BRINGING TRANSPARENCY TO ROBO INVESTING

EDITION 6

The Robo Report™ Fourth Quarter 2017

We are proud to publish the 6th edition of *The Robo Report*™, covering the 4th quarter of 2017. This report is a continuation of an ongoing study that monitors the most well-known robo advisors. We strive to provide a reliable resource for both investors and professionals interested in the digital advice industry. Alongside reporting performance on a quarterly basis, *The Robo Report*™ includes a discussion on the trends we saw during the quarter that drove performance, highlighting portfolios that benefited or were disadvantaged by market trends. Additionally, there is a Robo News section covering the most relevant news from the quarter, a risk/return and asset allocation analysis, as well as a Robo Reviews section discussing the non-performance features of a selection of robo advisors each quarter. This quarter also includes takeaways from interviews with Schwab, Merrill Edge, and TD Ameritrade.

The Executive Summary

Digital advice is transforming areas of the financial advice industry. It is becoming increasingly apparent that incumbent financial service firms are adopting digital advice solutions across the board. This quarter Morgan Stanley and Well Fargo launched products, and we still anticipate offerings from Goldman Sachs and JP Morgan Chase. As more firms bring on digital advice solutions, we continue to open and fund portfolios and collect performance data.

This quarter we added portfolios from Zack's Advantage and T. Rowe Price. Next quarter we will be publishing the first round of data on portfolios from USAA, Wells Fargo, Morgan Stanley, United Income, and Capital One. Over the past year we have seen many robos introduce an option to invest in a socially responsible portfolio and have opened three portfolios with this theme. In our next report we will be publishing results from socially responsible portfolios at Morgan Stanley, Betterment, and TIAA. Additionally, we have discontinued coverage of the e*Trade Hybrid portfolio as this strategy is no longer available to new customers. We have also changed how we cover the Ally Financial, previously TradeKing portfolio. Ally acquired TradeKing in 2016 and at the end of Q1 2017 we witnessed a significant change in strategy. In the interest of representing to our readers the portfolio and performance they would receive with Ally Financial we now report the Ally Financial account as of Q2 2017, after the transition. We still publish the performance on the portfolio before the transition under "TradeKing" in the addendum.

Closing out a year of fantastic equity returns, we now have seven portfolios that have been open for at least two years. Our market commentary and risk return sections will be focusing on these seven portfolios as we dive into the long-term results of Schwab, Betterment, Vanguard, Acorns, WiseBanyan, and Personal Capital. 2017 was a great year for both equity markets and *The Robo Report*™, and we look forward to another year of bringing transparency to the robo advice industry.

Top Performance for 4th Quarter Returns

	Best	2nd	3rd
Total Portfolio	WealthFront	TD Ameritrade	SigFig
Equity	WealthFront	SoFi	Fidelity Go
Fixed Income	SigFig	WealthFront	Fidelity Go

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Robo News

The 4th quarter of 2017 was another busy period in the digital advice industry. Incumbent financial institutions in the US and abroad continue to announce or launch digital advice products. Existing independent providers continue to bring on new features and add levels of service, while a few M&A and strategic partnerships were announced.

Morgan Stanley and Wells Fargo have both entered the arena with digital advice offerings. Morgan Stanley's offering stands out with its breadth of investment options. Users can choose different thematic tilts to their portfolios, with an emphasis on themes like robotics and AI, genomics and biomedicine, or a choice of two socially responsible

investing options. JP Morgan is preparing to roll out their new offering in March of 2018. FolioFN, which has found niche as a custodian for third-party robos, says they plan on releasing a digital advice product available directly to individual and retail investors in 2018.

Outside of the US, the pace of new digital advice offerings is picking up. HSBC and RBS have announced plans to launch robos in the UK. RBC is entering the market in Canada. ICBC, China's largest bank, has also announced plans to offer a digital advice product.

Meanwhile, Broadridge Financial has reached across the border to WealthSimple to form a partnership, offering a B2B solution to Canadian advisors. This is one of many partnerships announced this quarter. Acorns has been particularly active in expanding their offering and footprint. Their acquisition of retirement micro-investing app, Vault, earlier this year now allows Acorns to automatically deduct from a user's paycheck to fund a retirement account. Following this acquisition, PayPal and Acorns announced a partnership that allows users to directly fund their Acorns account using PayPal. Although neither are robos themselves, Quovo and Apex are trying to speed up the account transfer process by digitizing the outdated ACAT system.

As the space becomes more competitive, independent and incumbent robos alike are segmenting and differentiating their offerings. Ellevest has followed the trend of offering differing levels of service, recently increasing options to include access to live advice or a dedicated advisor for a higher fee, while simultaneously cutting the fee on their basic, digital-only solution. Betterment has released a feature to help users donate appreciated stock to charities, a method that has tax advantages over gifting cash. Meanwhile, robo advisor M1 has cut their fee to 0% for the normal usage of their platform.

It has been another busy quarter in the digital advice industry as members of the financial services industry are all trying to figure out how best to position themselves in this new wave of digitization and innovation.

Robo Interviews

This quarter, we interviewed three of the top institutional players with live digital advice products. Tobin McDaniel, Senior Vice President of Digital Advice and Innovation at Schwab, Keith Denerstein, Director of Guidance Product Management at TD Ameritrade, and David Poole, Head of Merrill Edge Advisory, Client Experiences and Digital Capabilities, at Merrill Edge, shared their insights with us on both their view of the future of digital advice their takeaways from the success of the individual products.

During our time covering robo advisors, we have seen two large misconceptions in both the investing public and the financial professional communities about robo advisors.

The first misconception is many individual investors hear about robo advisors and assume that algorithms and automation is at the core of the investment selection and asset allocation process. Although client onboarding, determination of risk tolerance, rebalancing, trading, tax-loss harvesting, and other functions are automated in most robo advice products, the asset selection, allocation, and construction of model portfolios in most cases is not an algorithmically driven, automated process. David Poole of Merrill Edge points out that their digital advice offering "is coupled with a strong partnership and support on the Merrill Lynch CIO side as far as designing the portfolios and [their] ongoing management." Poole later goes on to cite the role the chief investment office plays in attracting a broad spectrum of clients. "A big part of that is confidence of the CIO, we have heard it in the feedback, it's not just algo' driven, there is Merrill Lynch, this trusted entity behind it, that is developing the portfolios and managing through." We heard a similar story from Tobin McDaniel at Schwab about their asset selection process. "Charles Schwab Investment Advisory, who has investing experts, CFAs, PhDs and the like, identify the portfolio allocation so that it is appropriate across the risk spectrum." Once allocations are chosen, the team responsible for the digital advice offerings "is looking at the universe of ETFs available, those that are big enough, liquid enough and

track their indexes, and picking among the lowest cost…" Although robo advisors are digitizing and automating many parts of the investment process, it appears most providers are relying on real people, not just algorithms, in the construction of their model portfolios and asset selection.

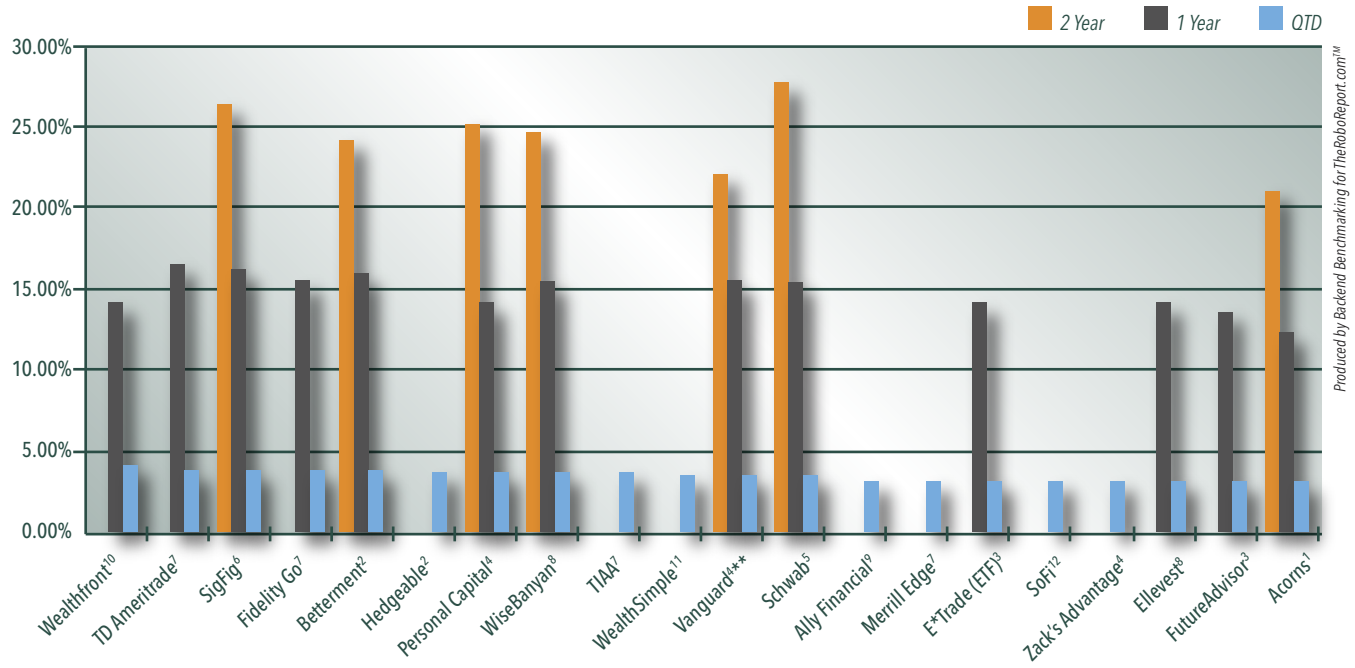
The second large misconception that we see in the investment professional community is that digital advice products are attracting mostly younger and lower asset clients. What we are learning from our research is that digital advice is appealing across demographics. "Something we have learned since the launch of their product is we can't look at clients in terms of their age or asset levels, we have to look at them in terms of what their needs are," says Keith Denerstein from TD Ameritrade. It appears that robo advice is proving most popular with investors who have not had a professional advice solution before. "As time goes by, a product like Essential Portfolios provides that low-cost entry point to professional money management. That is really what we have seen as our biggest opportunity," says Denerstein. McDaniel's comments support this notion: "What we are really seeing are people who generally did not avail themselves of any form of financial advice coming to us… It's been remarkable to see how it does really cut across the traditional demographic cut; it's more of a mindset then demographic." The numbers back up this notion that robo advice products are attracting older customers. Schwab shared with us that a little over half of their digital advice clients are over the age of 50; Merrill Edge shared that over 45% of their robo clients fall into that age group. Meanwhile, it was recently reported that more than 85% of the Vanguard Personal Advisor Services clientele are 50 or older.

The success with drawing in first-time investors and converting self-directed investors to an advised product has implications in the long-term consequences of digital advice on the traditional advice market. Robo advisors are expanding the market of managed money solutions, meaning they may have less of an impact on the market share of traditional advice. McDaniel from Schwab says, "…I think the market for advice is going to expand. You can serve more people at lower minimums at a better value." He sees robo advice as part of a longer trend at Schwab and in the industry in general. Falling costs and increased access have expanded the number of investors. Robo advice is another evolution in this process, further increasing access and decreasing barriers and costs to professional financial advice. Much of the growth of robo advisors may not come at the expense of traditional advice solutions, but instead from an expanding advice marketplace.

Although many robo clients may be new to professional investment advice, many are not new to the institution where they chose their robo. McDaniel said that around only 30% of the assets managed by their digital advice products came from outside of Schwab. Merrill Edge reported that 78% of Merrill Edge Guided Investing customers have a bank account at Bank of America. Some of those clients opened both a bank account and a Guided Investing account at the same time, or migrated from Guided Investing to Bank of America, but, many are joining Guided Investing after already being a Bank of America customer. Even if most clients of offerings at established financial services firms are already on that firm's platform, a robo advice product offers the opportunity to deepen the relationship and services provided to their self-directed, or new to investing customers.

As digital advice products are proving a successful entry point for clients new to financial advice, they are finding a place in the line-up of services offered by the large financial services providers. A theme we heard across our interviews is that providers are trying to implement a continuum of services to meet client needs as the client evolves. Robo advice products are fitting in nicely between offerings geared towards self-directed investors and more traditional advice relationships. Even within many digital advice products, there are two or more levels of support, ranging from a pure digital experience with no access to live advisors, to a more traditional relationship with a dedicated advisor. We are seeing pure robo advice providers adding live advisors and incumbent players adding pure digital advice solutions and everything in between. As Tobin McDaniel from Schwab puts it, "It is the firms that deliver the best digital experience combined with people, where people add a lot of value,… that is going to be the winning model."

Performance Commentary

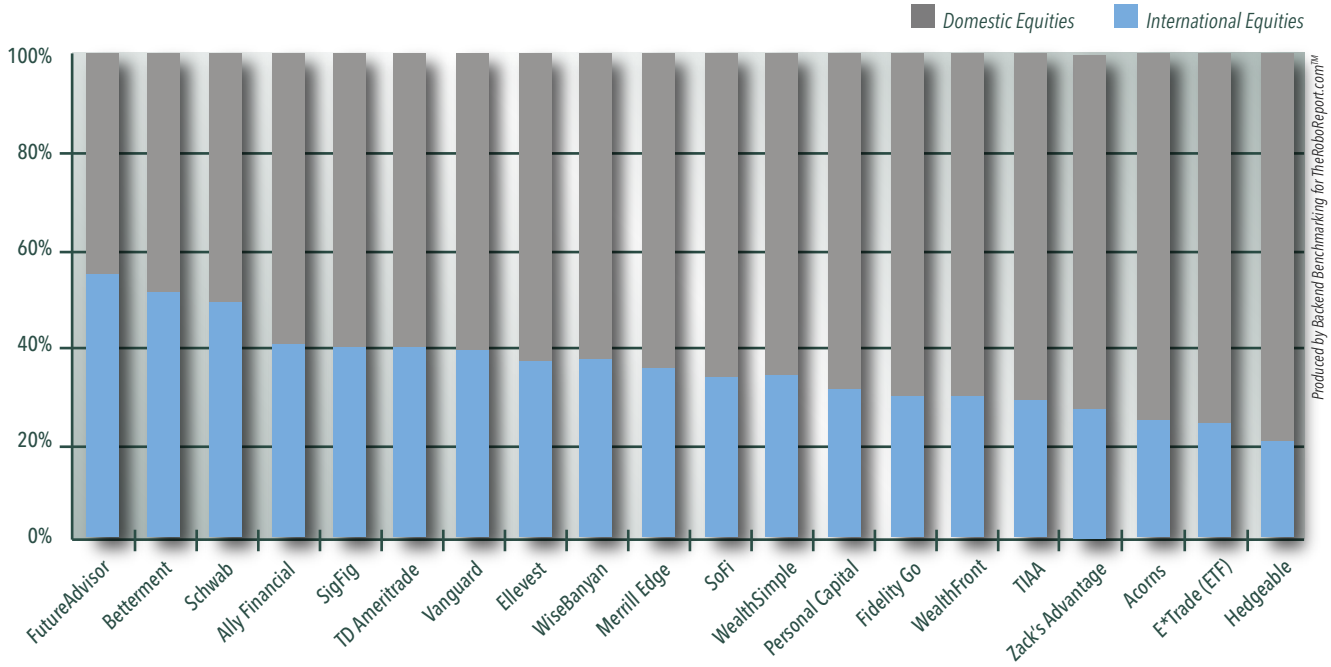


This quarter we will be focusing our performance commentary on the seven taxable portfolios that have two years' worth of returns. Investors typically take a long-term outlook on their investments, and as our accounts age we strive to provide more perspective on how the robo portfolios are performing in the long term. This quarter, our portfolios at Vanguard, Schwab, Betterment, Acorns, Personal Capital, SigFig, Ally Financial, and WiseBanyan have reached to the two-year mark.

The past two years have been strong for equity markets both at home and abroad. The S&P 500 returned 36.38%, while the MSCI emerging markets index returned 53.67% and the MSCI EAFE index returned 27.70%. 2016 saw growth concerns fueled by Brexit and concerns about declines in global trade following the election of Donald Trump with his protectionist rhetoric. International stocks in 2017 were driven by positive economic numbers across the globe, and gave rise to the term "synchronized growth," helping both emerging and developed market stocks post fantastic returns for the year.

The two best performing equity returns were Schwab and SigFig thanks in part to their holdings of the largest dedicated emerging market allocations at 7% and 13% of the total portfolio, respectively. Acorns, which lagged the group, ended the year with just 3% in emerging markets funds. At points over the past two years, their entire international allocation was held in an emerging markets fund, which would have proved a successful strategy, but they diversified away from emerging markets with poor market timing earlier this year. Betterment, Vanguard, and WiseBanyan all have between 4.5% and 6% allocated to emerging markets. Betterment and Schwab have some of the largest allocations to international as a whole, with around 30% of their total portfolios allocated to international funds.

International Allocation of Total Equity



Value and growth stocks were split between the two years, with 2016 being the year for value to outperform and 2017 the year for growth fueled by large upswings in large tech companies. Across the two-year period, growth edged out value, but not by large margins. Although a preference for slightly overweighting value funds can be seen in some of our portfolios, among this group of seven portfolios with two-year return numbers, there is not a significant weight towards or away from value.

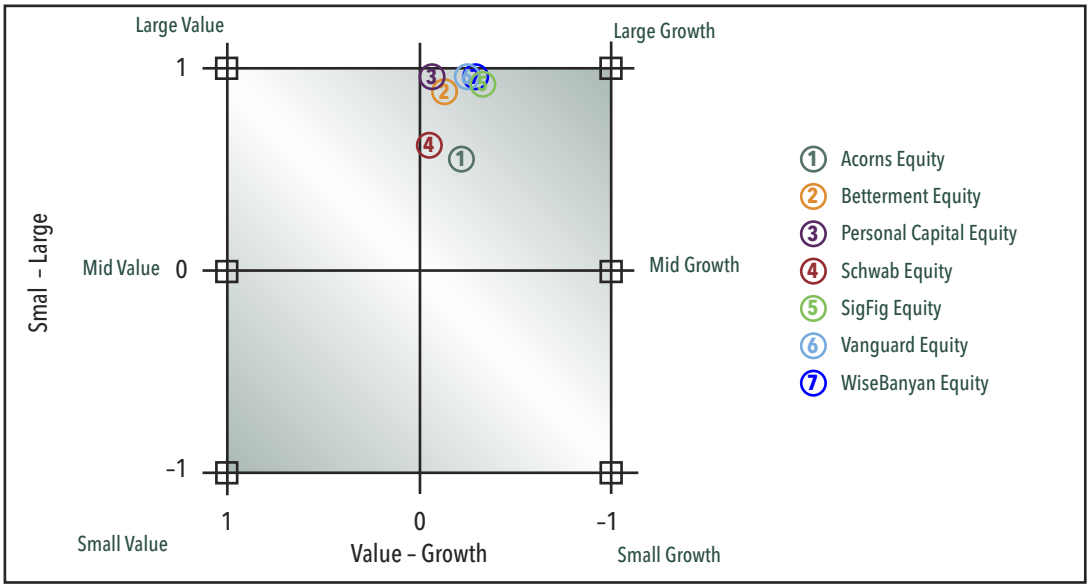
Although small-cap stocks outperformed their mid- and large-cap peers over the two-year period, it was not by large margins, and market capitalization was not a main driver of performance in our portfolios.

Fixed income allocations in our portfolios showed a much larger distribution of returns than the equity portion of the portfolios. The Federal Reserve has continued a moderate and steady approach to rising interest rates throughout the two years. In the 4th quarter of 2016, we saw municipal bond prices fall significantly surrounding the election of Donald Trump and the resulting expectation of a tax cut that reduces a municipal bond's tax advantage. A pick-up in economic growth abroad, reactions to the election of Donald Trump and tax reform, and positive economic numbers both at home and abroad have kept business confidence high and rewarded those managers who chose high-yield and international fixed income in their portfolios.

Among these seven portfolios, there was a much wider dispersion of returns in the fixed income allocations than the equity portions of the portfolios. Equities performance ranged from 32% to 38%, while fixed income returns ranged from 4% to 14%, meaning the best fixed income portfolio more than tripled the returns of the bottom fixed income portfolio. SigFig's and Schwab's fixed income portfolios held the top two spots, with a 11% and 14% return, respectively. Both portfolios invested in international debt. Of particular note, SigFig had an 8% allocation to an emerging markets sovereign debt fund and Schwab had a 4% allocation to emerging market debt funds that had total returns above 19% and 24%, respectively. Schwab also found success investing in a high-yield fund that had a total return north of 18%. WiseBanyan and Personal Capital both returned

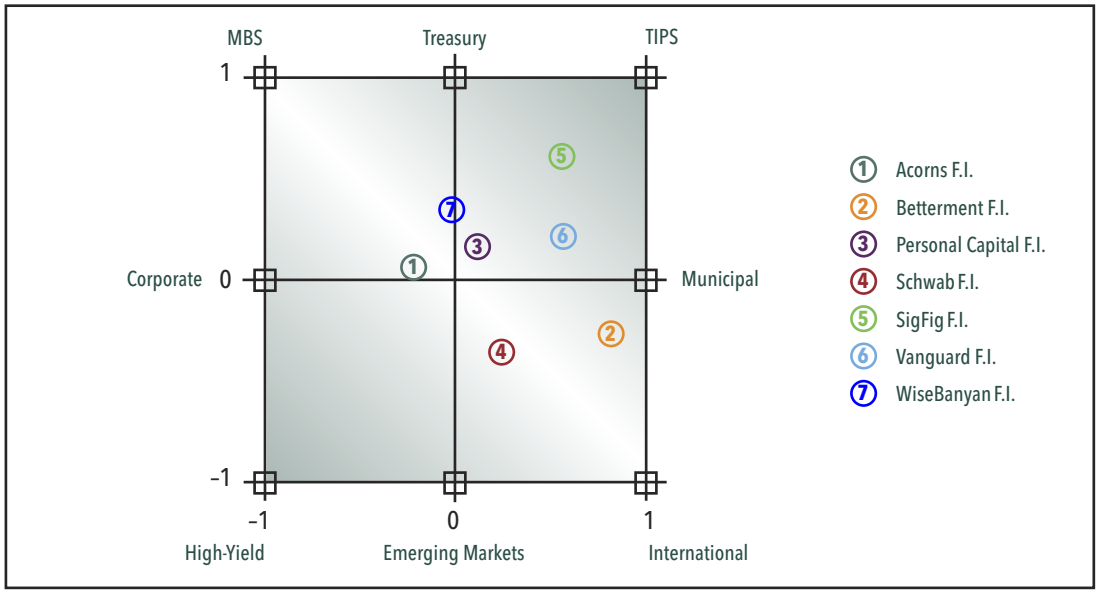
between 8% and 9% in their fixed income, similarly boosted by international bonds and corporates. Vanguard's and Acorns' fixed income portions both returned between 4% and 5%. Vanguard invests exclusively in municipal bonds, which had a rough period after the elections in 2016. Choices in the level of risk also help explain the wide dispersion of returns. It is not surprising that Schwab, who has allocated large portions to international and high-yield funds, has outperformed Vanguard, who has stayed in historically much safer domestic municipal bond funds during a period of growth and confidence in the markets.

Robo 6-ETF Equity Style Map: 2-Year Returns



This analysis produced with the help of Markov Process International, Inc. *Produced by Backend Benchmarking for TheRoboReport.com™*

Robo 8-ETF Fixed Income Style Map: 2-Year Returns



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Taxable Returns

	Total			Equity			Fixed Income		
	QTD	1 Year	2 Year	QTD	1 Year	2 Year	QTD	1 Year	2 Year
Acorns[1]	3.04%	12.39%	21.07%	5.01%	18.31%	31.93%	0.06%	2.65%	4.57%
Ally Financial[9]	3.45%	-	-	5.62%	-	-	0.23%	-	-
Betterment[2]	3.79%	15.98%	24.26%	5.51%	22.27%	34.18%	0.38%	4.24%	6.57%
Ellevest[8]	3.26%	14.18%	-	5.57%	21.41%	-	0.12%	4.16%	-
E*Trade (ETF)[3]	3.39%	14.12%	-	5.41%	20.93%	-	0.34%	4.22%	-
Fidelity Go[7]	3.94%	15.49%	-	6.00%	22.64%	-	0.83%	5.46%	-
FutureAdvisor[3]	3.08%	13.52%	-	4.98%	21.47%	-	0.40%	3.30%	-
Hedgeable[2]	3.72%	-	-	5.28%	-	-	0.79%	-	-
Merrill Edge[7]	3.45%	-	-	5.54%	-	-	0.48%	-	-
Personal Capital[4]	3.71%	14.30%	25.07%	4.98%	18.32%	31.45%	0.08%	3.56%	8.63%
Schwab[5]	3.53%	15.31%	27.70%	5.08%	20.97%	38.13%	0.48%	6.52%	14.04%
SigFig[6]	4.05%	16.28%	26.30%	5.93%	24.31%	37.48%	1.03%	4.50%	10.52%
SoFi[12]	3.33%	-	-	6.30%	-	-	-1.20%	-	-
TD Ameritrade[7]	4.16%	16.47%	-	5.82%	23.36%	-	0.38%	3.27%	-
TIAA[7]	3.65%	-	-	5.87%	-	-	0.15%	-	-
Vanguard[4]**	3.59%	15.60%	22.02%	5.67%	23.26%	34.70%	0.30%	4.12%	4.16%
Wealthfront[10]	4.28%	14.11%	-	6.43%	20.65%	-	0.84%	4.51%	-
WealthSimple[11]	3.60%	-	-	5.55%	-	-	0.53%	-	-
WiseBanyan[8]	3.71%	15.42%	24.63%	5.49%	22.48%	34.13%	0.50%	3.71%	8.66%
Zack's Advantage[4]	3.30%	-	-	5.44%	-	-	0.54%	-	-

*Some accounts have not been open long enough for 1 year or 2 year trailing returns.

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IRA Returns

	Total			Equity			Fixed Income		
	QTD	1 Year	2 Year	QTD	1 Year	2 Year	QTD	1 Year	2 Year
Ally Financial IRA[9]	5.22%	-	-	5.59%	-	-	0.36%	-	-
Betterment IRA[2]	4.78%	19.98%	-	5.40%	22.52%	-	0.68%	4.18%	-
E*Trade (ETF) IRA[3]	5.35%	-	-	5.49%	-	-	-	-	-
Fidelity Go IRA[7]	4.95%	19.39%	-	5.79%	22.50%	-	0.28%	3.28%	-
Hedgeable IRA[2]	6.97%	-	-	9.69%	-	-	-1.97%	-	-
Merrill Edge IRA[7]	4.98%	-	-	5.56%	-	-	0.59%	-	-
Personal Capital IRA[4]	4.87%	18.29%	-	5.03%	18.87%	-	0.09%	4.17%	-
Schwab IRA[7]	4.97%	19.44%	-	5.32%	20.83%	-	-	-	-
SigFig IRA[6]	4.97%	22.70%	-	5.48%	24.53%	-	0.65%	7.72%	-
TD Ameritrade IRA[7]	4.97%	19.88%	-	5.84%	23.40%	-	0.33%	3.33%	-
TIAA IRA[7]	5.21%	-	-	5.90%	-	-	0.35%	-	-
T Rowe Price[13]	5.03%	-	-	5.03%	-	-	-	-	-
WealthSimple[2]	4.57%	-	-	5.56%	-	-	0.53%	-	-
WiseBanyan IRA[8]	5.29%	21.82%	-	5.71%	23.56%	-	0.79%	4.42%	-

*Some accounts have not been open long enough for 1 year or 2 year returns.

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Taxable Account Facts

Portfolio	Fee	Account Minimum	Initial Asset Allocation (Equities/Fixed Income/ Miscellaneous/Cash)	Current Asset Allocation (Equities/Fixed Income/ Miscellaneous/Cash)	Initial Domestic/ International Equity Split	Current Domestic/ International Equity Split	Tax Efficiency Ratio (Percent Muni Bonds of Overall Fixed Income)
Acorns	$1/month up to $5k; 0.25% annually over $5k	No minimum	62%/38%/0%/0%	62%/38%/0%/0%	84%/16%	75%/25%	0%
Ally Financial	0.30% annually	$2,500	59%/38%/2%/1%	61%/37%/0%/3%	69%/31%	59%/41%	0%
Betterment	Digital Only: 0.25%; "Plus" (unlimited chat, 1 call/year with advisor): 0.40%; "Premium" (unlmited chat and calls with advisor): 0.50%; stop paying any fee on money above $2MM	"Digital Only": No minimum; "Plus" and "Premium": 100k	65%/35%/0%/0%	65%/35%/0%/0%	49%/51%	49%/51%	58%
Ellevest	0.25% annually for digital only; 0.50% for premium adding access to live advisors at this level	No minimum digital only; $50k minimum for premium	62%/36%/0%/2%	56%/41%/0%/2%	71%/29%	63%/37%	86%
E*Trade (ETF)	0.30% (promo – fee waived for 2016)	$5,000	60%/39%/0%/1%	61%/36%/0%/2%	75%/25%	76%/24%	0%
Fidelity Go	0.35% annually	$5,000	61%/39%/0%/0%	60%/40%/0%/1%	71%/29%	70%/30%	100%
FutureAdvisor	0.50% annually	$10,000	59%/41%/0%/0%	59%/39%/0%/1%	49%/51%	45%/55%	0%
Hedgeable	0.75% for first $50k decreasing in tiers to 0.30% for $1 million and above.	$1	56%/34%/8%/2%	59%/32%/8%/2%	79%/21%	79%/21%	100%
Merrill Edge	0.45% annually	$5,000	60%/39%/0%/1%	60%/36%/0%/4%	66%/34%	64%/36%	59%
Personal Capital	0.89% annually for the first $1 million; lower at different tiers over $1 million	$100,000	68%/25%/5%/2%	71%/24%/4%/1%	70%/30%	69%/31%	0%
Schwab	No fee for digital only "Intelligent Portfolio". Access to live advisor with "Intelligent Advisory" has 0.28% fee.	$5,000	62%/23%/5%/10%	64%/22%/4%/11%	51%/49%	51%/49%	33%
SigFig	No fee for the first $10k; 0.25% annually over $10k	$2,000	61%/37%/0%/2%	63%/35%/0%/2%	59%/41%	60%/40%	0%
SoFi	No Fee on first $10k invested: 0.25% anually on funds above $10k: no fee if client also has a SoFi loan	$100	60%/40%/0%/0%	60%/40%/0%/0%	33%/67%	66%/34%	83%
TD Ameritrade	0.30% annually for Essential Portfolios. Selective Portfolios tiered at a higher fee level depending account balance and portfolio selected.	$5,000 for Essential Portfolios, $25,000 for Selective Portfolios	65%/33%/0%/2%	71%/28%/0%/2%	65%/35%	60%/40%	0%
TIAA	0.30% annually	$5,000	61%/37%/0%/3%	62%/36%/0%/2%	61%/29%	71%/29%	0%
Vanguard	0.30% annually for the first $5 million; lower at different tiers over $5 million	$50,000	59%/41%/0%/0%	62%/38%/0%/0%	61%/39%	60%/40%	100%
WealthFront	0.25% on accounts above $10K in assets. Accounts with less than 10K in assets there is no management fee.	$500	58%/41%/0%/1%	63%/35%/0%/2%	69%/31%	70%/30%	87%
WealthSimple	0.50% fee on accounts less than $100k; 0.40% on accounts greater than $100k annually	No minimum	62%/38%/0%/0%	62%/38%/0%/0%	66%/34%	66%/34%	55%
WiseBanyan	No fee	No minimum	65%/35%/0%/0%	65%/35%/0%/0%	62%/38%	63%/37%	0%
Zack's Advantage	0.50% accounts less than $100k, 0.35% on accounts above $100k	$5,000	58%/32%/0%/9%	58%/32%/0%/9%	72%/28%	72%/28%	40%

**Due to rounding, may not add to 100%*

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IRA Facts

Portfolio	Fee	Account Minimum	Initial Asset Allocation (Equities/Fixed Income/ Miscellaneous/Cash)	Current Asset Allocation (Equities/Fixed Income / Miscellaneous/Cash)	Initial Domestic/ International Equity Split	Current Domestic/ International Equity Split
Ally Financial	0.30% annually	500	96%/3%/0%/1%	93%/4%/0%/3%	62%/38%	60%/40%
Betterment IRA	Digital Only: 0.25%; "Plus" (unlimited chat, 1 call/year with advisor): 0.40%; "Premium" (unlmited chat and calls with advisor): 0.50%; stop paying any fee on money above $2MM	"Digital Only": No minimum; "Plus" and "Premium": 100k	87%/13%/0%/0%	87%/13%/0%/0%	47%/53%	57%/43%
E*Trade (ETF) IRA	0.30% (promo – fee waived for 2016)	$5,000	98%/0%/0%/2%	97%/0%/0%/3%	75%/25%	74%/26%
Fidelity Go IRA	0.35% annually	$5,000	85%/15%/0%/1%	85%/14%/0%/1%	71%/29%	70%/30%
Hedgeable	0.75% for first $50k decreasing in tiers to 0.30% for $1 million and above	$1	87%/10%/0%/3%	95%/4%/0%/1%	100%/0%	100%/0%
Merrill Edge IRA	0.45% annually	$5,000	89%/8%/0%/3%	89%/8%/0%/3%	62%/38%	62%/38%
Personal Capital IRA	0.89% annually for the first $1 million; lower at different tiers over $1 million	$100,000	91%/3%/2%/ %	95%/2%/2%/1%	70%/30%	70%/30%
Schwab IRA	No fee	$5,000	94%/0%/0%/6%	94%/0%/0%/6%	54%/46%	53%/47%
SigFig IRA	No fee for the first $10K; 0.25% annually over $10K	$2,000	91%/9%/0%/0%	90%/9%/0%/1%	45%/55%	44%/56%
TD Ameritrade IRA	0.30% annually for Essential Portfolios. Selective Portfolios tiered at a higher fee level depending account balance and portfolio selected.	$5,000 for Essential Portfolios, $25,000 for Selective Portfolios	83%/15%/0%/2%	85%/13%/0%/2%	65%/35%	61%/39%
TIAA IRA	0.30% annually	$5,000	88%/11%/0%/2%	88%/10%/0%/2%	72%/28%	72%/28%
T Rowe Price	No Fee	$50,000[13]	100%/0%/0%/0%	100%/0%/0%/0%	69%/31%	69%/31%
WealthSimple IRA	0.50% fee on accounts less than $100K; 0.40% on accounts greater than $100k annually	No minimum	81%/19%/0%/0%	81%/19%/0%/0%	66%/34%	66%/34%
WiseBanyan IRA	No fee	No minimum	92%/ 8%/0%/ 0%	91%/8%/0%/0%	60%/ 40%	60%/40%

Due to rounding, may not add to 100%

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Risk/Return

Schwab has achieved the best risk-adjusted returns measured by the Sharpe ratio over the preceding two-year period. A higher Sharpe ratio implies better risk-adjusted returns. Their allocations internationally in both the fixed income and equity markets have increased their return without proving volatile investments. SigFig and Betterment, who had the 2nd and 3rd highest Sharpe ratios, respectively, also have higher-than-average international allocations and found success in fixed income markets abroad. Vanguard had the lowest standard deviation in the group. This may be due, in part, to their holdings in a few very broad-based funds. With just two equity funds that have global coverage, it is not expected that the individual funds will be volatile. Furthermore, Vanguard has a conservative fixed income portfolio made up of three municipal bond fonds. Compared with some other portfolios that hold high-yield and emerging market fixed income, Vanguard's is expected to have lower risk. Acorns made some adjustments to their portfolio in 2017 that were poorly timed, which is likely why their portfolio stands out with a lower Sharpe ratio.

When looking at the upside/downside capture ratio, three portfolios stand out. (Upside/downside capture ratio is a term that expresses how much a portfolio goes up when the general market is up, and down when the market is down.) The first is Vanguard. Their broad-based and conservative fixed income has succeeded in capturing less of both the downside and upside. Acorns, whose portfolios underperformed, had a low upside and high downside capture ratio. The third is Personal Capital, which, in contrast to Vanguard's few broad-based funds, holds many sector-specific funds. Their portfolio has been more volatile, capturing both out sized upside and downside. However, higher volatility can aid in capturing tax losses, and this may be part of the reason they hold more funds.

1-Year Trailing Risk/Return Statistics

	Acorns[1]	Better-ment[2]	E*Trade (ETF)[3]	Ellvest[8]	Fidelity Go[7]	Future-Advisor[3]	Personal Capital[4]	Schwab[5]	SigFig[6]	TD Amer-itrade[7]	Van-guard[7]	Wealth-Front[10]	Wise-Banyan[8]	BackEnd Robo Index 1 Yr History™
Annualized StdDev, %	2.36%	1.77%	1.81%	1.82%	1.75%	1.47%	2.09%	1.89%	2.05%	1.67%	1.74%	1.98%	1.74%	1.73%
Sharpe Ratio	4.64	7.84	6.82	6.8	7.72	8.02	6.01	7.11	6.92	8.62	7.77	6.31	7.7	7.52
1 Year Return, %	12.39%	15.98%	14.12%	14.18%	15.49%	13.52%	14.30%	15.31%	16.28%	16.47%	15.60%	14.11%	15.42%	14.86%

This analysis produced with the help of Markov Process International, Inc.

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2-Year Trailing Risk/Return Statistics

	Acorns[1]	Betterment[2]	Personal Capital[4]	Schwab[5]	SigFig[6]	Vanguard[7]	WiseBanyan[8]	BackEnd Robo Index 2 Yr History™
Annualized StdDev, %	6.18%	5.32%	5.87%	5.44%	5.52%	4.83%	5.48%	5.42%
Sharpe Ratio	1.49	1.98	1.85	2.19	2.05	1.98	1.95	1.95
Annualized Return, %	10.03%	11.47%	11.83%	13.01%	12.38%	10.45%	11.64%	11.55%

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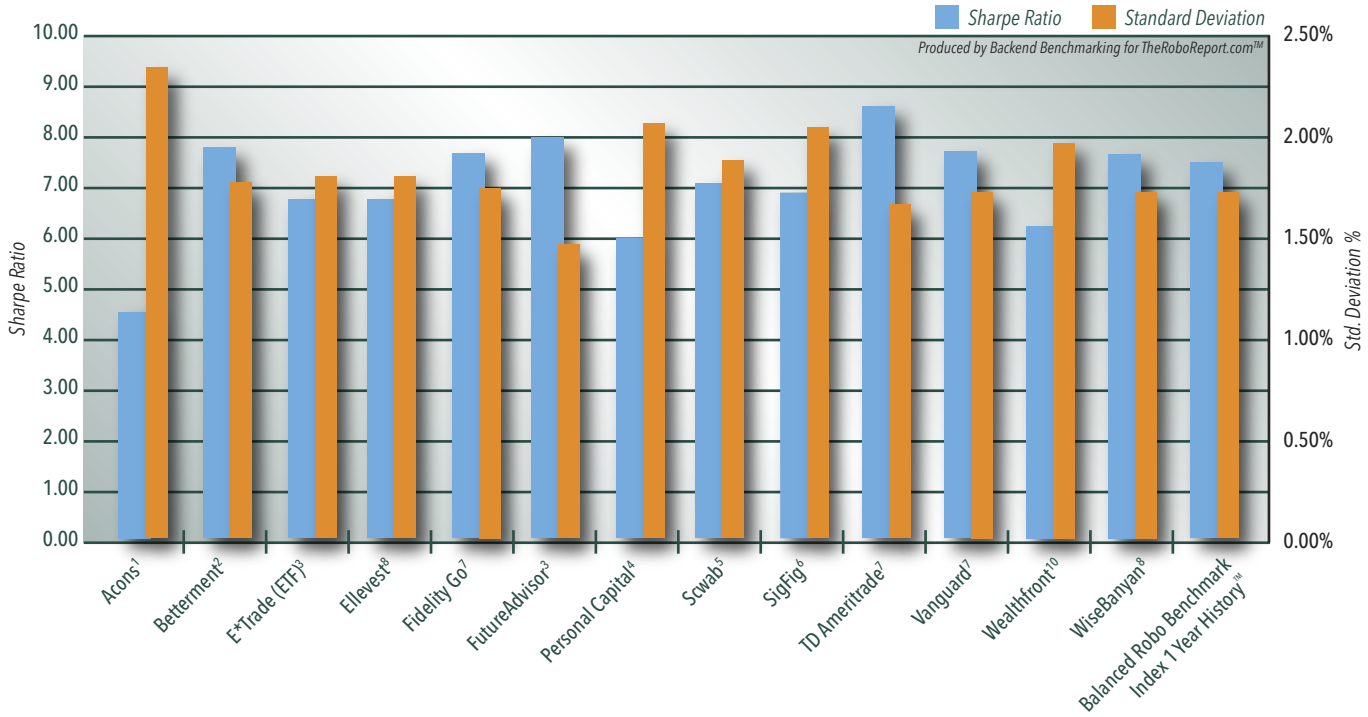
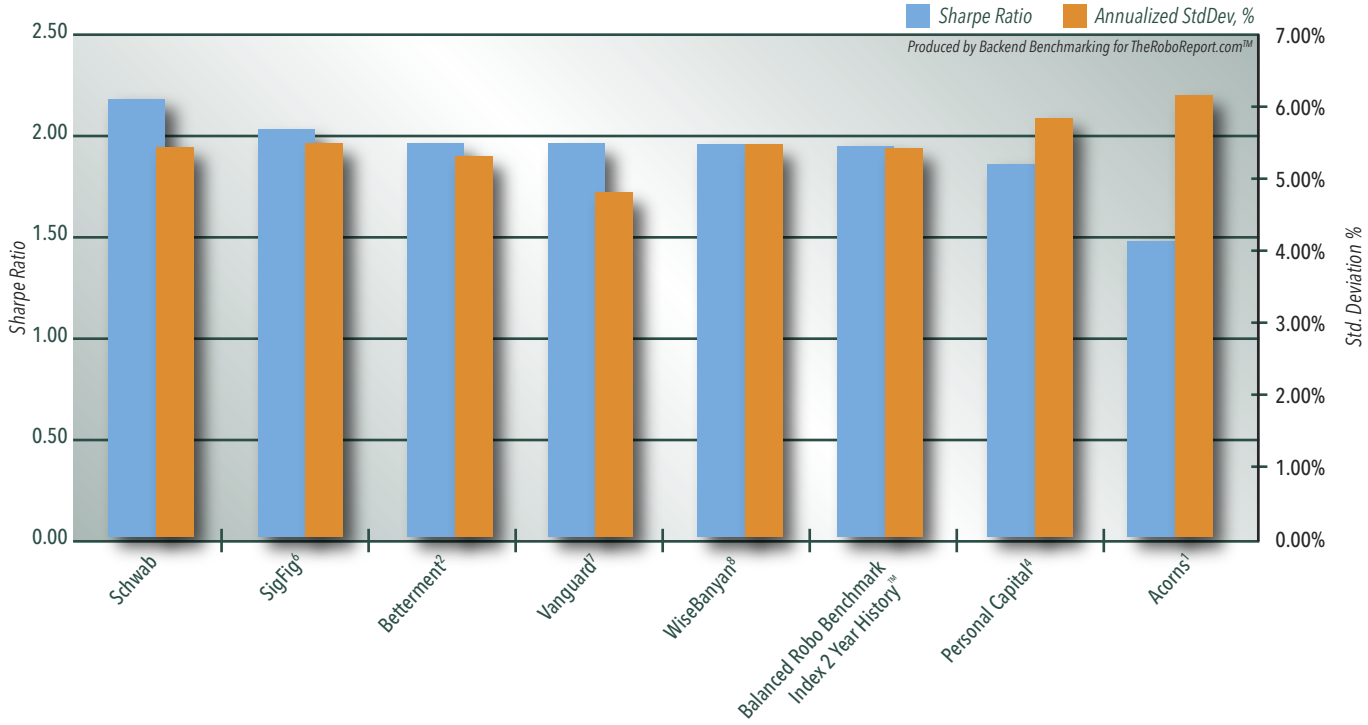
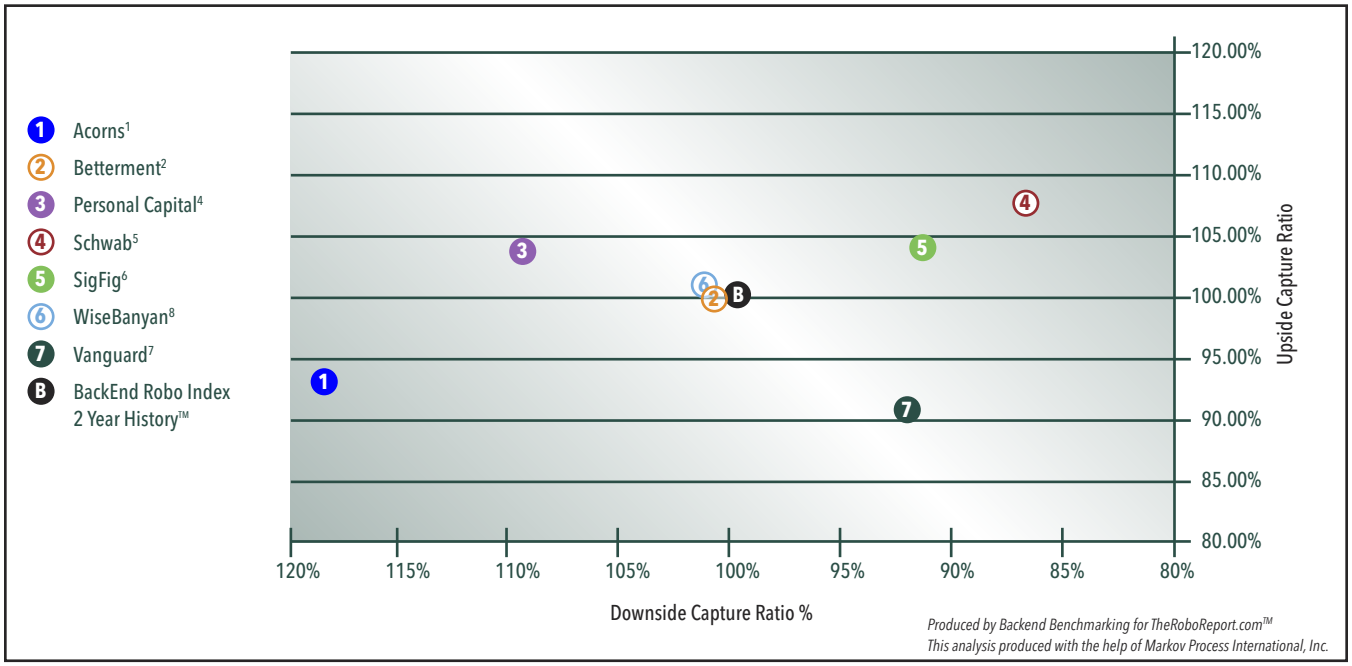
Risk/Return: Robos with 1 Year History (Sharpe Ratio and Standard Deviation)



Risk/Return: Robos with 2 Year History (Sharpe Ratio and Standard Deviation)



Upside/Downside Capture Ratio



1-Year Trailing Upside/Downside Statistics

	Acorns[1]	Better-ment[2]	E*Trade (ETF)[3]	Ellvest[8]	Fidelity Go[7]	Future-Advisor[3]	Personal Capital[4]	Schwab[5]	SigFig[6]	TD Amer-itrade[7]	Van-guard[7]	Wealth-Front[10]	Wise-Banyan[8]	BackEnd Robo Index 1 Yr History
Up Market Capture Ratio, %	83.38%	107.55%	95.15%	95.53%	104.25%	91.02%	96.33%	103.00%	109.44%	110.81%	104.94%	94.97%	103.86%	100.00%
Down Market Capture Ratio, %	–	–	–	–	–	–	–	–	–	–	–	–	–	–

** 2017 did not have any months with negative returns down market capture ratio cannont be calculated with one year of data.*

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2-Year Trailing Upside/Downside Statistics

	Acorns[1]	Betterment[2]	Personal Capital[4]	Schwab[5]	SigFig[6]	Vanguard[7]	WiseBanyan[8]	BackEnd Robo Index 2 Yr History
Up Market Capture Ratio, %	92.91%	99.61%	103.94%	107.70%	104.17%	90.64%	100.88%	100.00%
Down Market Capture Ratio, %	118.40%	100.83%	109.46%	86.71%	91.35%	92.12%	101.19%	100.00%

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Trades

As usual, there was very little movement in the portfolios during the fourth quarter. We saw quite a few rebalancing trades this quarter, but no major changes to allocations, other than the Hedgeable IRA account, which is our most actively traded account. In the Betterment IRA accounts, we saw sales of an international developed markets fund and the purchase of a domestic total stock market fund. We also saw the sale of a broad-based value ETF and the purchase of a mid- and small-cap ETF, as well as increasing emerging markets exposure. Personal Capital deployed a small amount of cash into a utilities ETF and a short-term bond ETF. Schwab swapped a SPDR municipal bond ETF for a Vanguard municipal bond ETF, while also deploying some cash near the end of the year to purchase a high-yield bond fund. SoFi also swapped a SPDR high-yield municipal bond ETF for a VanEck high-yield municipal fund.

The Hedgeable IRA is our most actively traded account. Hedgeable holds all individual stocks for the equity portion of the portfolio, paired with a single fixed income fund. They not only frequently adjust their equity positions, but also the percent allocated to fixed income. This quarter they reduced their fixed income allocation from 34% to just 4% of the portfolio, mostly adding to their consumer discretionary and consumer staples allocations. Proceeds were used to re-introduce positions in Comcast and Kraft Heinz at 7% and 8% of the total portfolio, respectively. They also boosted positions in Amazon (from 2% to 13%) and Starbucks (from 2% to 6%), as well as increasing their 10% position in Google to 13%. Other smaller changes were also made to other positions. Technology stocks increased from 63% of the portfolio to 65% of the portfolio. This concentration in technology and reduction of their fixed income allocation served them well this quarter, as they significantly outpaced the other aggressive IRA portfolios in Q4.

TD Ameritrade *Overview:*

Fee	Account Minimum	Our Taxable Account's Weighted Expense Ratio	Live Advisors	Automatic Rebalancing	Automatic Deposits
0.30% annually for Essential Portfolios. Selective Portfolios tiered at a higher fee level depending account balance and portfolio selected.	$5,000 for Essential Portfolios, $25,000 for Selective Portfolios	0.06%	Selective Portfolios has live advisors.	Yes	Yes

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TD Ameritrade Essential and Selective Portfolios

TD Ameritrade has a strong digital advice offering. They have two options of service, with the higher, Selective Portfolios, adding access to live advisors and more portfolio options. Their onboarding and client interface strikes a good balance of being informative but also simple enough for everyday investors to understand.

Sign up and Onboarding ★★★★

The Essential/Selective Portfolios' onboarding process is quick but informative. The questionnaire is thorough, and we liked that they have a question about whether there is sufficient cash savings to cover unforeseen circumstances. The risk section covers both the clients' financial circumstances and attitudes toward risks. On their projections chart, probability bands display statistics about expected return, volatility, probabilities of achieving a return, and the consequences of low likelihood outcomes. Including probability and a range of results helps investors better understand expectations. Although specific funds are not displayed, proposed asset allocation is available for the different portfolio options. Overall, the onboarding process strikes a good balance between being both simple and informative.

User Interface and Online Tools ★★★★

Once a client, the user interface is simple, straightforward, and easy to navigate. Their financial planning tool allows the client to easily change inputs like monthly contributions, goal amount, or age of retirement, which can help clients visualize how savings or other changes will affect their long-term goals. Account performance can be easily reached and is adjustable for time periods. TD also has the ability to see the allocation broken down by more than just asset classes into categories such as geography or sector, giving users more perspective. TD's user interface is intuitive, flexible, and informative.

Financial Planning ★★★ *(Essential Portfolios)* ★★★★ *(Selective Portfolios)*

TD's goal projection tool is helpful and flexible. Users can adjust inputs, allowing them to easily model different scenarios. Additionally, TD provides some automated suggestions on how to increase the chances of reaching a goal. If simple projections do not fulfill planning needs or wants, users have the option of upgrading to Selective Portfolios. Selective Portfolios users have access to live financial planning help and guidance.

Advice and Education ★★★

TD releases quarterly market commentary videos that are well-produced and informative. This is a nice feature for those investors who want to keep a closer eye on their portfolios and how they are managed. There is ample information on the assumptions they make, how and why they rebalance, tax-loss harvesting, and other features of Essential Portfolios. That said, there is not an abundance of content to help clients educate themselves on financial planning or other investment topics within the Essential Portfolios portal.

Tax-Loss Harvesting and Other Features ★★★ *(Essential Portfolios)* ★★★★ *(Selective Portfolios)*

TD Ameritrade does offer free tax-loss harvesting on their portfolios. At the Selective Portfolios level, there are more portfolio options. For example, there is an option containing actively managed funds or a more income-focused portfolio. TD Ameritrade also allows some ability to place investment restrictions in your portfolio, implying some level of customization is possible.

T. Rowe Price *Overview:*

Fee	Account Minimum	Our IRA Account's Weighted Expense Ratio	Live Advisors	Automatic Rebalancing	Automatic Deposits
No Fee	$50,000[13]	0.81%	Yes	Yes	Yes

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T. Rowe Price ActivePlus Portfolios

T. Rowe Price ActivePlus Portfolios have an interesting model where they do not charge a fee for management, but the portfolios are made up of most or all T. Rowe Price mutual funds. The mutual funds in the portfolios are typically actively managed. These portfolios are well suited for investors seeking active management or have familiarity or comfort with the T. Rowe Price brand.

Sign up and Onboarding ★★★

Onboarding reflects what is typical of other robo advisors. After some basic demographic information and a risk tolerance questionnaire, a model portfolio is recommended. T. Rowe does not incorporate any goal planning information at onboarding, and the asset allocation provided does not recommend specific funds.

User Interface and Online Tools ★★★★

The user interface is functional, and a client can easily access the basics upon signing in. Like many other incumbent players who have added a robo advisory product, the site has a lot of information and pages, sometimes making navigation a little difficult. The site has a variety of tools to help people navigate retirement planning or other topics. The breadth and quality of calculators and other information is greater than many other robos. Although they do not immediately jump out at you, an investor seeking useful tools can find them with T. Rowe.

Financial Planning ★★★★

There is access to live client specialists who can help with basic financial planning needs. A comprehensive plan for a client with complex needs would likely have to upgrade to a more traditional planning service with T. Rowe. In addition to access to live specialists, T. Rowe has a robust set of tools, including a financial planner called FuturePath. This tool goes a little bit farther than most and allows the input of future income events. The inputs can be easily changed, and different scenarios can be saved separately for side-by-side comparisons. Additionally, there are college savings and other calculators to help clients navigate a variety of financial planning topics.

Advice and Education ★★★★★

T. Rowe has a lot of information on the basics of investing, financial planning, and other topics. This along with calculators and a financial planning tool lead us to rate the advice and education area of T. Rowe high.

Tax-Loss Harvesting and Other Features ★★

T. Rowe currently does not support taxable accounts. Tax-loss harvesting techniques are not suited for tax-advantaged accounts like IRAs, so T. Rowe does not currently offer this feature.

Acorns *Overview:*

Fee	Account Minimum	Our Taxable Account's Weighted Expense Ratio	Live Advisors	Automatic Rebalancing	Automatic Deposits
$1/month up to $5k; 0.25% annually over $5k	No Minimum	0.09%	No	Yes	Yes, including their "round-up" feature

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Acorns

Acorns has an innovative approach to encouraging users to save and invest. The main advantage of their platform is the ability to "round up" daily credit and debit card transactions. This feature can help automate saving and help many start building an investment account. Although some other areas of the service did not score as well as other robos, we still believe Acorns is a compelling option for many who like the idea of saving a little daily in an automated way.

Sign up and Onboarding ★★

Acorns has a straightforward and easy sign-up process. They require users to create a profile and walk through opening an account before being presented with an asset allocation and model portfolio. The risk assessment appears to be made using a self-selected goal and timeline, and does not include attitudes toward investing, such as how a user would respond to a down market. There is less information about how the investments are expected to return during the onboarding process than many other robos.

User Interface and Online Tools ★★★

The user interface is sleek and simple. What tools they have to visualize the performance and future projections of an account are prominently displayed and are easy to use. Some information, specifically the actual assets held in an account, are difficult to find, and a user may need to look at the actual statements for this information. It is easy to find out a future projection based on increasing their regular contributions, but no other inputs, like the risk tolerance of a portfolio, can be easily adjusted. The performance section of the website does let you see the performance of different asset classes in the portfolio, which is a great feature to help investors understand the returns on their portfolio.

Financial Planning ★★

There is a portfolio feature that shows you how a user can expect their account to grow over time, with bands showing the probabilities of the outcomes. It is possible to run different simulations using different levels of recurring investments. Outside of this, there are not many features to help plan for large expenses or retirement spending.

Advice and Education ★

Acorns has little to offer for an investor looking to educate themselves on investing.

Tax-Loss Harvesting and Other Features ★★★★★

Acorns does not offer tax-loss harvesting. Acorns does stand out from other robos with its innovative approach to account funding. The robo is based on the idea of saving small amounts frequently to build an investment account. At the core of their offering is the ability to "round-up" credit card and debit card transactions, meaning transactions are rounded up to the nearest dollar and the difference is transferred to an account and invested. This feature can help users save and invest money passively. Features that address the behavioral components of saving and investing can be valuable, and we think this feature makes Acorns a compelling choice because they are empowering their users to save more.

Zack's Advantage *Overview:*

Fee	Account Minimum	Our Taxable Account's Weighted Expense Ratio	Live Advisors	Automatic Rebalancing	Automatic Deposits
0.50% accounts less than $100k; 0.35% on accounts above $100k	$5,000	0.12%	Yes	Yes	Yes

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Zack's Advantage

Zack's Advantage is a new offering from an established name in investment research and portfolio management. Zack's built their robo on the Schwab Institutional Intelligent Portfolios platform, meaning the online portal used to view and analyze a client's portfolio is managed by Schwab. Their offering also comes with a live advisor relationship. Investors with a little more to invest and looking for a hands-on approach from an experienced advisory team are a good fit for Zack's Advantage.

Sign up and Onboarding ★★★★

Zack's has a sleek and easy sign-up process consisting of a questionnaire, similar to other robos, but with a couple of extra features that we like. As the client works through the questionnaire, they are presented with an asset allocation chart. The chart adjusts the suggested allocation after each answer is selected, so the user can see how each choice affects the risk profile and resulting recommendation in real time. The final page of the questionnaire also has an interactive goal planning feature that helps users understand how they can expect their investment to grow and fluctuate in value and how much funding will be required over time to reach the goal. We wish a similar feature or tool was available after the account opening process to aid in financial planning.

User Interface and Online Tools ★★★

Schwab's dashboard is simple and easy to navigate. Asset allocation is shown clearly with the ability to click through to see underlying assets by category, along with descriptions of each asset class. The performance page allows the user to set custom dates for performance which can be helpful. Outside of simple pages for portfolio holdings, transactions, and performance, Zack's does not offer a lot for those trying to analyze or gain more in-depth understanding of their portfolios. That said, because Zack's offering has a live advisor relationship, many of these questions or insights can be gained from speaking with an advisor. As a whole, we like Zack's interface for its simplicity and ease of navigation.

Financial Planning ★★★★

At the end of the onboarding process, Zack's has a goal planning tool. This tool helps the user visualize how to achieve a goal in the long term, and helps them understand what to expect from their investment in terms of risk and return. Once the onboarding is complete, the user portal does not provide much to help a user wanting to look at long-term projections and create a plan. Although the online interface does not have strong DIY financial planning tools, financial planning services can be acquired through the live advisor team.

Advice and Education ★★★

Monthly outlook reports are provided to the customer discussing market trends, expectations, and other relevant topics regarding the portfolio and Zack's outlook. Clients can also utilize a wide variety of research through the traditional Schwab portal, although this does involve accessing a site separate from the Intelligent Portfolios portal. Additionally, the advisory team can help answer questions and dispense advice like in a more traditional advice relationship.

Tax-Loss Harvesting and Other Features ★★

Zack's offers free tax-loss harvesting on accounts over $50,000 in value.

DISCLOSURE:

[1] These accounts were funded with more than the minimum amount required to establish an account. Had the accounts been funded with more assets, they would be charged a same flat dollar fee up to $5,000 or a flat percentage on assets under management fee over $5,000. A higher advisory fee would have the result of decreasing reflected performance, while a lower advisory fee would have the result of increasing reflected performance.

[2] This account has no minimum required to establish an account, but had the account been funded with more assets, it would, at certain asset levels, be eligible for a lower advisory fee. The lower advisory fee would have the result of increasing reflected performance.

[3] These accounts were funded with more than the minimum amount required to establish an account. Due to the flat advisory fee, performance is not affected by the accounts' asset levels.

[4] This account was funded with the minimum amount required to establish an account. Had the account been funded with more assets it would, at certain asset levels, be eligible for a lower advisory fee. e lower advisory fee would have the result of increasing reflected performance.

[5] This account was funded with more than the minimum in order to take advantage of tax-loss harvesting. However, due to the flat advisory fee, performance is not affected by the account's asset level. Tax-loss harvesting may result in better or worse performance compared to similarly positioned accounts that do not have tax-loss harvesting associated with the account.

[6] This account was funded with the minimum amount required to establish an account. Had the account been funded with more assets it would be charged the same or, in the case of over $10,000, a higher advisory fee. A higher advisory fee would have the result of decreasing reflected performance.

[7] These accounts were funded with the minimum amount required to establish an account. Due to the flat advisory fee, performance is not affected by the accounts' asset levels.

[8] These accounts have no minimum required to establish an account. Due to the flat advisory fee, performance is not affected by these accounts' asset level.

[9] This account was funded with the minimum investment amount at the time. At the time of opening, the account had a 0.25% management fee. Due to changes in the service at the end of the 1st quarter 2017, new accounts are charged a 0.30% management fee. e fee on our account was grandfathered in and remains at 0.25%. e higher advisory fee would have the result of decreasing reflected performance.

[10] These accounts were funded with more than the minimum amount required to establish an account. e account has less than $10k in assets and is not charged an advisory fee at this level. If the account had more than $10k in assets a management fee would be charged which would decrease reflected performance.

[11] This account has no minimum required to establish an account, but had the account been funded with more assets, it would, at certain asset levels, be eligible for a lower advisory fee. The lower advisory fee would have the result of increasing reflected performance. A special request was made for an allocation of 60% equities and 40% fixed income or close to it, but this allocation was not one of the standard models at the time of account opening. At the time of account opening the closest standard models offered were a in the range of 50/50 or 75/25 equity to fixed income split.

[12] These accounts were funded with more than the minimum amount required to establish an account. Due to the flat advisory fee, performance is not affected by the accounts' asset levels. Because this provider does not offer a standard portfolio with close to a 60/40 equity bond split, two accounts with different risk tolerances were opened and funded with the amount so that the overall asset allocation between the combined accounts was close to a 60/40 equity bond split. Results and other metrics are reported on the accounts as though there were a single account.

[13] These accounts were funded with less than the minimum investment through an agreement between BackEnd Benchmarking and the provider. At higher levels of assets the fee remains the same and will not affect performance.

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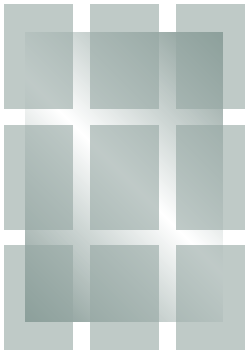
* *This report represents Condor's research, analysis and opinion only; the period tested was short in duration and may not provide a meaningful analysis; and, there can be no assurance that the performance trend demonstrated by Robos vs indices during the short period will continue.*

** *On June 19th, 2017, Vanguard removed BackEnd Benchmarking's primary Vanguard account from the Vanguard Personal Advisor Services program. As of June 20th, 2017, the primary account was replaced by a secondary account with the same risk profile as the primary account. e returns for the secondary account have been linked to the original primary account. Asset type and allocation between the two accounts at the time of the switch were very close but not identical.*

*** *BackEnd Benchmarking is under common ownership and control with Condor Capital Management, an SEC registered investment adviser. A copy of Condor's disclosure Brochure is available at www.condorcapital.com.*

**** *Condor Capital initiated a position in Schwab and TD Ameritrade in one of the strategies used in many of their discretionary accounts on 5/30/2017 and 5/31/2017. As of 12/31/2017 the total size of the position is 36,623 shares of Schwab common stock and 35,352 shares of TD Ameritrade common stock.*



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