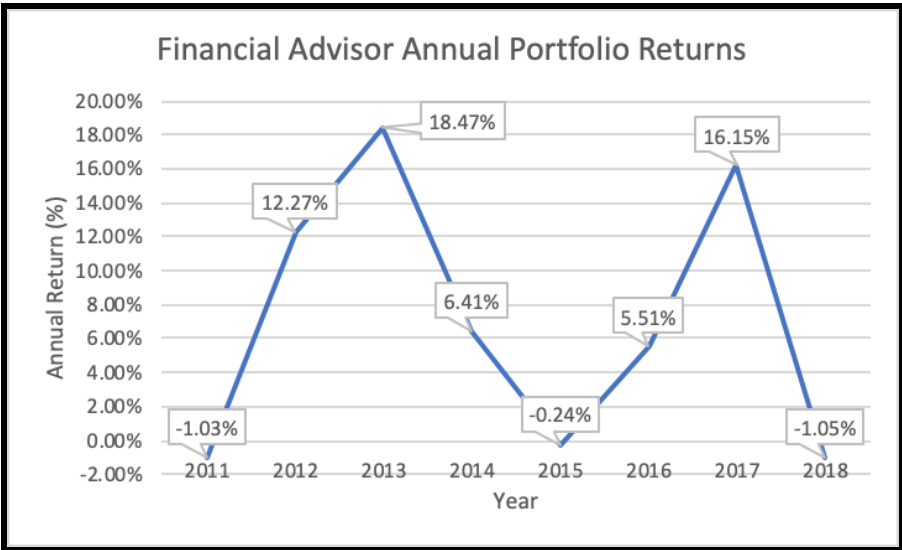


Figure 62. Financial Advisor Annual Portfolio % Returns 2011-2018. Source: Author Generated

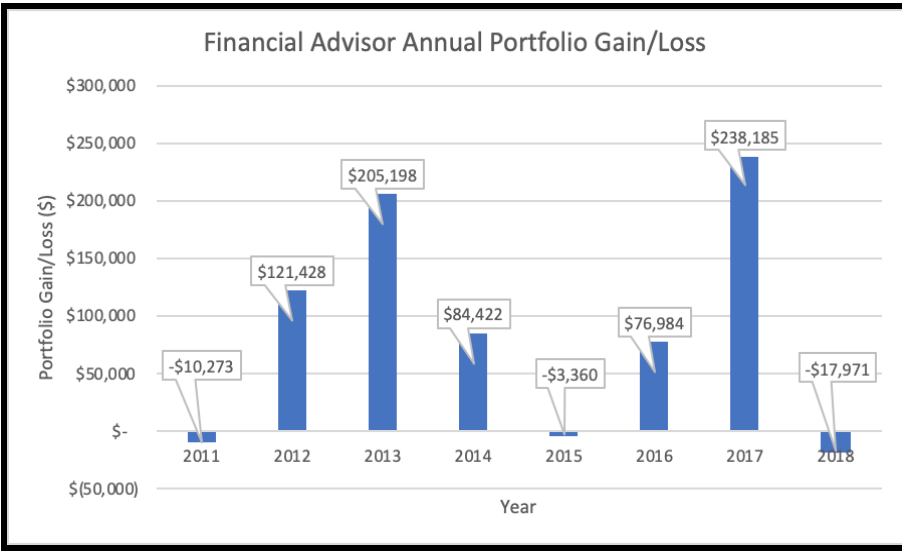


Figure 63. Financial Advisor Annual Portfolio Gains/Losses in \$ Terms 2011-2018. Source: Author Generated

The final step includes cumulatively combining the results from the cost analyses and benefit analyses earlier for financial advisors. The annual cost of 0.82% was subtracted from the yearly portfolio returns as shown in Figure 63 and then multiplied by the previous year’s portfolio balance to retrieve the net benefit/loss if a client used a financial advisor (see Figure 64).

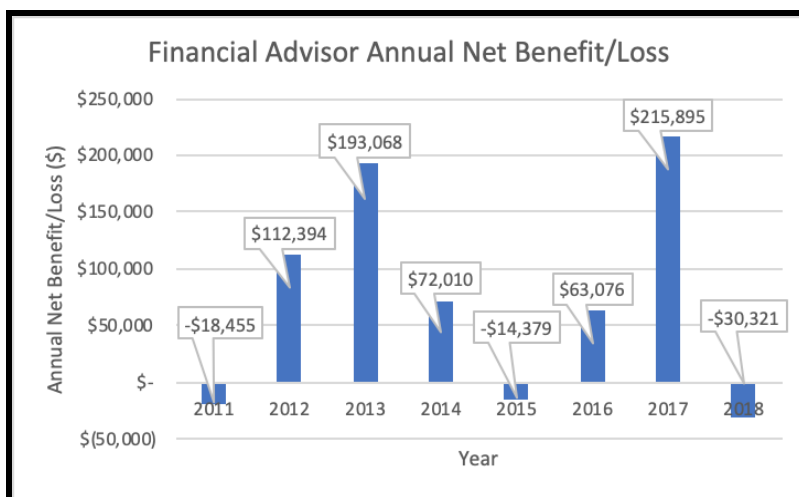


Figure 64. Financial Advisor Annual Portfolio Net Benefits/Losses in \$ Terms 2011-2018. Source: Author Generated

Now that annual net benefits and losses have been calculated for both robo-advisors and traditional financial advisors, comparisons can be made (see Figure 65). For the most part, the net benefits and losses have been close between each investing approach over the years. In all years except 2011, both sides experienced net gains or losses together. However, it may be concerning that there is a significant divergence as of now where clients using robo-advisors are potentially experiencing much more losses than those using financial advisors (nearly a \$20,000 difference). This can be confirmed by referring back to Vikram’s comments in the earlier section “Case Studies: An In-Depth Look Into A Robo-Advisor and a

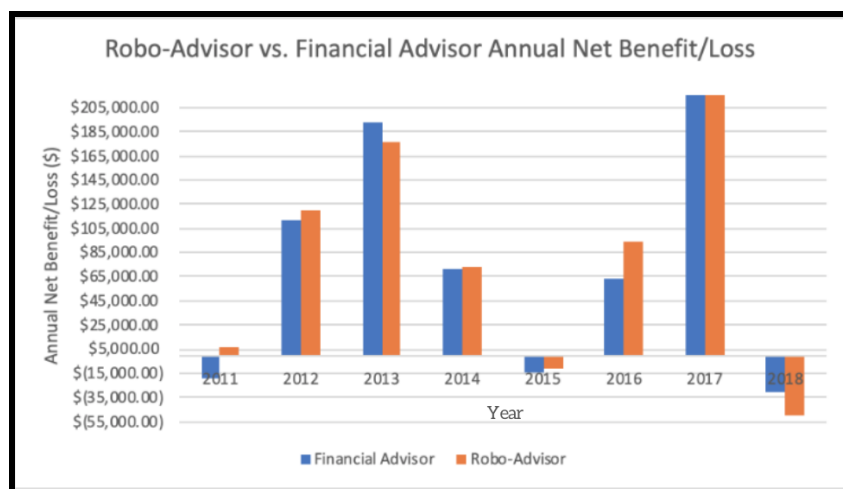


Figure 65. Robo-Advisor vs. Financial Advisor Annual Portfolio Net Benefits/Losses in \$ Terms 2011-2018. Source: Author Generated

Traditional Financial Advisor Firm” where one of his clients who decided to invest with a robo-advisor is losing lots of money currently.

Testing the Effectiveness of Robo-Advisors

Study Purpose

In order to validate our research and personally experience how robo-advisors work, we allocated our personal time and money to evaluate the technology over the course of one and a half months. The test platform chosen for this purpose was Betterment, the third largest robo-advisor by AUM of \$13.5 billion.

Why Betterment?

Betterment was one of the first companies we found due to their significant market share and involvement in the history of robo-advisors as one of the first robo-advisors since the segment sprung up in 2008. Although research of the top ten robo-advisors indicated that some platforms were an offshoot to traditional financial advisor firms such as Vanguard Personal Advisor and Schwab Intelligent Portfolios, one of the aspects we were looking for was an independent, stand-alone robo-advisor firm not connected to any conventional advising practices in order to fully experience the pure robo-advisor business model and technology. As it turns out, Betterment was the largest independent robo-advisor by AUM so this was appealing to us as well. As two college students, it was especially attractive to see that the account minimum to create a portfolio was advertised as requiring \$0, enabling us to put in a low amount of money. Finally, we decided to go with the Betterment Digital plan which was Betterment’s lowest costing plan at an annual account management fee of 0.25%.

Procedures

Before diving into more detail in the approximately 1.5-month investment with Betterment, it is important to understand the general steps that were taken during the investment period. These steps can be categorized into:

- Set-Up
- Performance Tracking and Monitoring
- Liquidation

Set-Up

The first step of the process was to fill out the Betterment questionnaire previously shown in Figure 36. In order, here were our answers to the questions that were posed to us:

1. The first question asked if we were currently retired and we responded “No”.

2. "21" was entered in response to the question asking how old we were.
3. Because at the time we didn't hold any full-time jobs, our annual pre-tax income was \$0.

At this stage, Betterment actually suggested us to select an investing goal (see Figure 66). It is important to note that this was still preliminary, given that an actual Betterment account was not created as of yet. Thus, we chose the first option, "Safety Net". Our reasoning for this was that we thought this was very applicable to potential clients of our demographics. Given that we were both college students, it made sense that an emergency fund be created since it would be nice to build up funds for any unexpected expenditures in the future (expensive course materials) or save up for future expenses such as monthly rent. The idea came from examining our personal finances showing that a variety of expenses (rent, utilities, transportation) ate away most of our available, free income left at the end. In addition, we leaned more towards being conservative investors, trying to minimize losses and being risk-averse as well in response to market volatilities.

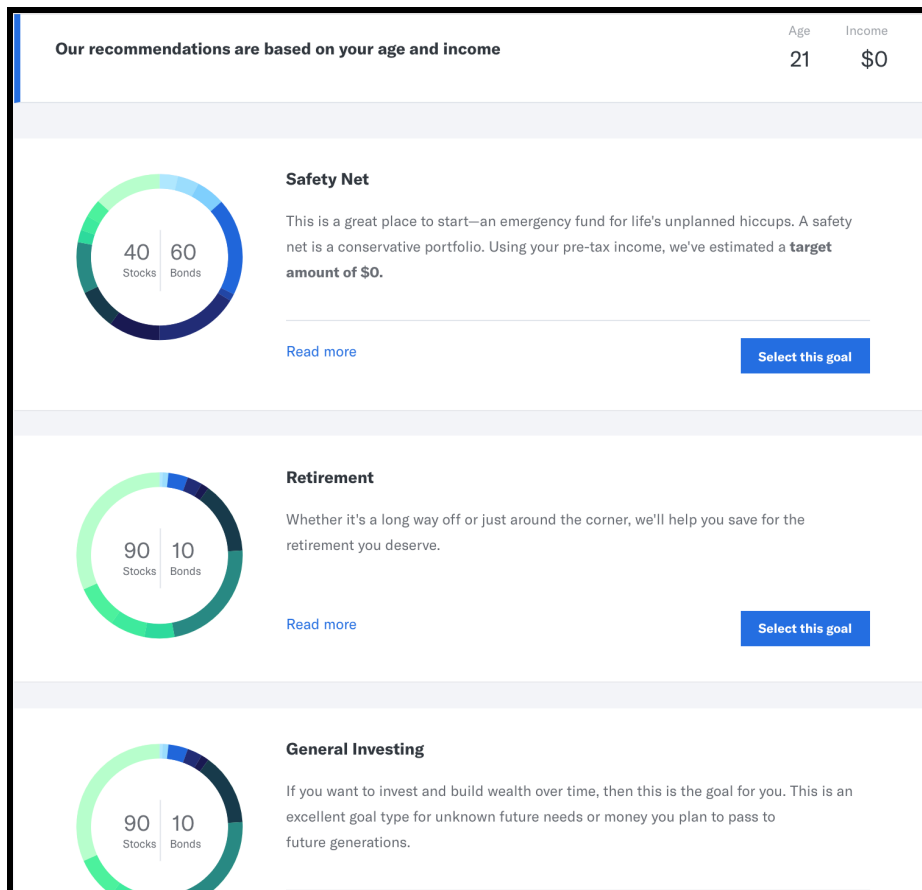


Figure 66. Betterment Preliminary Investing Goal Selection. Source: Betterment Web Portal

Next, account set-up procedures were initiated by asking us to link a primary email address and password to the account. It then asked for our contact information (name, address, phone number, etc.) and identity verification (SSN, date of birth, and gender). Betterment assured us that they used strong browser encryption, secure data storage, fraud protection, respected our personal information in accordance to their privacy policy, etc. in response to our hesitation to provide this info. It then asked us to choose our employment status at which we selected “Student”. Then, financial background questions were asked such as our tax filing status (“Single”), estimated our federal tax bracket at 10% based on our pre-tax annual income of \$0, and our estimated investable assets (responded with “\$500”). Moving on, regulatory questions were asked such as whether we were employed/associated with a broker dealer (an individual/firm who buys and sells securities on the behalf of customers), a 10% shareholder (owner) in a publicly traded company, etc. to which we replied “No”. Finally, primary and backup security questions were asked and terms agreement needed to be checked in order to create our Betterment account.

After creating the account, we set up a new investing goal within the Betterment portal which proceeded to ask further questions. Here were our responses:

4. When asked which type of account we would like to open, we responded by selecting the “Individual Taxable” option. This made sense since the other options were IRA accounts and Trust accounts which were not applicable to our financial situation.
5. To determine what the account would be used for, “Safety Net” was selected according to our reasoning explained earlier.
6. In order for Betterment to personalize our allocation, we renamed the investing goal as “Test” to correspondingly fit our concept of experimenting with one of the robo-advisor platforms. The questionnaire also asked how long we wanted to invest to which we responded 1 year with a target amount of originally \$530. Due to automatic deposits of \$100 a month, however, this changed to a target amount of \$1,789. A further discussion of this aspect will be discussed soon.
7. Next, it showed the recommended portfolio for our financial situation based on our earlier responses. As shown in Figure 36, Betterment recommended a portfolio of 40% stocks and 60% bonds. Since we wanted to purely test out how effective Betterment’s algorithms were, this recommendation was untouched and not modified in any way.
8. Finally, Betterment asked us to set our risk level. We agreed with their target allocation of 40% stocks and 60% bonds classifying us as taking “moderate” risk.

The last step was to deposit funds into the “Test” individual taxable account by linking one of our bank accounts to Betterment. Next, auto-deposits of \$25 every week (or \$100 a month) were set-up as well which linked up to the bank account.

Performance Tracking and Monitoring

Funds were transferred to the account and auto-deposits were set up as well on October 1st, 2018. However, it was not until October 2nd that Betterment received the funds and reflected them in our balance. Thus, performance of the portfolio didn't begin to be tracked until this date. While the Betterment portal online was a very useful tool to monitor our investments, the Betterment app was downloaded and used more often because of its convenience and greater accessibility. Nearly every day, we opened the app to primarily look at our "Total Betterment Balance", our "Total Earned", and our "Total Simple Earnings" (see highlighted areas in Figures 67-69). A discussion of how total simple earnings is calculated will be discussed later in the paper.

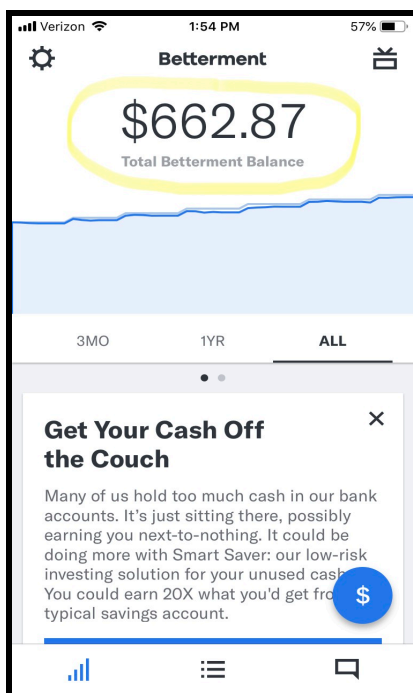


Figure 67. Total Betterment Balance. Source: Betterment App

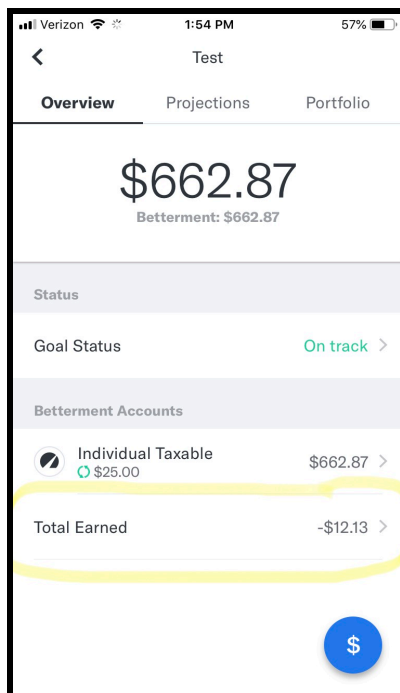


Figure 68. Total Earnings. Source: Betterment App

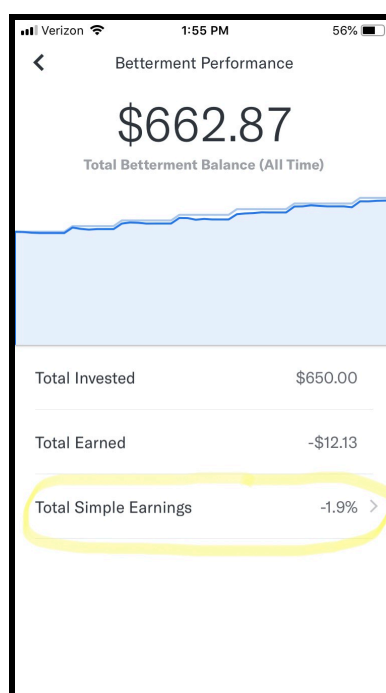


Figure 69. Total Simple Earnings (%). Source: Betterment App

Liquidation

On November 16, we liquidated our Betterment account, meaning we initiated a full balance withdrawal which marked the end of the investment period of approximately one and half months. This gave us enough time to analyze and evaluate our experience. The transaction was expected to take 4-5 business days to complete.

Results and Discussion

In order to discuss our experience with Betterment Digital and provide useful feedback to help any future potential users of robo-advisor platforms, a customer evaluation scorecard was created evaluating Betterment in five different areas (see Figure 70). Each area was scored out of ten points, with zero being very unsatisfactory and ten being very satisfactory. This was subjectively based on our own opinions. Taking a simple average of all five component ratings gave us an average score of 7.6/10. Listed below are the areas which were evaluated:

- User Friendliness
- Financial Performance
- Fees
- Tools and Resources
- Investment Options


 0 - Very Dissatisfied 10 - Very Satisfied	
User-Friendliness	9/10
Financial Performance	6/10
Fees	8/10
Tools and Resources	6/10
Investment Options	9/10
Total	38/50
Average Score	7.6/10

Figure 70. Betterment Customer Evaluation Scorecard. Source: Author Generated

User Friendliness - 9/10

Based on our own experience, we felt like the Betterment app and website portal were very easy to use (see Figure 71). In figures 67-69 displayed earlier, it can be seen that the tabs were neatly organized and named appropriately so that we knew exactly what we would or what we wanted to view. Information displayed was also not hard to follow and any average user would have effectively understood what they were looking at because Betterment did not incorporate any technical finance terms or formulas. The same goes for the website portal as shown below. The sections labeled after “Overview” clearly tell us what information we would find about our portfolio if clicked on. “Overview” provided a great snapshot which showed exactly the things clients would most likely want to know: the portfolio balance, earnings gained or lost, and whether we were on track to reach our investment goals. Moreover, the effective use of colors

and utilization of a simple layout on both the website and app was something we much appreciated as well. For instance, the bright green under “Goal Status” was helpful in easily understanding whether we were on the right path to achieving our goals. Furthermore, during account setup as discussed earlier, we were guided through the process smoothly on Betterment’s user interface and it was relatively straightforward understanding what information Betterment wanted from us.

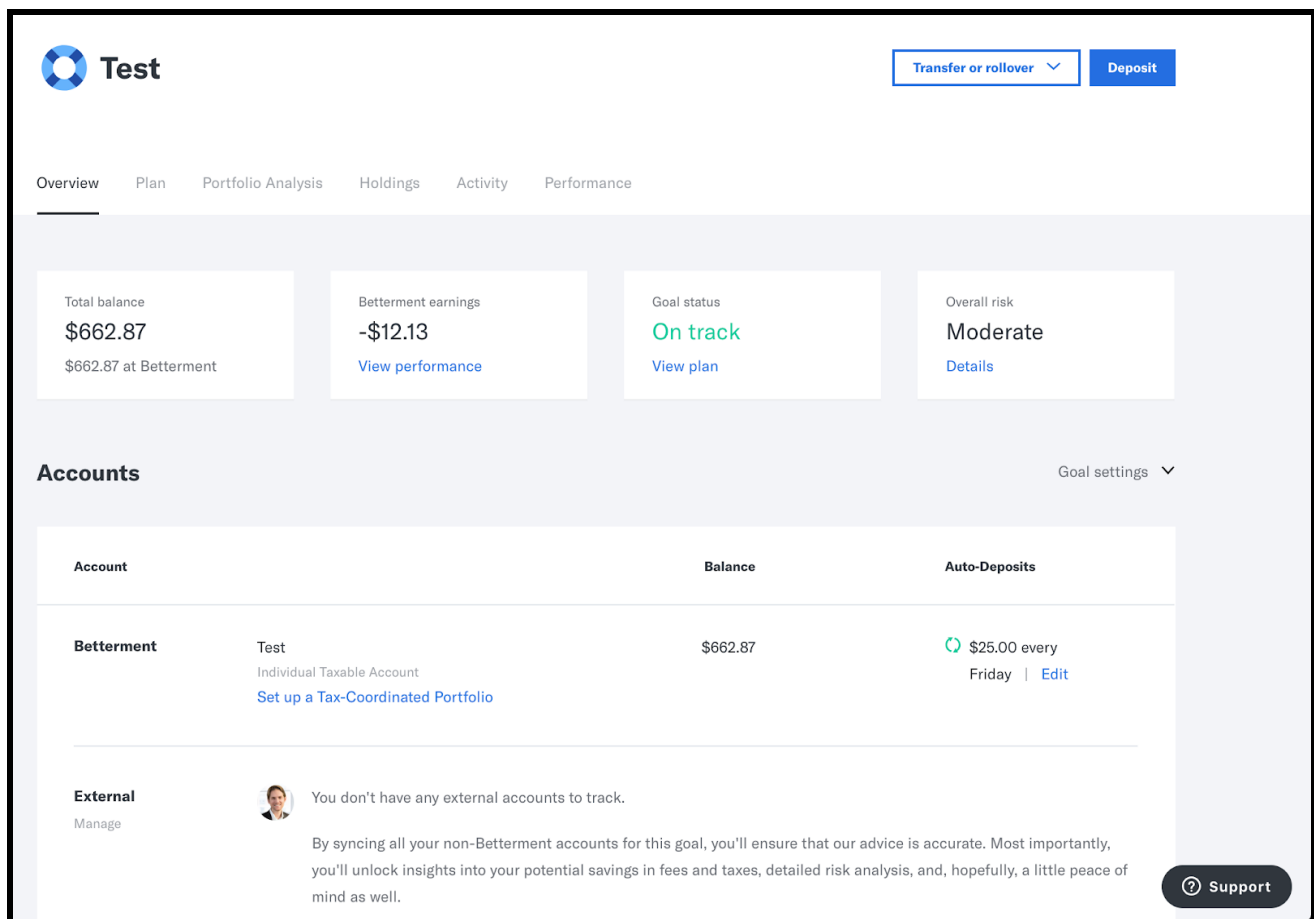


Figure 71. Betterment Website Portal Screen Capture. Source: Betterment Web Portal

After the successful creation of our portfolio, we appreciated Betterment’s efforts in trying to disprove the fact that robo-advisors relatively lack more personal touch towards their clients than do traditional financial advisors. One great example of this is that we immediately began to receive emails from the company which helped us feel as if we were a respected client of Betterment. Initial emails consisted of setting financial goals, incentives in exchange for referrals, and a checklist to show how we could make the most of our investment goals. Early on, we also received emails from a customer service representative and from the CEO, Jon Stein welcoming us into the Betterment community (see Figure 72). One of us even received a birthday email from

Betterment (see Figure 73)! These emails then really did help fill the hole of the lack of personal touch robo-advisors often suffer from. To this day, we still get useful emails which notify us when our automatic deposits will happen and when they are successfully transferred over as well as notifications of the reinvestment of dividends earned from our ETF holdings. Finally, our user-friendly experience was boosted even further when we were required to set up a four-digit pin code on the Betterment app (see Figure 74). This authentication was quite reassuring to us because we felt like our assets and personal information were being protected well from any intruders.

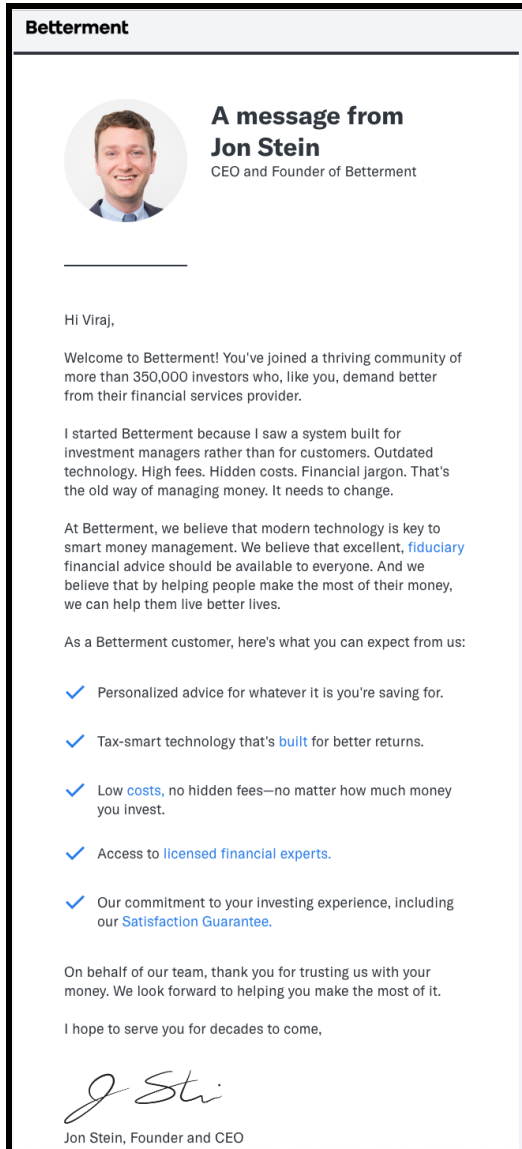


Figure 72. Betterment CEO Welcome Message. Source: Personal Email

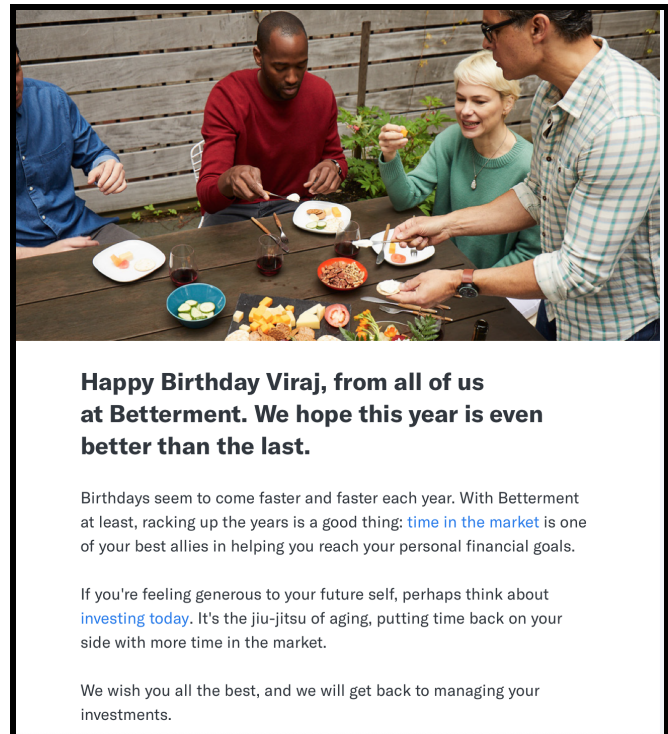


Figure 73. Betterment Birthday Message. Source: Personal Email

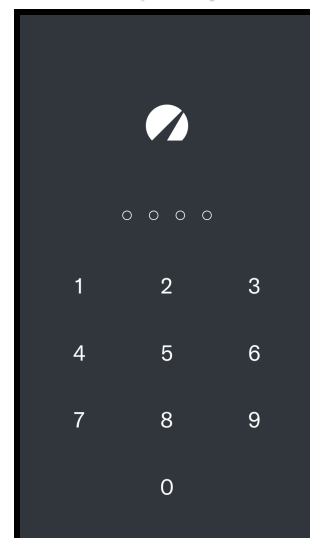


Figure 74. Betterment Account Authentication. Source: Betterment App

However, because the Betterment app was a condensed version of the online portal, we were not able to view our historical portfolio returns at the amount of detail we wanted. While total simple earnings in percentage form was displayed, there were no accompanying graphs to show performance of returns over time. The website, meanwhile, expanded upon this by providing not only simple earnings but also time-weighted investment returns, its cumulative performance displayed through a line chart, and another type of return metric called the internal rate of return (see Figure 75). A discussion of all these return types will be covered in the next subsection of the scorecard, *Financial Performance*. Thus, it was a little disappointing to learn this because if it was incorporated in the more convenient app, valuable insights about our portfolio would have been learned more efficiently and quickly.



Figure 75. Website Portal Time-Weighted Investment Returns. Source: Betterment Web Portal

Financial Performance - 6/10

At the end of the investing period, November 16, final portfolio returns were analyzed. Note that it did take time for our portfolio to completely sell off (on November 19, the next business day) and so there were some changes to the following numbers discussed. However, analysis will cover only the October 2-November 16 (considered the date we sold our assets) time frame.

Betterment, as mentioned earlier, essentially provided us two types of metrics to measure performance: time-weighted investment returns and money-weighted returns. A discussion will take place around each:

Time-Weighted Investment Returns

What are time-weighted investment returns? According to Betterment, they can be thought of as the amount a dollar would have changed if it was invested during our first deposit (which was reflected on October 2). These returns are unaffected by deposits, withdrawals, dividends that are ultimately reinvested, or any other external cash flows from our account (e.g. \$25 auto-deposit per week in our case). This measure is useful in reflecting Betterment’s ability to manage our portfolio according to the investing goal and strategy we outlined (currently \$1,789 in 1 year with a 40% stock/60% bond portfolio).⁹² As seen in Figure 75, time-weighted investment returns are shown over time starting from October 2. After liquidation, it was determined that these returns were -2.6%. How was this calculated? Take a look at Figure 76. Final earnings in this calculation are -\$12.86 (market changes). The dividends that were paid out from the holdings we had (\$0.73), again, are not included because these are technically reinvested back into our portfolio in order to rebalance. Betterment’s use of fractional shares makes it possible for this rebalancing to happen by buying shares of stock or bond funds to maintain the 40%/60% allocation. To perform the calculation, -\$12.86 is divided by \$500 (the initial investment excluding any recurring auto-deposits) to get -0.0257 or -2.57% which is ultimately rounded to -2.6%.

Earnings	-\$12.13
Market changes	-\$12.86
Dividends	\$0.73
Management fees	\$0.00
<hr/>	
Ending balance on November 17th, 2018	\$637.87

Figure 76. Betterment Investing Period End Portfolio Earnings and Ending Balance. Source: Betterment Web Portal

However, this number was disappointing given that we were hoping for positive returns by the time we sold our portfolio. Regardless, on the website portal, Betterment suggested that this metric was useful in comparing our returns to other investments.

First, let’s compare our portfolio returns to the US Large Cap Fund which tracks the S&P 500, the stock market index based on the market caps (market values) of the 500 largest companies. As it turns out, the portfolio did rather well compared to this fund as of the liquidation date and

⁹² “What Is a Time Weighted Return?” *Betterment*

relatively returned 3.6% less losses (see Figure 77). From this figure, it can also be seen that we invested with Betterment when the stock market was at an all-time high during early October and consequently, sharply dropped and has been at a loss since then. Compared to the fund which tracks domestic high quality bonds, however, our portfolio returned 2.3% more losses (see Figure 78). Because our portfolio had a 60% exposure to bonds, it was logical to see that performance was in the middle of the two funds' performances. Although losses were not fully minimized, the portfolio was well protected against major losses in the stock market.

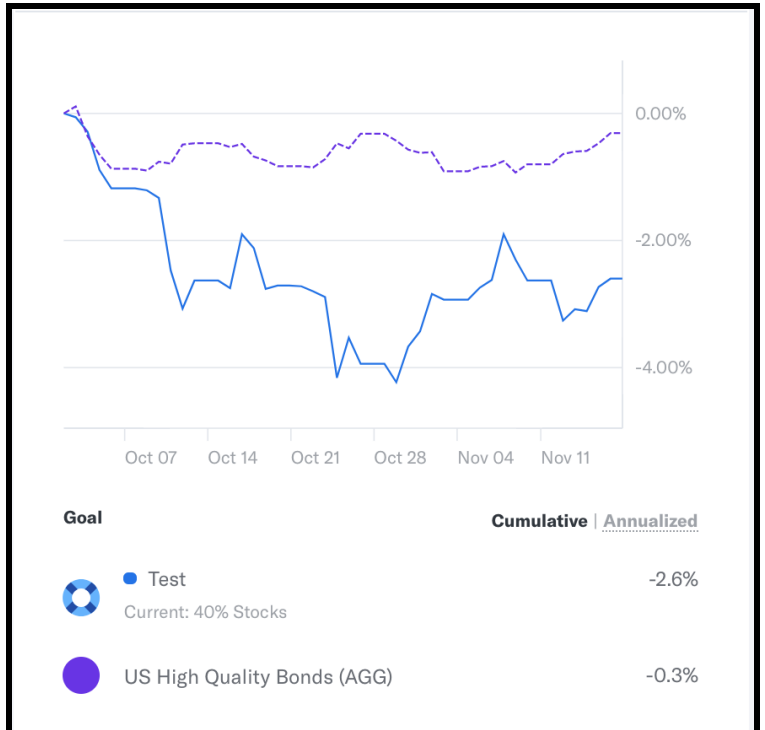
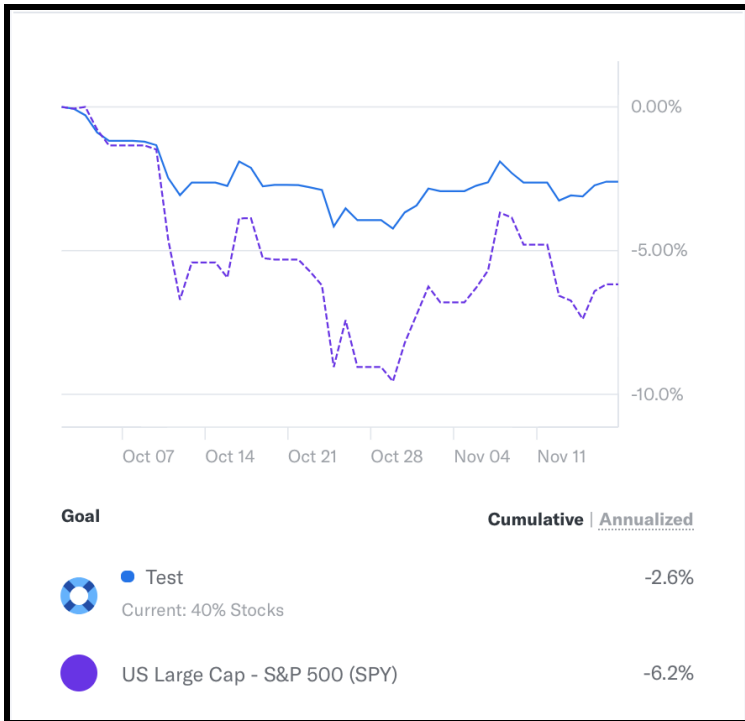


Figure 77. Test Portfolio vs. S&P 500 Time-Weighted Investment Returns (%). Source: Betterment Web Portal | Figure 78. Test Portfolio vs. U.S High Quality Bonds. Source: Betterment Web Portal

At the same time, although a 40%/60% stock/bond allocation was chosen initially, it was disappointing to see that similar Betterment portfolios of allocations heavily weighted more towards bonds would have incurred less losses and even slight returns (see Figure 79). Thus, this showed Betterment's failure of providing us a rather static portfolio allocation without dynamically changing the stock/bond weights in response to market opportunities to minimize losses even further or to produce gains.

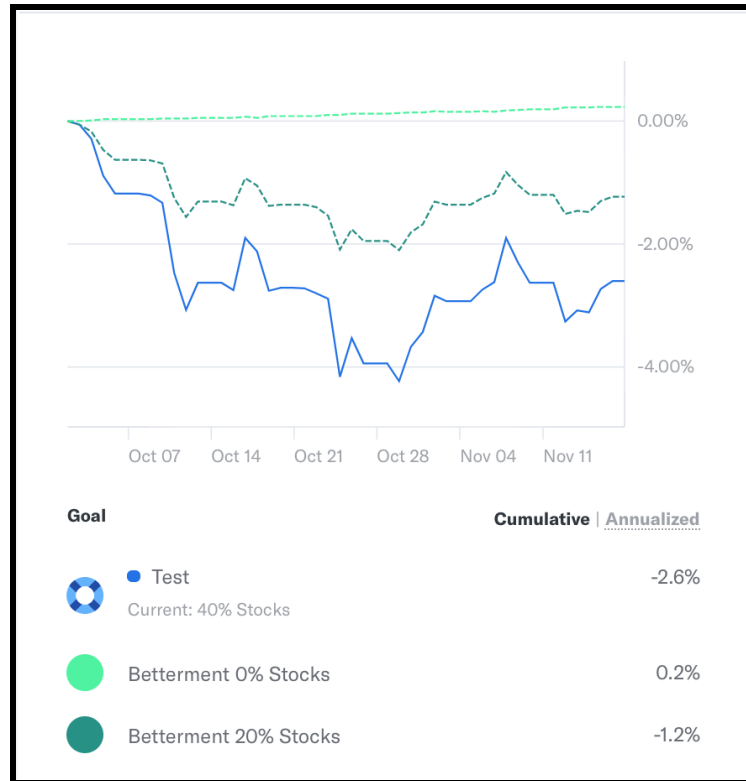


Figure 79. Test Portfolio vs. 0% Stock Allocation vs. 20% Stock Allocation Time-Weighted Investment Returns (%). Source: Betterment Web Portal

Money-Weighted Returns

While this metric is not useful for comparison studies, it was still beneficial for us to gain further insights into our portfolio. Money-weighted returns, unlike time-weighted returns, take into account all cash flows into and out of the account (auto-deposits, dividends, withdrawals, etc.). The simple earnings percent and internal rate of return fall under this category.

Simple Earnings Percent:

As shown earlier, this measure was primarily checked by us daily in order to provide a quick and simple way of understanding how our portfolio was performing. At its most basic level, this is defined as the amount we gained as a percentage of the amount we invested. It is important to note that one of the pitfalls associated with this is that all kinds of deposits in our account including our initial deposit are treated as if they occurred at the same time which can skew

(distort) the number with a larger investment of funds (explained later in this paragraph).⁹³ For us, our simple earnings percent was -1.9%. How was this calculated? Refer back to Figure 76. Because earnings are now inclusive of all cash flows, the -\$12.13 is taken. Following this same logic then, our total investment during the period was (\$12.13 + the ending balance of \$637.87 or \$650). Dividing -\$12.13 by \$650 gives -0.01866 or -1.866% rounded to -1.9%. Although -1.9% is not too substantially different from our time-weighted return of -2.6%, it is easy to see how a larger investment on our own end could have skewed the simple earnings percentage. For instance, keeping the -\$12.13 the same, if \$1,000 was invested instead then the simple earnings percentage would be -\$12.13 by \$1000 or -1.2%, more than 50% less than the time-weighted return! Regardless, our simple earnings percent was negative indicating that we indeed incurred losses during the time frame.

Internal Rate of Return:

The internal rate of return accounts for the size and timing of deposits and withdrawals in addition to portfolio performance. This is essentially the total all-in return of our account. To calculate this measure, the total earnings over the investment period is divided by the average amount that is invested.⁹⁴ How is this calculated? Technically speaking, our investment period was from October 1 (the day we transferred over the funds) to November 16, the liquidation date. This period is around 47 days. To calculate the average amount that was invested, a weighted average needs to be taken. This means dividing the number of days a particular amount was invested for by how long the investment period was and then multiplying it by the actual amount that was invested. Then, a sum is taken of each of these components. For instance, our initial balance of \$500 was invested for 7 days and so a weight of 7/47 would be multiplied by \$500 and so on and so forth. Of course, the amount invested each period increases by the \$25 auto-deposit that was set up to be transferred over each week. The calculation is shown below:

$$(7/47) * 500 + (6/47) * 525 + (7/47) * 550 + (7/47) * 575 + (7/47) * 600 + (8/47) * 625 + (5/47) * 650 = \mathbf{\$573.92}$$

\$573.92 is the average amount that was invested over the period. Next, the same earnings of -\$12.13 is divided by this number to get -0.0211 or -2.1% which is what Betterment reported to us in the website portal. The internal rate of return is then often cited as a better measure than the simple earnings percent because it eliminates the pitfall of assuming all deposits occur at the same time. Regardless, the -2.1% number is not significantly different from the -1.9% simple earnings percentage.

Figure 80 shows another interpretation of Figure 75 where comparisons are made between the amount of funds that were invested and what the ending balance of our portfolio was over the investing period. From the figure, it can again be seen that losses were experienced because our

⁹³ Egan, Dan. "HOW DOES BETTERMENT CALCULATE INVESTMENT RETURNS?" *Betterment*, 16 Nov. 2018

⁹⁴ Grealish, Adam. "DISPLAYING PERFORMANCE TO SHAPE BETTER INVESTOR BEHAVIOR." *Betterment*, 14 Sept. 2018

ending balances were consistently lower even after funding through auto-deposits was done to artificially inflate the value of our portfolio. Again, this contributed to our dissatisfaction with the service. Another disadvantage with regards to financial performance that we experienced refers to Figure 81. This feature, found in both the app and website portal, indicated whether we were on track to achieving our goal of \$1,789 in one year. Although we were on track for the entire investment period, this was only due to the fact that we set up auto-deposits of at least \$100 every month. It was a rough learning process to eventually learn that not setting up an auto-deposit would have automatically categorized our portfolio as being off track to achieving our goal. In the end then, it was dissatisfying to see that our target and projected amount of a little more than \$2,000 reached during the latter half of next year were to be primarily aided by our total deposits. For instance, given an average market outcome, only less than 5% of the achieved target would be attributed to the asset management services of Betterment. The rest would come from our contributions. Even worse, a poor market outcome would result in our goal being achieved relatively at least 3 months later where our deposits would have exceeded the target at least 10% by then. Furthermore, it wasn't too convincing to see that the minimum bound set by Betterment of our chances of achieving our goal was only 50%. This ultimately set in a negative view of our portfolio's financial success.

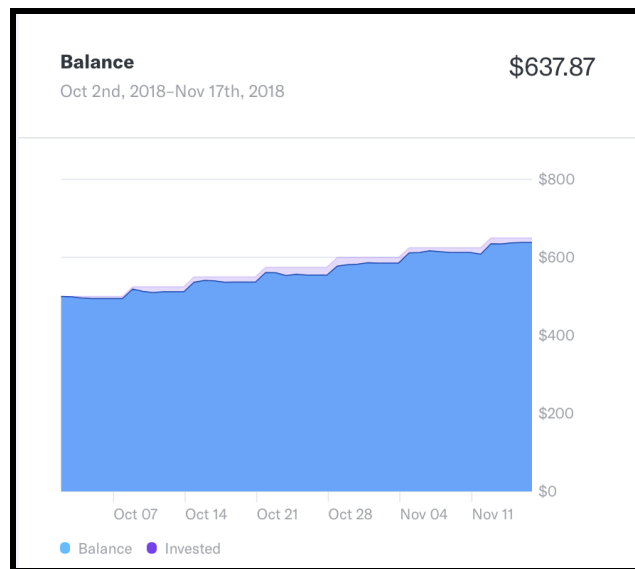


Figure 80. Betterment Portfolio Invested Funds vs. Ending Balances (\$). Source: Betterment Web Portal

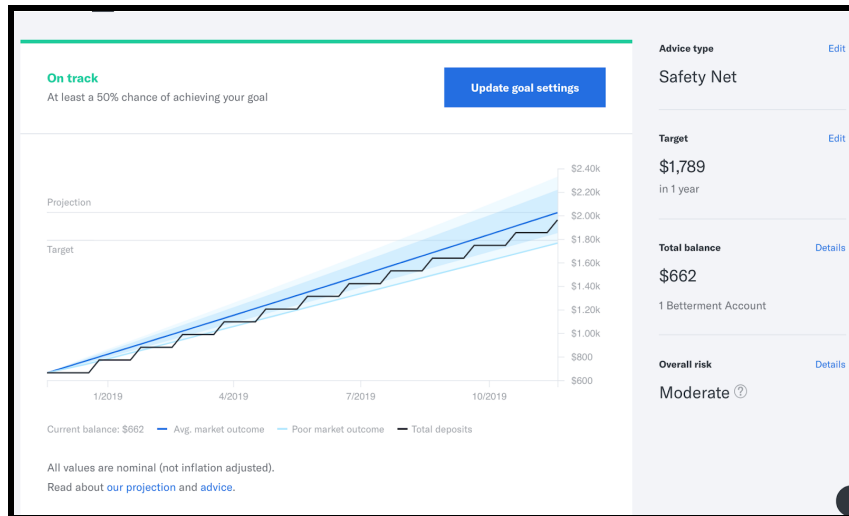


Figure 81. Financial Plan Performance and Tracker. Source: Betterment Web Portal

As we were looking at the “Performance” tab, we continuously noticed a message from Betterment at the top which emphasized how important it was to stay invested over the long-term despite any short-term losses like we had experienced. The same philosophy likely holds for other robo-advisor platforms as well due to their passive management strategies which track indexes and require a “buy-and-hold” mentality as well. Before investing with Betterment, we did recognize this but we were hopeful that short-term gains could be incurred. Nonetheless, our experience here validated and confirmed the fact that robo-advisors are primarily better suited for investors looking to hold their money with the platform for the long run.

Fees - 8/10

After liquidating our portfolio, we noticed that advisory fees would soon be reflected in our Betterment account and cut down on the amount we would be able to withdraw back into our bank account. Fortunately, these fees were only \$0.19. What are these advisory fees? They were appropriately Betterment Digital’s advertised AUM annual fee of 0.25% (see “Robo-Advisor Offerings Differences”) adjusted for our investment period of approximately 1.5 months. This equates to 0.0625% quarterly, or every three months. However, since a full balance withdrawal was done before the three month period, fees were charged based on the number of investment period days in the quarter. How was this calculated? Feedback from customer service indicated that the 0.25% annual fee was prorated (allocated) on a daily basis within the quarterly fee of 0.0625%. For instance, assuming 90 days in a quarter, 0.000625 divided by 90 would give the daily fee of 0.000006944 or 0.0006944%. Then, this number is multiplied by every daily closing portfolio balance during our investment period and summed to an amount of \$0.187, which is approximately \$0.19. In order to charge this fee, miniscule fractional shares of our holdings were sold. Additionally, one aspect of Betterment that we appreciated regarding fees was that no

investment expense ratios were charged. Rather, after again talking to customer support, we learned that these ratios are only charged every year which was not applicable to our 1.5 month investment period.

One downside we did identify was the lack of communication and clarity from Betterment's end. Prior to investing with the platform, research was done by reading forums and blogs where we learned that a minimum auto-deposit of \$100 a month was necessary to avoid a flat fee of \$3 a month (a replacement for the annual account management fee). Although later on we learned that this fee structure was changed early last year, failure of clarification from Betterment to guarantee just a 0.25% annual account management fee without any hidden fees to dispel our worries was disappointing. The flat fee of \$3 a month was initially very concerning to us since approximately \$4.50 over the span of 1.5 months in fees would have ended up costing us 2,368% more compared to just \$0.19! Along with market movements, these losses would have severely cut into our earnings and so we had to take action even if there was misunderstanding. In the end, we ended up auto-depositing \$175 more rather than just the initial investment of \$500 over the course of the investment period which also kept the portfolio on track to meeting our investing goals (another disadvantage pointed out earlier).

Tools and Resources - 6/10

During account set-up with Betterment, multiple hours of research had to be done in order to accurately answer the questions in the platform's questionnaire. This ultimately defied what research had indicated in the "Robo-Advisors vs. Traditional Financial Advisors" section earlier where a minimal knowledge was needed to set up the account. To start off, refer back to Figure 66. Although it was stated that we decided upon going with the "Safety Net" plan, it took quite a while to personally decide whether this was appropriate compared to the "General Investing" plan, a more aggressive portfolio strategy with greater stock exposure to build long-term wealth. It was only through watching many YouTube videos on the end performances of each plan as well as reading user reviews that the "Safety Net" plan was selected due to its more relevant applicability to us as college students, shorter-term focus, and its lower risk (more exposure to bonds). Even then, there was some hesitation on our part to choose this plan since higher returns in the "General Investing" plan was attractive to us as well. Betterment offered little help in this aspect. It simply provided general articles explaining what each plan was with no tailoring to our own situation. Furthermore, when the platform asked how much we would be willing to invest, there was no clear-cut answer and no guidance that Betterment provided through their tools and resources. The ambiguity frustrated us and we learned that the initial numbers we came up with (\$20 and then \$100) were not enough only after we viewed threads describing users' experiences. It was shocking for us to learn from others that with market movements (especially downturns) and fees (then thought to be \$3/month) would cut into our small original investment quite severely. On top of that, former and current users commented that a small amount of money, even if the advertised account minimum was \$0, wasn't enough to buy even one

complete ETF share or even all ETFs in our portfolio. All these pressures ultimately ended up with us deciding on a much larger amount of \$500 and then the addition of auto-deposits of \$100 a month. On top of that, we couldn't initially invest any more than that since we were only college students with a limited amount of funds to contribute.

Moving on, our investing goal target amount was very time-consuming to calculate. While we did choose the "Safety Net" plan, Betterment resources weren't too helpful in helping us calculate the target amount. According to one article provided by Betterment, a simple formula could be used to calculate the amount by multiplying monthly expenditures by the re-employment period.⁹⁵ Even after calculating just one of our individual estimated monthly expenses, it was determined that this number was over \$2,300. This number, we felt, was not reasonable given that we were initially funding only \$500 to the account. Receiving returns of more than 400% in one year was irrational to us. Furthermore, the re-employment period is the number of months it might take us to find a new job. This number was to be multiplied by the monthly expenses, however it was not applicable in our case since we hadn't even held full-time jobs and weren't considered unemployed either since we were just students. Given this frustration, we decided on the target amount by simply looking at the average return a 40%/60% stock/bond portfolio has generated with the available data Betterment had. According to the platform's site, this number was determined to be 5.1% as an average annual return.⁹⁶ Multiplying this by our initial \$500 investment gave us a target of \$525.5 which was rounded to \$530 in hopes of slightly higher gains than the norm. Even then, Betterment failed to remind us that the implementation of auto-deposits would change this goal. Thus, it took nearly two weeks to realize that our financial plan indicated our investing goal of \$530 in 1 year was eventually met simply because we auto-deposited \$25 each week. This gave the wrong impression and was not what we were aiming for. Therefore, it took additional time to recalculate our new investing goal, now incorporating auto-deposits to determine our total investment amount added with the 5.1% average annual return to ultimately get \$1,789. Even with auto-deposits, Betterment never gave us a definitive answer explaining whether it was better to auto-deposit a lump sum of \$100 a month or \$25 every week of the month. Again, it was only through reading user suggestions online that the \$25 a week strategy was decided to ultimately become implemented. This was based on the reasoning that depositing a small amount every week would make the portfolio less susceptible to negative market changes. The overall account set-up process took *six* hours, including independent research on our own end. In the end, it may have been helpful to incorporate how-to or personalized videos/software within the process to more efficiently guide users like us without having to peruse the web for articles, forums, or YouTube videos.

When our portfolio began to experience losses more rapidly during the investment period, Betterment articles weren't that convincing for us to continue holding our money with the service

⁹⁵ Egan, Dan. "Funding a Safety Net: Calculate Your Target Amount." *Betterment*, 6 Aug. 2013

⁹⁶ "Evidence-Based Investment Portfolios Built for You." *Betterment*, 2018

either. Although these articles were thoughtful and well-written to help boost moods of investors like us, the advice wasn't personalized and didn't sound believable. To summarize, one such article recommended to stay calm since market drops are expected and unavoidable. It also recommended to remain patient if we had a long-term goal (which we hadn't) since a short-term market drop would have already been factored in.⁹⁷ Thus, the article's focus on long-term gains echoing the same message that was also told to us in the website portal (see *Financial Performance*) was again not helpful.

Looking at the Betterment app once again, it wasn't until close to the end of our experiment that we discovered that we could utilize the free in-app messaging service to ask financial advisors and/or customer support any questions we had. Although this Betterment feature was researched earlier in "Robo-Advisor Offerings and Differences", we felt like it was not well advertised and apparent in the app's user interface. Take a look back at Figures 67-69. From Figure 67 (the main home screen of the app), this feature was placed at the far right bottom indicated by a chat icon. Little emphasis is placed on where the service may be conveniently located on the screen. Moreover, as investors, we were primarily focused on portfolio performance and returns. As reiterated earlier, Figures 68 and 69 also show that the portfolio was checked daily only to see our total balance, earnings, and simple earnings percentage. This made the messaging service even less apparent. Another reason why the portfolio was checked to only see these three metrics is the simple truth that typical clients like us lead busy lives. Time constraints prevent the checking of each and every aspect of our portfolio and its available features. Thus, it may be helpful to consider placing the in-app messaging service more prominently, on the top, and with a distinguishing color.

When we eventually did ask Betterment a question to assist with our paper, we were initially disappointed to find out how long it usually takes to hear back (see Figure 82 below). "Within 3-4 business days", we felt, was a rather long interval to wait for a response and disappointing given that this question was crucial for our paper and time-sensitive. It was a pleasant surprise to see though that customer support responded on the same day and with a comprehensive, detailed answer. Still, there is a risk when this automatically generated response is given to not only us but to all clients and potential clients on Betterment. It made us feel as if we weren't supported enough in exchange for trusting the platform to manage our assets. Compared to a traditional financial advisor, however, clients have the ability to immediately call their advisor to address concerns or answer questions.

⁹⁷ Egan, Dan. "What to Do After a Market Drop." *Betterment*, 16 Nov. 2018

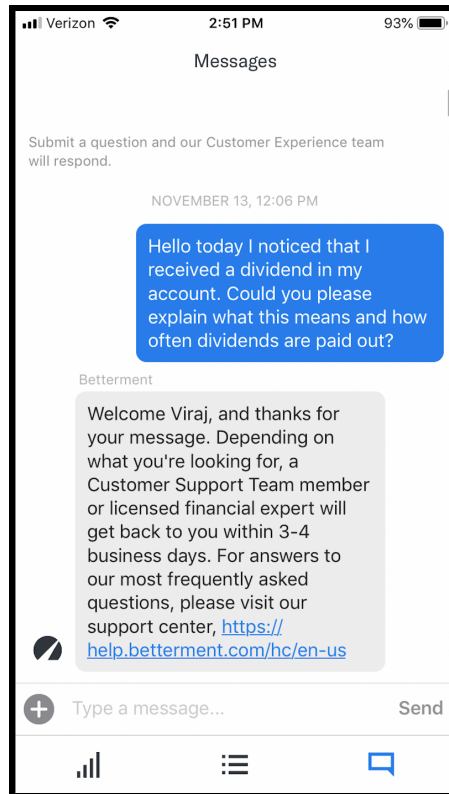


Figure 82. Betterment In-App Messaging Service Response Time Frame. Source: Betterment App

At other times, the absence of a personal touch with robo-advisors was justified and made clear. After asking whether we would be able to view certain aspects of the account such as past performances and returns after our portfolio was fully liquidated, customer support only partially answered our question. It took another follow-up question in order to get our question completely answered. Without face-to-face interaction then, a text message cannot completely capture what we sought to get out of asking a question. Additionally, although it was advertised that clients would receive financial advisor consultation with the service (see “Robo-Advisor Offerings and Differences”), we were in contact with only customer support to answer our questions. On top of that, resources provided to assist us were unsatisfactory. For instance, when we were curious on how to calculate time-weighted investment returns, support replied back with a basic answer which was exactly worded according to a Betterment article we read beforehand which was not helpful. Furthermore, a link was given to a white paper written by Betterment which included complex formulas and terminology to calculate these kinds of returns. After physically calling customer support, the same answer was provided and they redirected us to an Investopedia article to help us figure out the calculations *on our own*. Even after giving access to our Betterment account, there was no assistance provided to guide us step-by-step on how to calculate returns according to the unique numbers we had in our portfolio (auto-deposits, ending balances, etc.). Lack of a tailored and personalized service was frustrating. We ended up figuring

out the calculations on our own which ended up being much simpler than the complicated math Betterment provided in their resources. A similar situation occurred when we asked how our advisory fees were calculated, however the correct explanation was given through a follow-up email after the call with customer support was not helpful. Still, calculations of the fees had to be done on our own end. Finally, we were in contact with the same customer support representative most of the time. While this could be considered personalized, assistance (as mentioned earlier) was of sub-par quality.

Investment Options - 9/10

Research on robo-advisors beforehand indicated that Betterment, like most other platforms, utilized ETFs to construct portfolios for clients (see "Selection" under "Underlying Mechanics" and "Robo-Advisor Offerings and Differences"). Expansion of the holdings shown in Figure 83 indicate that a certain ETF was utilized for each subsection of the portfolio. It is important to note that we were initially not very familiar with investment options since we invested our funds with Betterment before this paper began to be written. However, the fact that ETFs were utilized in our experience with Betterment validated our research. Although the use of only ETFs was limited in a sense, the primary benefits as indicated earlier were leveraged to prove beneficial to Betterment clients like us (e.g. lower management fees passed on to clients compared to mutual funds). This is something we greatly appreciated. In addition, it was relieving to see that total fund fees per year as indicated in the figure were 0.12%, in accordance with Betterment's advertisement of investment expense ratios amounting to 0.13% according to prior research (see "Robo-Advisor Offerings and Differences"). Furthermore, each holding charged an expense ratio that was significantly lower than the industry average. Moreover, Betterment effectively diversified our portfolio thus minimizing firm or sector specific risk by investing in variants of the domestic stock market and international stock market but also variants of the domestic bond market and international bond market as well. The only area in this aspect of the scorecard we would have preferred was greater involvement of us in the process of fund selection by giving feedback as to what investments (ETFs) we would like to see in our portfolios to feel more closely connected with the use of our funds.














Holdings	Current weight	Fund fees per year %
> U.S. Total Stock Market	13.3% 	0.04%
> U.S. Value Stocks - Large Cap	3.6% 	0.05%
> U.S. Value Stocks - Mid Cap	2.9% 	0.07%
> U.S. Value Stocks - Small Cap	2.4% 	0.07%
> International Developed Market Stoc...	10.0% 	0.07%
> International Emerging Market Stocks	7.8% 	0.14%
> U.S. Inflation-Protected Bonds	3.6% 	0.06%
> U.S. High Quality Bonds	4.2% 	0.05%
> U.S. Short-Term Treasury Bonds	5.6% 	0.15%
> U.S. Municipal Bonds	19.0% 	0.07%
> U.S. Short-Term Investment-Grade B...	1.4% 	0.25%
> International Developed Market Bonds	16.2% 	0.11%
> International Emerging Market Bonds	10.1% 	0.40%
Total	100%	0.12%

Figure 83. Betterment Portfolio Holdings. Source: Betterment Web Portal

On a separate note, it is important to understand that our portfolio, during the investing period, only went through cash flow rebalancing whenever auto-deposits were added and when dividends were reinvested. Dividends received came from the bond ETFs we held which are paid out monthly in contrast to the dividends of stock ETFs paid out quarterly (but our investment period was less than a quarter). Reinvestment of dividends, unfortunately, couldn't be turned off since it was central to the philosophy of long-term passive, automated investing. This can be considered another disadvantage since we were looking for short-term gains. However, by using all our dividends (\$0.73) to rebalance by buying fractional shares of ETFs, greater tax-efficiency was achieved rather than selling shares and getting taxed on any capital gains. Sell/buy

rebalancing never occurred because the portfolio's drift never reached or exceeded Betterment's threshold of 3%. Finally, allocation change rebalancing didn't occur either since our risk preferences, investing goals, and time horizon didn't change (remained moderate risk at a 40%/60% stock/bond allocation with a 1-year "Safety Net" goal). A complete explanation of cash flow, sell/buy, and allocation change rebalancing can be found under "Adjustment" in "Underlying Mechanics".

Conclusion

Betterment's user-friendly investing platform offered us a smooth transition given we had no exposure to using robo-advisors in the past. Its simple, organized layout without the use of any complicated terminologies and formulas made it easy for us to pull up the information we needed. The use of notifications and attempts to welcome us into the Betterment community through email were steps in the right direction to make up for the lack of personal touch, a typical robo-advisor flaw. However, it may be useful to expand financial analysis of portfolios in the app. While we were not fully exposed to crashes in the stock market, a dynamically changing portfolio with regards to stock/bond allocations would have prevented us from experiencing a disappointing -2.6% time-weighted return over the investment period. Heavy reliance on auto-deposits to keep our portfolio on track towards achieving the target amount in a year also made us feel as if Betterment's asset management services weren't contributing much value (especially with poor market outcomes and a low probability that our goals would be met). Given our financial performance then, we came to the conclusion that robo-advisors indeed are not suitable for investors looking for short-term gains. For instance, Betterment's philosophy of passive management and dividend reinvestment requires potential clients to come in looking to hold their assets with the platform for the long run. Fees were minimal and accurately charged according to modifications of the 0.25% annual account management fee. The absence of ETF expense ratio charges were an added plus as well. Thus, this reconfirmed the cost efficient structure of robo-advisors. However, Betterment's fees could be made more transparent and communicated more clearly preventing cautious investors like us researching for hidden fees which are not even applicable anymore (eventually leading to investing more with the service to bypass these fees). The absence of personalization to our unique situation (characteristic of robo-advisors in general as well) was emphasized the most during our struggles of setting up the Betterment account causing us to spend many hours doing our own research. Tailored online training and how-to videos within the set-up process could have the potential to alleviate most of this problem. Little emphasis on the placement of Betterment's in-app messaging service was another issue which we feel could be rectified with simple formatting adjustments. Even then, however, it was troubling to experience the incapability of support through the app and on the phone to comprehensively and fully answer our questions tailored to our own portfolio. Finally, the holdings Betterment chose for us were well diversified and cost-efficient. They validated our research concerning the types of funds which were selected (ETFs, a typical choice of robo-advisors) and their annual expense ratios. A consideration in the future, however, would be

to incorporate personal feedback in choosing portfolio holdings to establish a stronger client connection with the utilization of funds.

Conclusion and Recommendations

Robo-advisors are on the rise and as their technology advances (e.g. through improved artificial intelligence and expansion into estate planning as well as insurance), traditional ways of financial advisory begin to become threatened. Global AUM for all asset managers has surpassed over \$79.2 trillion and robo-advisors account for about \$398 billion of this.⁹⁸ Although this represents less than 0.5%, the segment is expected to rise over \$1.45 trillion by 2022 with 122 million users of robo-advisors worldwide. Furthermore, while there were only a little under 100 robo-advisor firms globally in 2016, there are now over 200 robo-advisors in the United States alone giving potential clients a diverse array of robo-advisor platforms to choose from in order to satisfy their needs. Thus, this industry is rapidly growing and for good reason.

One of the key areas that still needs to be improved upon, however, is the regulation of robo-advisors to ensure that suitability and fiduciary requirements are being met. Issues such as robo-advisor questionnaires not being able to collect detailed, complex information from clients in a consistent and accurate way still persist today. Therefore, proper guidance with regulations and examinations tailored towards just automated investment advisors rather than all investment advisors would go a long way to ensure compliance with the Investment Advisers Act of 1940.

Coming into the project, we wanted to come to the conclusion that robo-advisors are clearly the future of investing and will take over the financial services industry. Unfortunately, there is no definitive answer that one version is better than the other in their current forms. Both traditional advisors and robo-advisors have their advantages and disadvantages which ultimately depend on an investor's unique financial situation and goals to decide the better option. Robo-advisors are limited to their simple passive management investment strategy however their low fees and minimum account balances make it more accessible to low-income individuals who could not afford a traditional financial advisor. It provides a user-friendly experience as well as automated asset management and rebalancing to help create a portfolio that will best fit a client while having the potential to save time and labor costs. Unfortunately, investing behind a computer screen will create a lack of personalization. Financial situation complexities are ignored, the emotional aspect of investing is absent, and a large amount of risk can be taken on to please clients with high returns, building up the potential for large losses. Cost-efficiency, then, does not always guarantee quality.

Cost-benefit analyses showed, however, that the annual material net benefits and losses for both robo-advisors and financial advisors weren't that much different since 2011. However, this year

⁹⁸ "Global Assets under Management 2002-2017 | Statistic." *Statista*, 2018

once all set and done has the potential to change this trend. Based on partial data for 2018, robo-advisors are currently experiencing materially significant losses compared to traditional financial advisors causing another area of concern. Through personal investments with Betterment over an approximately 1.5-month investing period, the user-friendly experience, minimal fees, protection against major shocks in the stock market, and cost-efficient, diversified holdings were all major pluses. However, a negative return, absence of a dynamic portfolio, heavy reliance on auto-deposits, and a lack of personalization during account set-up and customer assistance were some of the disappointing downsides. Recommendations to help eliminate the most pressing issue to us, a lack of personalization, are to incorporate educational learning platforms and interactive software receptive to previous client responses.

Based on our research and our own experience, we recommend robo-advisor services to individuals who are new to the world of investing. We believe that the ideal client for robo-advisors would be a college freshman who would be potentially entering the next four years of college with student loans and thereby wanting to save their money. Many students enter college with a savings account that often show low returns. However, by transferring that money into a robo-advisor portfolio, these students would be able to find a larger return over their four years at college and learn more about the market and investing in general. Our experience with Betterment has shown us that these services are not great for clients looking for a short-term gain. The passive investment strategy is more beneficial for long-term returns so we believe that a four-year college student perfectly fits this. It is important to note that potential clients saving for retirement would also fit well with the robo-advisor model.

One of the reasons we are hesitant to recommend robo-advisor platforms though is the mere fact that most use the Modern Portfolio Theory as a foundation to their portfolio creation algorithms. While it has been historically successful and keeps clients invested, our research indicated that it was flawed since it fails to incorporate investors' varying degrees of risk aversion and utilizes improper portfolio weights. We would recommend the robo-advisor we used for our project, Betterment, due to their use of a mixture of the Modern Portfolio Theory and the Black-Litterman Model. Firms tend to use the Modern Portfolio Theory because it is a common industry practice and so tend to overlook other theories despite their advantages. Despite firms believing the Black-Litterman Model is impractical to implement due to difficulty in finding the market portfolio, the model ends up greatly improving their algorithms and portfolio optimization techniques. Full Scale Optimization is an effective theory as well that takes into account the reality of skewed returns and tweaks for loss aversion but the robo-advisor platforms say that it takes too much computing power despite our research finding that it is possible with their current technology.

We will see robo-advisors expand into active management strategies and add more investment options for potential clients in the future while continuing to charge low fees. However, it is more likely that hybrid robo-advisors and models of investing will lead the way as opposed to purely automated robo-advisors. Their ability to combine the personalized touch offered by financial

advisors along with robo-advisor software and algorithms allowing for cost efficiency is a powerful combination.

Overall, this research is based on direct exposures to using a robo-advisor platform, conducting interviews, using online references, and contacting robo-advisor representatives. Through all that, there is no definitive answer whether an individual should go online this instant and create a robo-advisor account. Take what you can from our research and understand that the world and technology is rapidly advancing logically leading to the creation of alternatives such as robo-advisors to conventional practices. Some alternatives may be great and some might indicate otherwise, but in the end, it is up to you to go out and try it for yourself.

Project Limitations

There are a number of limitations with this paper. First, any conclusions which came out of our personal experience with only one robo-advisor, Betterment, may have created biases which were applied to robo-advisors in general. We also had a limited amount of time to write this report—10 weeks of our college quarter. This set our investment period a lot shorter than we wanted. We were also limited with the amount of money we invested with the robo-advisor platform. If we had sufficient funds, we would have been able to diversify our money by investing in more robo-advisor platforms. A number of robo-advisors had higher account minimums that could not be met, thereby limiting our robo-advisor platform choice as well. The scorecard which summarized our experience with Betterment, therefore, didn't serve well as the benchmark/industry standard since we weren't able to compare it with other robo-advisors. Next, our cost-benefit analyses were limited to the past 8 years and only one kind of general client profile was accounted for along with the assumptions that were made. The Portfolio Visualizer tool itself used in the benefit analyses generated hypothetical portfolio returns which may not be representative of the actual portfolios of clients with regards to their financial situations and needs. The utilization of historical data due to its convenience and availability throughout the analysis is another limiting factor since past performance is usually not indicative of future results. Interviews conducted with Raymond and Vikram were biased as indicated earlier due to their own personal experiences. Furthermore, interviewing only two individuals could be limiting as well since we weren't exposed to a diverse range of expert opinions and insights to gain a better understanding of both robo-advisors and traditional financial advisors. This, again, related back to the limited amount of time we had.

Next Steps

If we were to move further with this project, there are a couple of things we suggest that could be done. With regards to the cost-benefit analyses, more client profiles more specific with regards to client needs and financial situations can be considered. Looking at the cost-benefit analyses, more active approaches to extract or backward forecast (backcast) historical data of longer time periods could be taken. Understanding how both robo-advisors and financial advisors fared against each other before and during the Great Recession would give valuable insights to the

effectiveness of the platform. Furthermore, time series models can be created to forecast future annual net benefits and losses for both types of investment advice to help mitigate the limiting nature of using only historical data. Further testing of more robo-advisor platforms with more funds and for longer periods of time would be very beneficial. Ideally, there would be enough funds to invest in all of the top ten robo-advisor platforms that were researched instead of just one. With larger funds, there can be an investment of equal funds in all ten platforms to test effectiveness and determine the best and the worst of the top ten robo-advisor platforms. Instead of investing for only 1.5 months, better insights would be gained through an investment period of 1 year since robo-advisors are known for long-term returns. More interviews can also be conducted with representatives from a diverse range of robo-advisor platforms and financial advising firms. These interviews will bring further insights into the future of financial investing through two lenses. Next, interviews with engineers of robo-advisor platforms would allow the readers to understand how the platform works from a technical perspective. Furthermore, the interviewees could bring forth insights towards the future of robo-advisor algorithms and how they could operate/improve in the future. These interviews would add value in understanding how this platform would ultimately shape up to be looking ahead.

Appendix

Interview Questions – Raymond Siu

1. What is your current position and what do you do at Charles Schwab?
2. Do you work for the robo-advisor subsection of Charles Schwab or are you mainly a traditional financial advisor?
3. We understand that Schwab Intelligent Portfolios has an account minimum of \$5,000. Other robo-advisors, such as Betterment or Wealthfront, usually require minimums ranging from \$0-\$500. What are your thoughts on this? Can you tell us what you believe is a reasonable amount of money to start up an account with a robo-advisor (considering our goal would be long-term growth, i.e retirement)?
4. Could you tell us what the 10-year historical tangible, financial benefits to clients have been of utilizing robo-advisors (average robo-advisor industry 10 year historical portfolio returns for a typical 60/40 stock/bond portfolio)? Are there any resources/data you could provide to us on this? Furthermore, as your technology advances, do you see new and other benefits of having a robo-advisor emerging?
5. According to our research, we learned that the costs for using a robo-advisor primarily include the initial account minimum balance to open an account. Next, annual account management fees as a % of AUM, annual investment expense ratios, and miscellaneous account fees (for opening, closing, and withdrawing from accounts, transfers, account maintenance fees, etc.) can be charged. What are the average typical robo-advisor annual costs for each of these cost categories? Are there any other ways robo-advisors earn profits from their client payments?
6. What are usually the demographics of robo-advisor current clientele? Moreover, what are the most common, specific needs clients have which underlies the reason for employing robo-advisor services?
7. Research indicates that having a personal touch and customization tailored to each client's needs are very important. Hybrid services (combining both the automated asset management tools and personal connection with human advisors) are starting to become more popular. Do you feel like hybrid services/robo-advisors then have an edge over fully automated robo-advisors and are a more promising outlook for the future? How about compared to financial advisors?
8. Can you talk more about the advantages of automated rebalancing and asset management compared to having a traditional financial advisor managing your portfolio?
9. From our research, we found that the cost of a robo-advisor acquiring a new client is at least \$100. Could you explain the breakdown of this number and what it entails for robo-advisors, considering that acquisition costs have actually been high enough to cause robo-advisor firms such as Hedgeable to discontinue their investment management service and FutureAdvisor to sell themselves to financial advisors?
10. We understand that your product provides tax-loss harvesting. Could you go into more detail of the benefits of this? From our research, we found that it might not be the most beneficial considering that taxes are just getting deferred into the future.
11. Currently, Schwab Intelligent Portfolios and many other robo-advisors focus on passive management by mainly investing in ETF's and sometimes mutual funds. Do you see an expansion of investment strategies (timberland, insurance, active management, etc.) in the future or do you see the future of robo-advisors to remain largely the same (using passive management and focusing primarily on ETF's)?

Figure 84. Raymond Siu Interview Questions Part 1. Source: Author Generated

12. Do you feel the inadequacy of current regulations under the Investment Advisers Act of 1940 and SEC requirements and guidelines is making it difficult for robo-advisors to meet suitability and fiduciary requirements?
13. Can you talk to us a little more about how your company's software and algorithm works? We understand that robo-advisor algorithms are generally either based off of the Modern Portfolio Theory, the Black-Litterman Model, and/or Full Scale Optimization with the Modern Portfolio Theory being the most popular. Furthermore, we have understood that there are some disadvantages with employing the Modern Portfolio Theory as opposed to the Black-Litterman Model and Full Scale Optimization. What are your thoughts on this and why do you believe so many robo-advisors (~60% according to our research) still use the Modern Portfolio Theory still?

Interview Questions – Vikram Kohli

1. In your fifteen years of working within the financial advising industry, have you witnessed or experienced seeing other financial advisors committing malpractice or acting unethically by influencing their client to purchase (unnecessary) investments with high expense ratios and fees for profit or churning/reverse churning?
2. In your practice, are you currently employing any automated investing software such as automated tax-loss harvesting/rebalancing and algorithms to optimally allocate assets for an investor based on their risk profile? If yes, is the motivation primarily to make your workload easier and/or to entice potential clients to sign up with your firm? If no, why not?
3. Do you personally believe that acquiring a smaller robo-advisor platform or leveraging robo-advisor technology would open up more business opportunities/expand customer bases/compete effectively with larger, independent robo-advisors for your firm given the promising market growth potential or would it negatively affect the company's prospective growth?
4. What are your thoughts on fully automated robo-advisors? Do you believe that they alone constitute the future of investing and have the capability to replace traditional financial advice? If so, why? If not, what are the downsides to using the technology? Can they at least be used in conjunction with human financial advisors?
5. In your opinion, what are the advantages and disadvantages of robo-advisors? Advantages (e.g. personalized plans and personal touch, eliminating DIY (do-it-yourself) investment research) and disadvantages of conventional, human financial advisors? Why?
6. Do you notice any pressure building up among financial advisor firms and financial advisors in response to the highly cost efficient fee structures of robo-advisors? Are there fears that competition from robo-advisors with growing market shares will continue to cause fees charged to clients to decline and erode profit margins?
7. Could you explain the demographics of your current clientele and the kinds of investment products and financial plans you offer your clients? What are the most common, specific needs your clients have which underlies the reason for employing your services?
8. Has Ameriprise looked into strategies to target younger generations and address their own unique financial situations and preferences?
9. How exactly do you earn compensation for the services you provide from your clients? Are they generally based on fees or commissions?
10. What are the differences and similarities between the fee structures of a fee-only advisor, a fee-based advisor, and a commission-only advisor? In other words, in what ways are profits earned from clients for each type of advisor? Advantages and disadvantages of each type of advisor?

11. Part of our report includes a cost-benefit analysis of robo-advisors compared to traditional financial advisors. If we came to your office today requesting investment management services, what would the typical fee structure look like? How much do the services cost annually? Could you provide a breakdown of what aspects of the service would typically be paid for (e.g. hourly meetings, portfolio management annual fees as a % of AUM, expense ratios, tax-loss harvesting, rebalancing)? To what extent would you say these fees eat into a portfolio's annual return? (Our research indicated that a 60/40 portfolio with 60% stocks and 40% bonds would have its annual portfolio returns cut by nearly 37% due to expense ratios and financial advisor account management fees excluding transaction fees, taxes, etc.).

12. According to our research, robo-advisors typically employ the Modern Portfolio Theory, Black-Litterman Model, and/or Full Scale Optimization. Are you familiar with these theories and if so, do you or your firm utilize any one of these methods in investment strategies? Have you seen any tangible benefits from using these methods or using one over the other?

13. What would a typical client investment portfolio look like? Are client funds allocated towards ETF's, mutual funds, individual equities, and/or individual fixed income securities? More specifically, how are funds usually split between these asset classes? Rationale behind this?

14. If we were to sign up with your company today, how long would the initial meeting be? Would there be multiple meetings before we are able to fully set up a portfolio? How long would it take until you would be able to fully grasp a client's financial situation and feel confident in creating a plan? Also, how often do you have follow up meetings with your clients?

15. How does your firm attract new customers? What features of Ameriprise Financial Services Inc. are selling points to grow the company's customer base?

16. Throughout your career, how do you handle clients when there are losses in their portfolio? How do you manage their emotions while still being able to retain them as a client?

17. In your experience, have you seen or heard stories of financial advisors or investors turning overconfident when it came to investing, relying on their personal judgments rather than the data presented to them? Does active management exacerbate this problem by leading an advisor/investor to take on more and more risk especially in the presence of a bull market?

18. Since the financial advisory field is broad and unregulated, anyone is able to sell financial advice and planning without any credentials. Because of this, there is always a possibility that investors could select a poor financial advisor. Is this a statement you agree with and why? In your opinion, what are the qualities of an incompetent financial advisor?

19. Clients may pressurize financial advisors to build a portfolio with certain exposures and risks even if it may not be the wise thing to do. Is this a prevalent problem today and if so, how would you respond to a situation like this? Would the sustainment of client relationships by going along with a client's requests and demands take priority over giving sound financial advice?

Figure 87. Vikram Kohli Interview Questions Part 2. Source: Author Generated

Holdings:	Vanguard Personal Advisor	Schwab Intelligent Portfolios	Betterment	Wealthfront	E-Trade Core Portfolios	Wealthsimple	FutureAdvisor	Acorns	Fidelity Go
VTSAX	36.0%								
VTIAX	24.0%								
VBTLX	14.0%								
VTABX	12.0%								
VFIDX	8.0%								
VFSUX	6.0%								
FNDX		11.0%							
SCHX		8.0%							
FNDA		7.0%							
FNDF		7.0%							
SCHF		5.0%							
SCHA		4.0%							
SCHC		3.0%							
FNDE		4.0%							
FNDC		4.0%							
SCHE		3.0%							
SCHH		3.0%							
VNQI		2.0%					4.6%		
SCHR		7.5%							
SCHP		7.0%							
VMBS		6.0%							
HYLB		3.0%							
EBND		2.0%							
SPIB		1.0%							
CASHX		7.5%							0.5%
IAU		5.0%							
BNDX			12.0%				10.7%		
EMB			7.2%						
VTI			20.5%	23.0%		25.3%	9.3%		
VWO			10.7%	9.0%		4.5%	12.2%	3.0%	
VTV			5.5%				9.3%		
VTIP			2.8%				17.6%		
VBR			3.8%			8.0%			
MUB			14.4%			22.5%			
VEA			15.2%	14.0%			7.6%	12.0%	
VOE			4.3%			4.8%			
AGG			3.6%						
VIG				13.0%					
VTEB				35.0%	36.0%				
VCIT				6.0%					
ITOT					29.0%				
IJR					10.0%				
BBEU					21.0%				
OGBCX					4.0%				
BND						13.8%			
VGK						11.0%			
ANGL						4.3%			
TIP						2.0%			
DXI						4.0%			
VB							2.1%	10.0%	
EFV							7.6%		
VSS							3.8%		
VNQ							4.6%	6.0%	
SCHZ							10.7%		
VOO								29.0%	
LQD								20.0%	
SHY								20.0%	
FDPIX									34.4%
FLXSX									4.2%
FLAPX									3.4%
FITFX									18.0%
FUENX									35.0%
FUEMX									4.5%
Total	100%	100%	100%	100%	100%	100%	100%	100%	100%

Figure 88. Robo-Advisor Portfolio Holdings Tickers and Percentages. Source: Author Generated