Financial Services Observer

June 2018

Robo-Advisor Upgrade! Installing a Program for Profitability: Digital Advice Raises Profits for Investment Services Industry

Contents

Executive Summary

We agree that there's much to be skeptical of with the original robo-advisor business model. In fact, we wrote in 2015 about the challenging economics, how many stand-alone robo-advisors wouldn't survive, and robo-advisors integrated with established financial institutions would leapfrog the early leaders. However, new business models are addressing the three faults of the original robo-advisor model: high client acquisition costs, ongoing costs of servicing clients, and low revenue yield on client assets. Lead-generation tools and strategic partnerships are reducing acquisition costs, while building for scale and operating leverage eventually solves service costs. Revenue-enhancement strategies underpin much of our optimism for select robo-advisors becoming profitable. Upselling to human advice, ancillary service offerings, and incorporating proprietary products in portfolios are key revenue drivers.

We don't see robo-advisors disrupting moaty financial institutions. Instead, we expect established financial institutions will co-opt the technology and user experience improvements of robo-advisors to expand their own businesses. Among the asset management, wealth management, and online brokerage firms that we cover, we believe Invesco, Credit Suisse, and UBS are trading at the most attractive valuations.

Investment Services Firms Developing Digital Advice Offerings

Name/Ticker	Economic Moat	Moat Trend	Currency	Fair Value Estimate	Current Price	Uncertainty Rating	Morningstar Rating	Credit Rating	Market Cap (Bil)
BlackRock BLK	Wide	Positive	USD	600	549.14	Medium	★★★★	AA-	88.49
Charles Schwab SCHW	Wide	Stable	USD	57	57.34	High	★★★	A+	77.36
Credit Suisse Group CS	Narrow	Stable	USD	23	15.53	High	★★★★	NR	39.51
Invesco IVZ	Narrow	Positive	USD	40	27.76	Medium	★★★★	A-	11.40
Morgan Stanley MS	Narrow	Stable	USD	50	52.14	High	★★★	NR	92.30
Raymond James Financial RJF	None	Stable	USD	89	99.58	High	★★★	NR	14.52
TD Ameritrade AMTD	Narrow	Stable	USD	60	62.11	Very High	★★★	A	35.24
UBS Group UBS	Narrow	Stable	USD	21	15.55	High	★★★★	NR	57.78

Financial Services Observer

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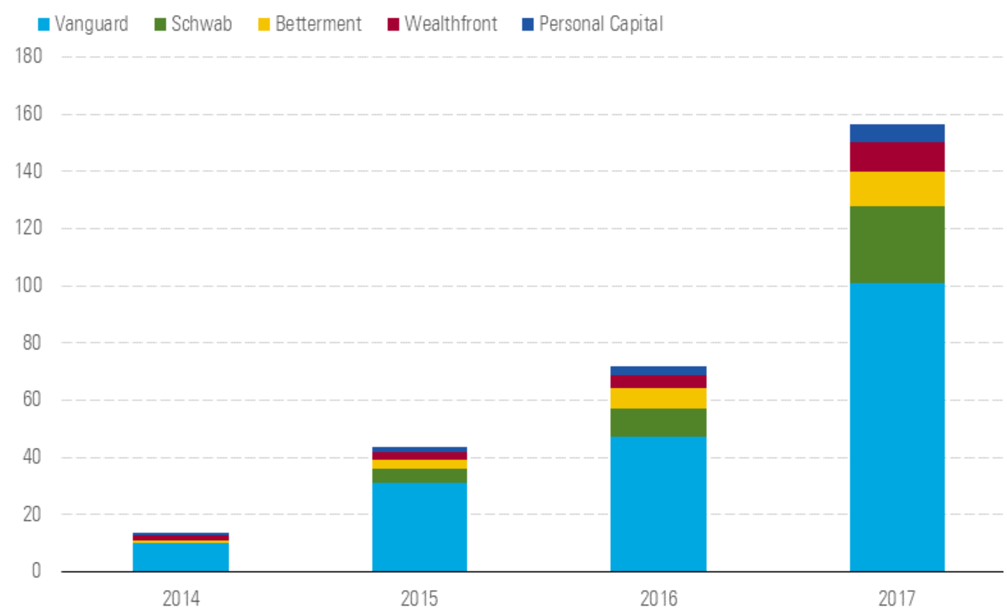
Key Takeaways

- Our dire assessment of the original robo-advisor business models has proved correct. They have failed to disrupt investment services incumbents and are still unprofitable. Many have sold themselves to established firms after realizing they can't count on investors giving them money.
- New robo-advisor business models and strategies influencing the key profitability determinants of client acquisition costs, ongoing operating costs, and revenue yield on client assets give us confidence that select robo-advisors will be profitable.
- Moaty financial services firms, like Charles Schwab and Vanguard, have leapfrogged early robo-advisors with their digital advice offerings.

Exhibit 1 While Later to the Scene, Established Firms Charles Schwab and Vanguard Have Leapfrogged Early Robo-Advisors in Digital Advice Assets Under Management
($ Billions)



Source: Company regulatory filings, Morningstar estimates

- Robo-advisors have three life-or-death choices: grow slowly and hope investors keep funding them, partner with an established financial services firm, or grow quickly with high-cost advertising.
- According to PitchBook Data, Betterment and Wealthfront have both raised capital in the last year. We reasonably conclude that they've eaten through $100 million-$200 million of capital to reach $10 billion of client assets.
- We still assess that advertising cost per account acquisition at robo-advisors is approximately $300 per gross new account and $1,000 per net new account. At their presumably low operating margin after they become profitable, the payback period on advertising costs can be more than a decade.

Exhibit 2 Payback Periods on $300 of Client Acquisition Costs for Robo-Advisors Are Lengthy
(Years)

Adjusted Operating Income (bps)

Account Size ($Thousands)	2.5	5	10	15	20	35
$25	48	24	12	8	6	3.4
$50	24	12	6	4	3	1.7
$75	16	8	4	2.7	2	1.1
$100	12	6	3	2	1.5	0.9
$150	8	4	2	1.3	1	0.6
$250	4.8	2.4	1.2	0.8	0.6	0.3

SCHW
AMTD
ETFC
Robo

Source: Company filings, Morningstar
Average account sizes at Charles Schwab, E*Trade, and TD Ameritrade are calculated as client assets divided by total active or funded brokerage accounts
Adjusted operating income excludes advertising, restructuring, and other unusual expenses

- Robo-advisors can use four strategies to lower their cost of client asset acquisition, but each has drawbacks.

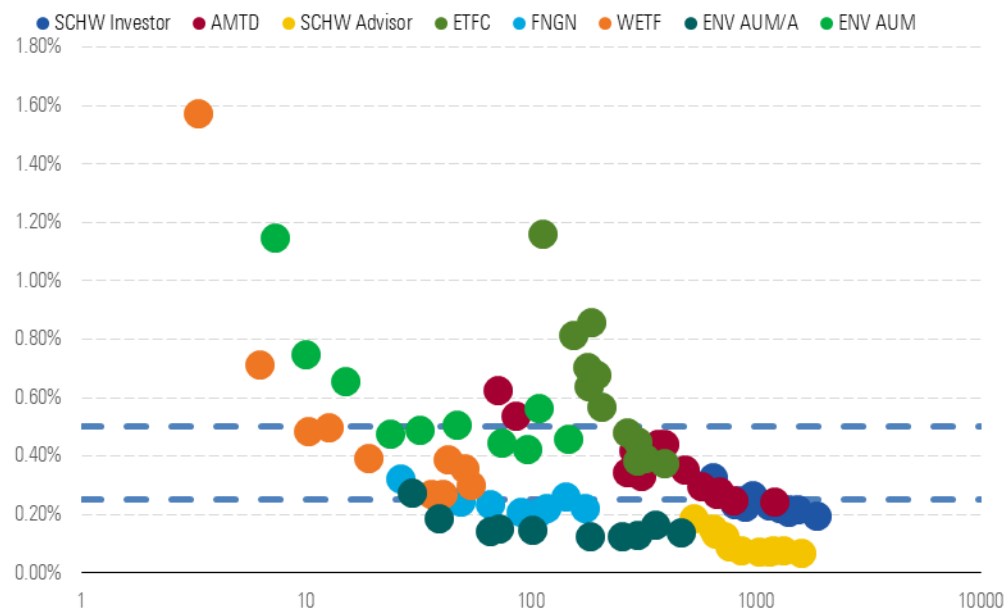
Exhibit 3 Each Client Asset Acquisition Strategy Has Drawbacks

Strategy	**Drawback**
Advertising	Expensive
3rd PartyPartnering	Lack of Control, Economics Sharing
Cross-Sell to Existing Customers	Cannibalization
Lead Generation Product	Development and Maintenance Costs
Higher Account Balance	Various

Source: Morningstar

- Robo-advisors need to build a high-operating-leverage business model to be profitable. We believe digital advice firms will spur growth in salaried financial consultants, as opposed to the traditional financial advisor compensation model of a percentage of revenue generated, to produce operating leverage.
- Expanded service offerings and higher revenue yields dramatically reduce the operating expense ratio and client asset hurdles to reach the goal of profitability. We estimate the break-even point for robo-advisors that sustain a 50-basis-point revenue yield could be $15 billion-$25 billion of client assets, 38%-63% lower than the break-even point for a robo-advisor that charges 25 basis points.

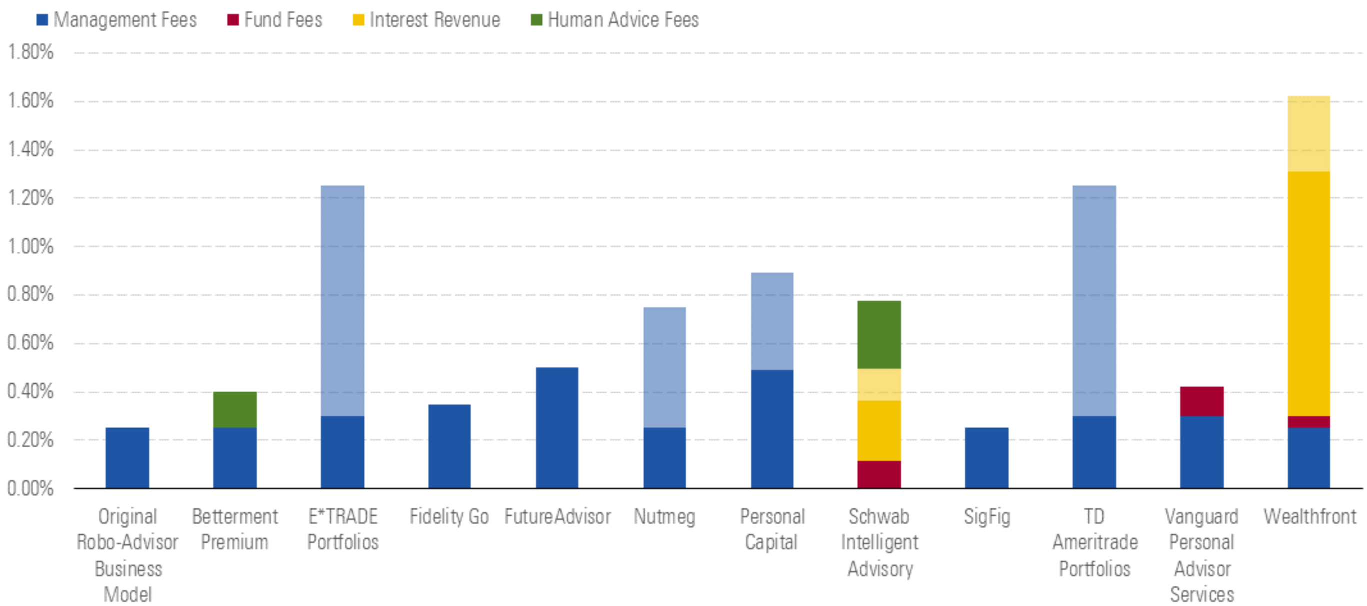
Exhibit 4 The Break-Even Point for a Robo-Advisor That Charges 50 Basis Points Could Be 38%-63% Lower Than for a Robo-Advisor That Charges 25 Basis Points
(Operating Expenses as Percentage of Client Assets; $ Billions)



Source: Company filings, Morningstar

- Four revenue-enhancing strategies at robo-advisors are charging more, upselling clients from a robo-advisor product to a digital advice offering, cross-selling additional products and services, and utilizing proprietary products in investment portfolios

Exhibit 5 New Business Models Are Transforming Robo-Advisors Into Moneymaking Machines
(Revenue as Percentage of Client Assets)



Source: Betterment, Charles Schwab, E*Trade, Fidelity, FutureAdvisor, Morningstar, Nutmeg, Personal Capital, SigFig, TD Ameritrade, Vanguard, Wealthfront
Schwab Intelligent Advisory revenue yield estimate is based on the asset allocation of a moderate-risk Schwab Intelligent Portfolio
Wealthfront revenue yield assumes maximum use of Portfolio Line of Credit

- Among the asset management, wealth management, and online brokerage firms that we cover, we believe Invesco, Credit Suisse, and UBS are currently trading at the most attractive valuations. Invesco is trading at a 30% discount to our fair value estimate and a 20% discount to its peers, which we believe is unwarranted based on its history of relatively strong organic asset growth. We see the relationships and sophisticated products offered by Credit Suisse and UBS to their ultra-high-net-worth clients as being particularly difficult for fintech companies to duplicate.

Our Dire Assessment of the Original Robo-Advisor Business Model Materialized, but New Strategies for Profitability Are Emerging

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In 2015, when we wrote our report "Hungry Robo-Advisors Are Eyeing Wealth Management Assets: We Believe Wealth Management Moats Can Repel the Fiber-Clad Legion," robo-advisors (which we defined as primarily digital firms that offer automated, semi-tailored investment portfolios direct to retail end customers) were widely touted as disrupters that would destroy the wealth management industry. We took the opposite side of the argument, asserting that established financial institutions with economic moats, like wide-moat Charles Schwab and narrow-moat Morgan Stanley, would retain their competitive positions and "The current legion of stand-alone robo-advisors will have to invest heavily in advertising, or consolidate to gain scale, be acquired or partner with established brokerages, or go out of business."

Looking at business models, we see robo-advisors, discount brokerages, and full-service wealth managers have value propositions that target different customer bases. Additionally, many of the discount brokerages are well scaled with material cost advantages, while the reputation, relationships, and product offerings of the full-service wealth management firms create customer switching costs. We believe the economic moats of incumbent investment services firms can withstand the robo-advisor encroachment.

Exhibit 6 Robo-Advisors and Hybrid Advisors Fill a Niche Between Discount Brokerages and Traditional Wealth Managers

Source: Morningstar

Additional key takeaways from our earlier research on robo-advisors:

- With their low fee rate, robo-advisors need near industry-leading expense efficiency and substantially more scale to be profitable. Using a range of comparable companies, we estimated that the break-even client asset level for robo-advisors is $16 billion-$40 billion.
- Much of the capital raised by the robo-advisors will have to be used to pay for the tens to hundreds of millions of dollars in marketing needed to gather assets and reach a profitable scale. Even after they become profitable, their slim operating margins and low average account size imply that it could take a decade or more to recoup advertising costs.

Over the past three years, we've seen many of these predictions validated, as the market adopted our bearish view. One of the most concrete indicators of the shift in sentiment to negative from positive for robo-advisors is the decrease in the post-money valuation of Wealthfront. According to private market data provider PitchBook Data,[1] Wealthfront's post-money valuation fell to $500 million after its January 2018 fundraising, compared with $700 million after its October 2014 fundraising.

[1] PitchBook Data is a Morningstar subsidiary.

Exhibit 7 The Decrease in Wealthfront's Post-Money Valuation Illustrates the Change in Robo-Advisor Sentiment

PitchBook

Deal No.	Deal Date	Deal Type	Deal Size (million, USD)	Company Pre-money Valuation (million, USD)	Company Post-money Valuation (million, USD)
1	13-Feb-2007	Early Stage VC	0.15	3.30	3.45
2	15-Dec-2008	Angel (individual)	2.96	12.00	14.96
3	15-Dec-2009	Later Stage VC	7.84	54.04	61.87
4	20-Mar-2013	Later Stage VC	19.78	66.09	85.88
5	27-Mar-2013	Seed Round			
6	02-Apr-2014	Later Stage VC	35.00	252.33	287.33
7	28-Oct-2014	Later Stage VC	64.17	635.83	700.00
8	04-Jan-2018	Later Stage VC	75.00	425.00	500.00

Source: PitchBook

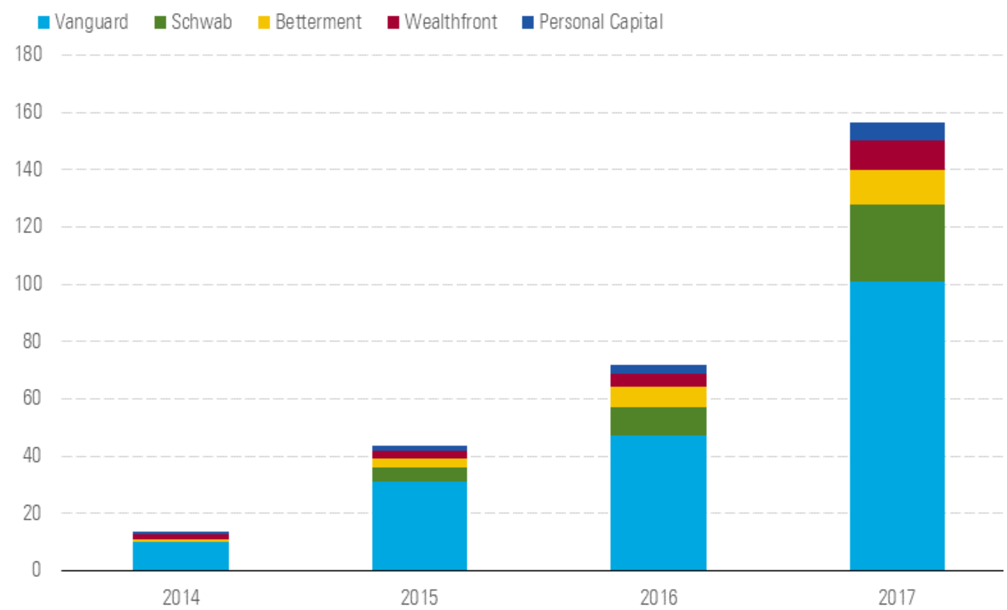
Wealthfront's valuation decreased despite the company rapidly increasing assets from about $1.5 billion three years ago to $10 billion recently. Some of the negativity can be traced to the success of the established financial institutions that robo-advisors were supposed to disrupt.

Moaty Financial Sector Incumbents Are Surpassing the Early Robo Leaders

Not only have established wealth management and brokerage firms avoided disruption by the legion of robo-advisors, their moats have kept them flourishing. Over the past several years, Charles Schwab has returned over 90%, Morgan Stanley 50%, and TD Ameritrade 70%. Moreover, they've learned from the robo-advisor firms and are adding to their arsenal many of the technologies and user experience improvements that robo-advisors pioneered.

Charles Schwab is a great example of a firm that was able to utilize its core strengths to arguably beat robo-advisors at their own game. The company launched its robo-advisor offering, Schwab Intelligent Portfolios, in 2015; since then, it along with Schwab Intelligent Advisory has accumulated over $30 billion in assets. This is approximately 3 times the amount that two of the early leaders in robo-advisory, Betterment and Wealthfront, have despite Charles Schwab launching its offering seven years after them.

Exhibit 8 While Later to the Scene, Established Firms Charles Schwab and Vanguard Have Leapfrogged the Early Robo-Advisors In Digital Advice Assets Under Management
($ Billions)



Source: Company regulatory filings, Morningstar estimates

Vanguard, with its reimagination of its Vanguard Personal Advisor Services into a hybrid digital advice offering, is arguably the current leader. It has over $100 billion in assets—approximately 10 times that of Betterment and Wealthfront and 15 times that of Personal Capital.

Many Robo-Advisors Have Realized That Their Road to Profitability as Stand-Alone B2C Firms Was Long and Uncertain, So Chose to Partner With Established Firms

2015 seems to have been a turning point in robo-advisors believing that they could conquer the world by disintermediating the established investment services players. Robo-advisor headlines from 2015 onward have been more about robo-advisors partnering with or being acquired by major financial institutions than pronouncements of their inherent superiority and destiny of disruption.

Major acquisitions of robo-advisors or digital advice firms since 2015 include the following.

- March 2015: Northwestern Mutual acquires LearnVest.
- August 2015: BlackRock acquires FutureAdvisor.
- January 2016: Invesco acquires Jemstep.
- May 2018: Principal Financial Group acquires RobustWealth.

Multiple robo-advisors that had been offering their services directly to retail end clients (a business-to-consumer orientation) have completely pivoted to or have complemented their B2C offering with services that will be provided in partnership with asset managers, banks, or wealth management firms.

Betterment, FutureAdvisor, and SigFig are examples of this shift. Betterment has Betterment for Advisors; FutureAdvisor after being acquired by BlackRock announced partnerships with BBVA, LPL Financial, Royal Bank of Canada, and U.S. Bank; and SigFig has announced partnerships with UBS and Wells Fargo.

Robo-advisors partnering with established financial institutions is a result that we expected. We initially estimated that robo-advisors would need $16 billion-$40 billion in client assets to break even, which was approximately 8-20 times the level of leading stand-alone robo-advisors at the time. Even if the robo-advisors were increasing assets quickly—which they have done, with compound annual growth rates of around 100% over the last two years at leading firms—they would be running in the red until they reached a profitable scale. For robo-advisors that weren't the leaders at the time, the losses they would incur for an extended period and the uncertainty about continued funding from venture capitalists meant that it was a reasonable decision to either partner or be acquired.

Signs Point to Even the Leading Robo-Advisors Still Being Unprofitable

Some might assume that robo-advisors are technology-based companies that can run on a shoestring budget and be profitable at significantly lower levels of assets under management than our initial estimates, but multiple signs indicate they have yet to reach a profitable scale.

First is actual financial data from one robo-advisor. According to PitchBook, leading robo-advisor Nutmeg in the United Kingdom had a net operating loss of $12.6 million in 2016. At that time, Nutmeg had 73 employees, about GBP 600 million in assets under management, and 25,000 clients.

Exhibit 9 Leading Robo-Advisor Nutmeg Is Still in the Red

PitchBook

Income Statement (TTM)

Company: Nutmeg *Amounts in thousands, USD (except Ratios, Multiples & per share items)*	Dec-2013	Dec-2014	Dec-2015	Dec-2016
Gross Profit				
Total Revenue	162	1,046	2,622	3,454
Operating (Income)/Expenses				
Wages and Salaries	2,640	4,171	6,738	7,217
Depreciation		16	50	143
Pretax Income				
Pretax Income	(5,779)	(8,700)	(13,674)	(12,629)

Source: Company filings, PitchBook

We can also infer that leading robo-advisors Betterment and Wealthfront, both of which are private companies in the United States with no publicly available financial information, are still unprofitable, because they're still raising money. According to PitchBook, Betterment raised $70 million of Series E funding in July 2017 and Wealthfront raised $75 million of Series G venture funding in January 2018. Before their most recent funding rounds, Betterment had already raised $205 million while Wealthfront had raised $129.9 million, according to PitchBook. Both of the firms probably had around $10 billion of assets under management when they last raised money, so we can reasonably conclude that they've spent $100 million-$200 million to reach $10 billion in assets.

Exhibit 10 Recent Fund Raisings Lend Support to Betterment Not Having Reached Profitability at $10 Billion of Assets Under Management

PitchBook

Deal No.	Deal Date	Deal Type	Deal Size (million, USD)	Raised to Date
1	22-Nov-2010	Early Stage VC	3.00	3.00
2	25-Sep-2012	Early Stage VC	10.00	13.00
3	15-Apr-2014	Later Stage VC	32.00	45.00
4	18-Feb-2015	Later Stage VC	60.00	105.00
5	29-Mar-2016	Later Stage VC	100.00	205.00
6	21-Jul-2017	Later Stage VC	70.00	275.00

Source: PitchBook

Exhibit 11 Recent Fund Raisings Lend Support to Wealthfront Not Having Reached Profitability at $10 Billion of Assets Under Management

PitchBook

Deal No.	Deal Date	Deal Type	Deal Size (million, USD)	Raised to Date
1	13-Feb-2007	Early Stage VC	0.15	0.15
2	15-Dec-2008	Angel (individual)	2.96	3.11
3	15-Dec-2009	Later Stage VC	7.84	10.95
4	20-Mar-2013	Later Stage VC	19.78	30.73
5	27-Mar-2013	Seed Round		30.73
6	02-Apr-2014	Later Stage VC	35.00	65.73
7	28-Oct-2014	Later Stage VC	64.17	129.90
8	04-Jan-2018	Later Stage VC	75.00	204.90

Source: PitchBook

Fundraising, Advertising, and the 3 Life-or-Death Choices for Robo-Advisors

Initially, many robo-advisors appeared to believe that they could expand their business by word of mouth and social media alone—that is, free advertising. We don't disagree that this is a growth path that robo-advisors can choose. What we disagree with, and what we previously asserted, is that robo-advisors would have to dig into the money piles they raised from venture capitalists to fund advertising campaigns to reach a profitable scale. Almost all the stand-alone robo-advisors are bleeding money, as we've seen in the financials of Nutmeg and as we can reasonably conclude from the capital raisings of Betterment and Wealthfront.

Stand-alone robo-advisors have three life-or-death choices:

- Grow slowly while continually losing money and hope that new capital can be raised to plug the hole.
- Work with established firms via a distribution partnership or merger.
- Grow quickly by spending on advertising to reach a profitable scale.

At the moment, we see most robo-advisors electing the first choice as really just choosing death. It's quite possible that a robo-advisor can have only a couple dozen people and only be losing low-single-digit millions per year, as opposed to larger Nutmeg with recent annual losses in excess of $10 million. However, these firms will eventually deplete their initial capital and then be subject to the vagaries of the capital-raising environment. Our best prediction of what will happen is that either they'll go bankrupt, de facto sell themselves to venture capitalists that demand increasing ownership of the firm with each additional capital raise, or decide on choice 2: selling themselves or partnering to survive.

Some firms have already made the second choice of selling themselves to or partnering with established firms since 2015. FutureAdvisor, LearnVest, Jemstep, and RobustWealth have already assured some payoff for their founders and their continued existence with their sale to more established firms. Betterment and SigFig have so far chosen to remain independent but are working with other financial institutions to ramp to a profitable scale.

Choice 3 is a luxury that arguably only Betterment and Wealthfront can elect. They're both at the top of the charts for capital-raising at over $200 million, so they have enough capital to keep the lights on, invest in product development, and spend on advertising to spur client asset growth. Additionally, with both at over $10 billion in client assets, they're approaching the low end of our initial break-even client asset level estimate of $16 billion-$40 billion in assets, which means they can conceivably reach profitability without tapping the capital markets again.

Betterment and Wealthfront may also be in a virtuous circle where because of their leadership positions, they're most likely to succeed and therefore have investors they can raise money from. As they have investors willing to fund them, they are in turn able to use the funding to further distance themselves from other industry players, which increases their probability of success, leads to access to funding, and so on.

While we don't know if Betterment and Wealthfront have paid the tens to hundreds of millions of dollars on advertising that we calculated could be necessary to reach a profitable scale, we do know that they're not just relying on social media and word of mouth to acquire client assets. During and following NCAA March Madness games, Betterment and Charles Schwab ran television ads for their robo-advisor products. Wealthfront has also run television ads during Comedy Central and college football games. In 2016, Betterment even bought advertising in *The Wall Street Journal* and *The New York Times* that was in defense of the Department of Labor's fiduciary rule and promoted Betterment as an investment service that people can trust.

Upgrading the Old Robo-Advisor Business Model by Installing a Program for Profitability

We believe a program for profitability must address three faults of the original robo-advisor business model:

- Client acquisition costs.
- Ongoing costs of servicing clients.
- Revenue yield on client assets.

Over the past several years, the economically unviable business models that robo-advisors had have rapidly evolved to address these sticking points. We now believe that there are viable paths to profitability for robo-advisors.

Strategies for Lowering the Cost of Client and Asset Acquisition

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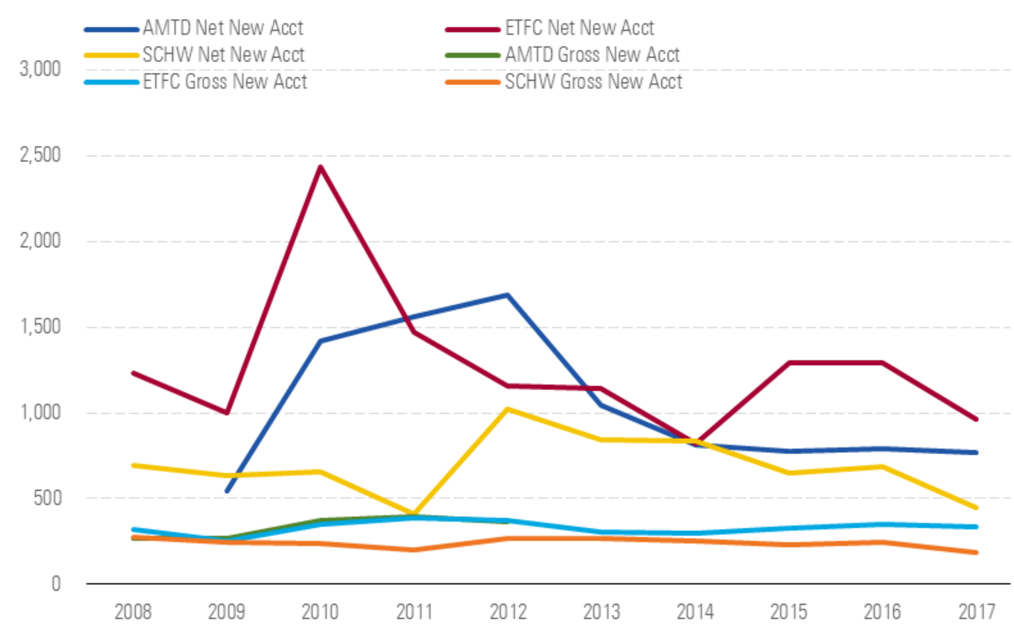
In our previous report, we thought a reasonable way to assess the client acquisition cost for robo-advisors would be to look at the advertising cost per new account at U.S. online retail brokerages. We calculated that the advertising cost per gross new account was approximately $300 and the cost per net new account was $1,000 at Charles Schwab, E*Trade, and TD Ameritrade. Looking at more recent data, the cost of account acquisition has remained fairly stable at E*Trade at around $300 per gross new account and $1,000 per net new account. Charles Schwab's and TD Ameritrade's costs per new account have declined over the past three years, as total advertising costs at the two firms have remained steady, but they've both opened more accounts than in the years preceding 2015.

Exhibit 12 Cost of Account Acquisition Has Modestly Declined In Recent Years



Source: Company filings, Morningstar

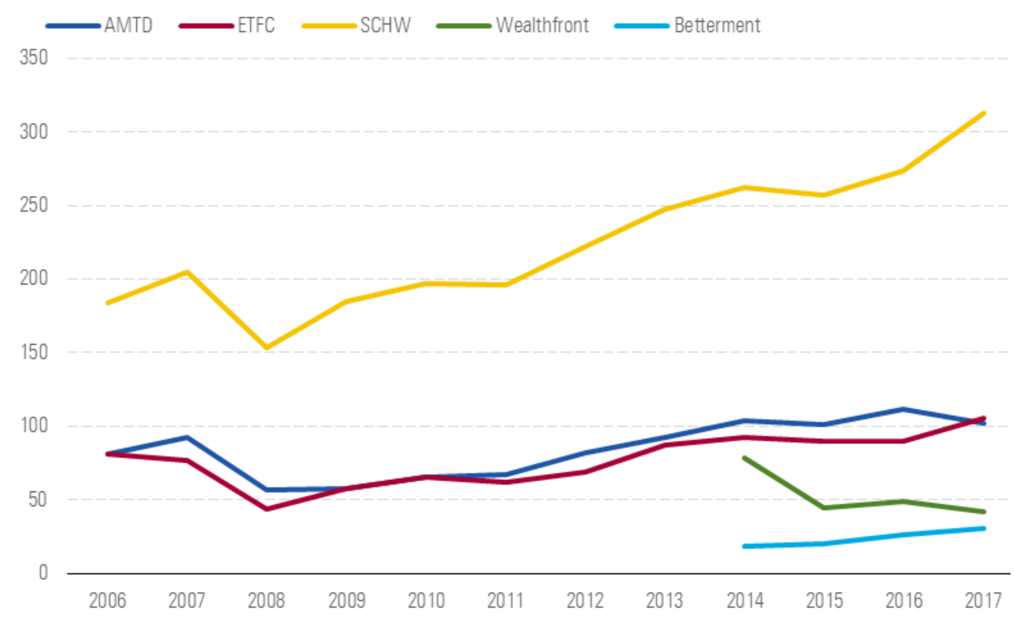
We still believe that around $300 per gross new account is a reasonable estimate for the cost of client acquisition based on the online retail brokerages. Our $300 customer acquisition cost is also roughly in line with others' estimates, such as SCM Direct's estimate of GBP 180, Boring Money's estimate of GBP 200-500, and Burnmark's estimate of $389.

The cost of client acquisition is important, because with the cost of client acquisition, average client account balance, and assumed operating margin, we can estimate the payback period for client acquisition costs. Additionally, it can form the basis for an estimate of the amount of advertising needed to grow to a profitable scale.

Based on Average Account Sizes and Potential Operating Margins, the Payback Period on Robo-Advisor Accounts Can Be a Decade or More

The average account size at the online brokerages is a multiple of that of the leading online robo-advisors. Betterment's average account size has increased approximately 50% over the past several years to $30 thousand from $20 thousand. However, Wealthfront's average account size has decreased nearly 50% to approximately $40 thousand from $80 thousand. We would hazard a guess that the decrease in Wealthfront's average account size is related to the company's expansion from its affluent Silicon Valley roots and a relative decrease in the number of charitable and corporate organizations that Wealthfront does business with compared to retail investors.

Exhibit 13 Average Account Sizes at Robo-Advisors Are Materially Lower Than the Online Brokerages
($ Thousands)



Source: Company filings, Morningstar
Average account sizes at Charles Schwab, E*Trade, and TD Ameritrade are calculated as client assets divided by total active or funded brokerage accounts

Based on different scenarios for how profitable robo-advisors will eventually be once they're scaled to a profitable level, we can calculate a payback period on client acquisition costs.

Exhibit 14 Payback Periods on $300 of Client Acquisition Costs for Robo-Advisors Are Lengthy
(Years)

Account Size ($Thousands)	Adjusted Operating Income (bps)					
	2.5	5	10	15	20	35
$25	48	24	12	8	6	3.4
$50	24	12	6	4	3	1.7
$75	16	8	4	2.7	2	1.1
$100	12	6	3	2	1.5	0.9
$150	8	4	2	1.3	1	0.6
$250	4.8	2.4	1.2	0.8	0.6	0.3

SCHW
AMTD
ETFC
Robo

Source: Company filings, Morningstar
Average account sizes at Charles Schwab, E*Trade, and TD Ameritrade are calculated as client assets divided by total active or funded brokerage accounts
Adjusted operating income excludes advertising, restructuring, and other unusual expenses

While the payback period on advertising costs for gross new accounts at the established online brokerages is less than two years, the payback period for robo-advisors is likely more than a decade for the foreseeable future.

Advertising to Reach Profitable Scale May Be Within Reach for Betterment and Wealthfront

We previously estimated a range of client assets for break-even profitability for the stand alone robo-advisors at $16 billion-$40 billion of client assets. Given that Betterment and Wealthfront both had around $2 billion of assets when we wrote the report in 2015, we also estimated that Betterment would need to invest $240 million-$600 million and Wealthfront would need to invest $60 million-$150 million in advertising to reach $16 billion-$40 billion of client assets. Based on their current assets under management and average account sizes, both would only need approximately $40 million in advertising to reach $16 billion in client assets and a little less than $300 million to reach $40 billion. Given that both Betterment and Wealthfront have raised $70 million or more in the last 12 months, reaching the $16 billion low end of our break-even profitability estimate should be achievable off their latest funding round.

Robo-Advisor Strategies for Lowering Client Acquisition Costs

Given the challenges and generally poor economics of mass advertising to attain profitable scale, are there other strategies that can be used?

We see four strategies being used in the market to decrease the costs of customer acquisition:

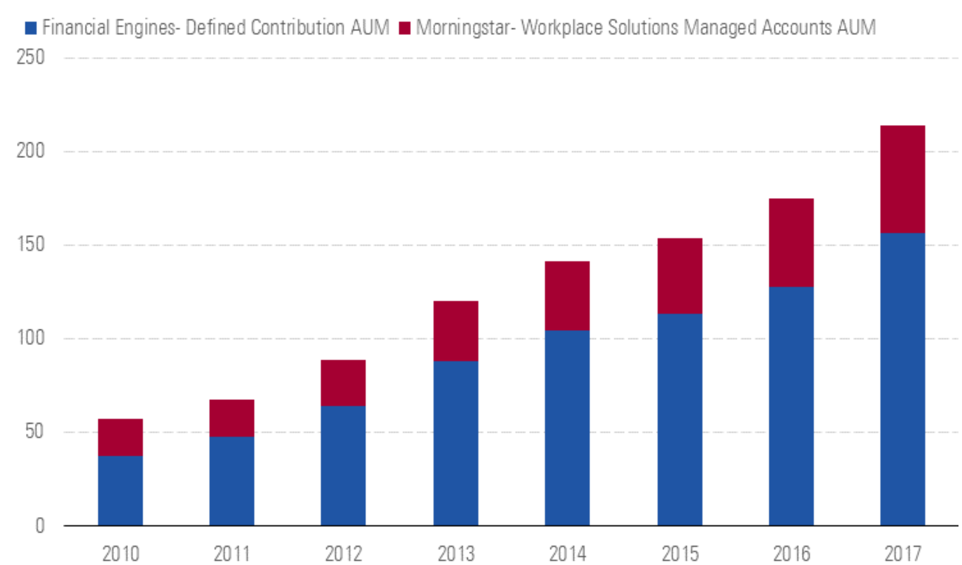
- Partnering with an established firm.
- Cross-selling robo-advisor services to existing customers.
- Developing a lead-generation tool.
- Acquiring clients with higher account balances.

New Robo-Advisors Are Adopting a Strategy Similar to Pioneers of Automated Portfolio Management: Morningstar and Financial Engines

Partnering with an established firm is the core strategy of the robo-advisors that have shifted to a business-to-business service. B2B is the primary orientation of SigFig and FutureAdvisor, while Betterment has hedged its initial B2C bet with its B2B Betterment for Advisors offering. For example, taking FutureAdvisor and its development of Guided Wealth Portfolios with LPL Financial, FutureAdvisor gains exposure to over 15,000 advisors that touch $600 billion of client assets with that one partnership.

The partnering or B2B strategy of recent stand-alone robo-advisors can be considered to be taken from the playbook of two of the firms that predated the recent crop of robo-advisors: Morningstar and Financial Engines. Morningstar and Financial Engines were early providers of institutional-level digital advice products to corporate retirement participants for more than a decade. As Morningstar and Financial Engines worked directly with retirement plan providers and retirement plan sponsors, they were able to tap into large pools of clients without having to engage in mass retail advertising. Consequently, they have over $200 billion in assets under management combined.

Exhibit 15 Morningstar and Financial Engines Have Accumulated Over $200 Billion in AUM by Partnering With Retirement Plan Sponsors and Plan Providers
($ Billions)



Source: Company filings

Partnering with third parties has the advantage of relatively low-cost access to potential clients, but it doesn't necessarily translate into low-cost or profitable conversion. While the third party grants access, it often wants to keep the primary relationship with the customer. For example, a financial advisor who uses a robo-advisor platform wants the client to be attached to him or her, not the robo-advisor. Third parties may also put constraints on the forms of outreach to the end client, which can hinder adoption of the service. Finally, dealing with a large third party often means sharing economics with it. This is a cost that is potentially ongoing compared with a one-time advertising cost, and it wouldn't have be incurred had the robo-advisor been able to directly sign up the end client.

Managing Cannibalization Is the Key Cost Control for Established Financial Institutions Cross-Selling Digital Advice

Cross-selling of robo-advisor or digital advice services is a strategy that multiple established financial institutions have employed. Charles Schwab has its Intelligent Portfolios and Intelligent Advisory line of services with over $30 billion in assets. TD Ameritrade has its Essential, Selective, and Personalized Portfolios with over $15 billion in assets.[2] Vanguard has its Vanguard Personal Advisor Services with over $100 billion in assets.

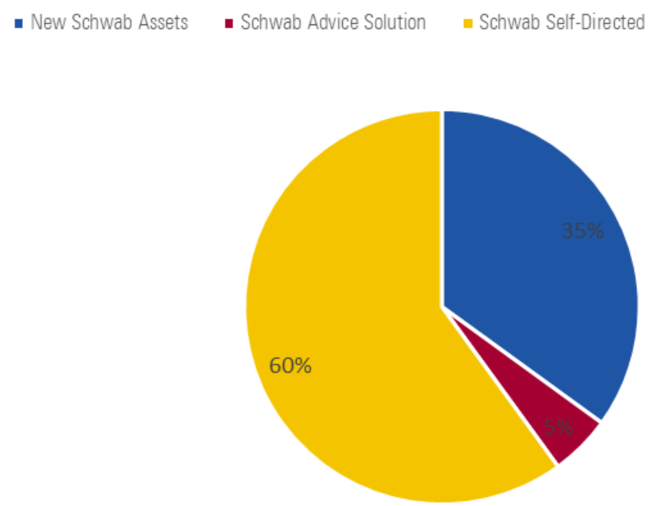
Each of these established financial institutions has been able to leverage its brand and existing customer base to accumulate more assets in its digital advice solution than the stand-alone robo-advisors. It's also likely that its average client acquisition cost for its digital advice accounts is materially lower than our $300 advertising cost estimate for stand-alone robo-advisors.

While rapidly growing digital advice assets is admirable, established financial institutions have to deal with whether their digital advice solutions are actually additive to their bottom line. The major criticisms of the established firms entering the digital advice realm is whether they're adding new clients instead of only converting existing ones and whether they're cannibalizing their own revenue.

Charles Schwab is a good case study. For the first quarter of 2018, 35% of flows into its Intelligent Portfolios were new assets for the firm, 5% were from an existing customer using another Charles Schwab advice solution, and 60% were from clients that were self-directed or not using an advice solution. While the majority of assets are coming from existing Schwab customers, 35% is still a healthy number. Considering that Schwab has over $30 billion in Intelligent Portfolios and Intelligent Advisory, if we were to exclude assets from existing customers and only add the approximately 35% new-to-firm digital advice assets, it's accumulated nearly as much as Betterment and Wealthfront.

[2] Morningstar Investment Management LLC is a consultant to TD Ameritrade Investment Management

Exhibit 16 A Material Portion of Client Assets in Schwab's Intelligent Portfolios Is Coming From New Clients



Source: Charles Schwab spring business update, April 20, 2018

Revenue cannibalization can be determined by the type of Schwab client converting to its Intelligent Portfolios. We estimate that assets that came out of one of Charles Schwab's advice solutions would currently have a revenue cannibalization of 14 basis points on average. For assets coming from one of Charles Schwab's more specialized advice solutions, like ThomasPartners or Windhaven, the revenue cannibalization can be upward of 54 basis points. Asset movement from one of Charles Schwab's other advice products is the predominant cannibalization risk. However, it seems to be relatively minor, with the percentage of assets coming from existing clients using an advice solution having decreased to 5% in the first quarter of 2018 from 10% in the first quarter of 2016.

Exhibit 17 Attracting New Clients and Retaining Existing Clients Can Offset the Potential Cannibalization of Higher-Revenue-Yielding Advice Solutions
(Revenue as Percentage of Client Assets)

Client Type	Revenue Yield	Current SIP Yield +-	Normalized SIP Yield +-	Bullish SIP Yield +-
New or Retained	0.00%	0.36%	0.49%	0.56%
Buy and Hold	0.05%	0.31%	0.44%	0.51%
Average Retail	0.38%	-0.02%	-0.01%	0.00%
Retail Advice Solution	0.50%	-0.14%	-0.01%	0.06%
Managed Product	0.90%	-0.54%	-0.41%	-0.34%

Source: Company filings, Morningstar
Estimated Schwab Intelligent Portfolios yield is based on the asset allocation of a moderate portfolio

The cannibalization effect of the 60% of assets that came from Charles Schwab clients who weren't previously using an advice product is probably limited or even a net positive. First, any client retained by Schwab who was thinking of transferring assets to an outside robo-advisor is a clear positive and is equivalent to a new client. Buy-and-hold investors who trade infrequently and don't hold material cash balances aren't very profitable; Schwab will generate more revenue from them if they choose a digital advice solution.

The revenue yield on average retail or investor services client assets in 2017 was 38 basis points, compared with our estimate for the revenue yield on a moderate portfolio allocation for Intelligent Portfolios of 36 basis points. The cannibalization on average retail assets of 2 basis points currently and estimated 1 basis point in a more normalized interest rate environment is influenced and potentially inflated by two factors. First, the average retail revenue yield includes assets that are in the higher-revenue-yielding retail advice or managed product categories. Our estimate for the average revenue yield on nonadvised retail assets is closer to 30 basis points than 38 basis points. Second, we're using a 12% cash allocation for the moderate portfolio. This is slightly higher than the recent average cash allocation of Charles Schwab's clients at 10%-11% but probably materially lower than the average cash allocation of the company's retail clients. For example, in 2010 and 2011, the company's overall cash allocation was upward of 14%, and this included financial advisor accounts, which tend to have relatively low cash allocations.

Overall, conversion of existing clients to a digital advice solution may seem attractive, but it has to be approached thoughtfully. For Charles Schwab, the cost of client acquisition represented by cannibalized revenue from clients using other Charles Schwab advice products with a current revenue yield of over 50 basis points to Intelligent Portfolios with our currently estimated revenue yield of 36 basis points should be more than offset by the revenue contribution from retained clients and buy-and-hold clients. However, this dynamic may not hold true for other financial services companies.

Creating Products for Lead Generation

A strategy used by a handful of robo-advisors is to create products that serve as a lead-generation tool for the robo-advisory service. Two firms that have employed this are Personal Capital and SigFig with their free personal finance tools. Personal Capital boasts that it has 1.6 million users and $500 billion of tracked accounts, while SigFig has 800 thousand users and $350 billion of tracked portfolios.

There are costs for Personal Capital and SigFig to upsell their existing clients from free tools to their paid, managed investment account offerings. They have the initial development cost of the tools and ongoing maintenance. Furthermore, they may have to invest in a sales team to convert the users of the free tools into paying customers.

Overall, these tools have so far been great at creating pipelines of customers for the robo-advisors to prospect, but their use as conversion tools is uneven. Personal Capital has around $7 billion of assets under management. While this may seem like a low conversion rate relative to the $500 billion of tracked accounts using Personal Capital tools, $7 billion of assets under management makes Personal Capital one of the leading digital advice providers. SigFig has over $200 million of assets under management, which is materially more than many of the start-up robo-advisors but pales in comparison with the assets under management at robo-advisor leaders, which are in the billions. SigFig's regulatory assets under management may not be the best gauge of its revenue, though, as the company probably has software licensing and subadvisory fees from its business partnerships that may not be based on reported assets under management.

Attracting Higher-Asset-Balance Accounts Is Another Key Lever That May Be Tilted by Psychology as Much as Math

The revenue model for the majority of robo-advisors is based on assets under management, so the cost of acquiring client assets rather than the cost of acquiring clients is arguably the more salient metric. Acquiring one client with a $100,000 account for $300 in advertising costs is 4 times more effective than acquiring four clients that each have a $25,000 account for $1,200 of advertising.

The robo-advisor strategy for increasing account size appears to be based on establishing account minimums for different promotional offers or services. For example, this year, Betterment has run a promotional offer in which it will waive management fees for a period of time based on the amount deposited within 45 days.

Exhibit 18 Betterment Is Using a Promotional Offer to Increase Account Sizes

Deposited	Management Fee Waived
$15,000 - $99,999	1 month
$100,000 - $249,999	6 months
>$250,000	1 year

Source: Betterment banner ad, Yahoo Finance, May 25, 2018

Convincing clients to increase the amount that they deposit with Betterment in order to temporarily waive management fees drastically reduces the cost of asset acquisition. Using our $300 advertising cost per account acquisition, acquiring a $30,000 account and waiving one month of management fees would result in a total cost of acquisition of $306.25. However, if a client were to invest $100,000 with Betterment in order to have six months of waived management fees, the company would have a total cost of acquisition of $425 for that account, but this would be the same as if it had acquired 3 1/3 accounts with $30,000 in assets for $127.50 per account, which is much better than $306.25. Similarly, a $250,000 account would have a total cost of acquisition of $625 but would be equivalent to acquiring 8 1/3 average accounts for $111 each.

Exhibit 19 Onboarding Larger Accounts Has the Equivalent Effect of Lowering the Cost of Client Acquisition

Account Size	Fixed Cost of Acquisition	Monthly Fee	Months Waived	Waived Fees	Total Cost of Acquisition	Equivalent $30k Accounts	Cost Per $30k Acquired
$30,000	$300	$6.25	1	$6.25	$306.25	1	$306.25
$100,000	$300	$20.83	6	$125.00	$425.00	3 1/3	$127.50
$250,000	$300	$52.08	12	$625.00	$925.00	8 1/3	$111.00

Source: Morningstar

Besides promotional offers, multiple digital advice firms tie increased benefits with minimum asset levels. These benefits can come in the form of additional service offerings or lower fees, and the desire to access these additional service offerings can induce clients to move more assets to particular digital advice firms.

Wealthfront has at least four service offerings tied to asset levels. At $100,000, clients can opt to have a portion of their portfolio invested in Wealthfront's Risk Parity Fund. Additionally at $100,000, they gain access to a Portfolio Line of Credit for up to 25% of their account value. Between $100,000 and $500,000 of assets, Wealthfront will purchase individual stocks that are constituents of major U.S. stock index exchange-traded funds. These individual stocks can subsequently be sold if they're in a loss position to generate tax-loss benefits that wouldn't be achievable by holding an ETF of the actual index. At $500,000, Wealthfront uses a multifactor model to weight securities in the portfolio with the aim of increasing returns.

Exhibit 20 Wealthfront Clients May Increase Their Account Balances for Additional Service Offerings

Account Balance Required	Service
$100,000	Risk Parity
$100,000	Portfolio Line of Credit
$100,000 to $500,000	Stock-Level Tax-Loss Harvesting
$500,000	Smart Beta

Source: Wealthfront

Personal Capital has additional services and a decreasing fee schedule based on client account balances. Overall, as client asset levels increase, portfolios become more individualized and can include not only ETFs, but also individual stocks and bonds. Clients with more assets also gain access to more personalized financial consulting from estate attorneys, certified financial planners, and certified public accountants, who can give advice on a wider range of topics, such as college and estate planning.

Exhibit 21 Personal Capital Clients Receive Customized Investment Portfolios and Can Access More Complex Advice Services at Higher Asset Levels

Account Balance	Sample Services
<$200,000	Financial Advisory Team
	ETF Portfolio
	401k Advice
$200,000-$1,000,000	Two Personal Financial Advisors
	Individual Stocks and ETFs
	529 Planning
>$1,000,000	Individual Stocks, Individual Bonds, and ETFs
	Private Banking Services
	Estate Attorney and CPA Services

Source: Personal Capital

The fee rate that Personal Capital charges on incremental balances also decreases with more assets. For accounts with less than $1 million, the rate is 0.89%. For accounts with less than $3 million but more than $1 million, the fee rate is 0.79%. After $3 million, there is a separate fee rate on incremental balances. So, an account with $5 million in assets will be charged 0.79% on the first $3 million but only 0.69% on the next $2 million.

Exhibit 22 Higher Account Balances Can Lead to Lower Fee Rates

Account Balance	**Fee Rate**
<$1,000,000	0.89%
<$3,000,000	0.79%
$3,000,000-$5,000,000	0.69%
$5,000,000-$10,000,000	0.59%
>$10,000,000	0.49%

Source: Personal Capital

To the extent that clients move more assets to digital advice firms to gain access to these more extensive service offerings or lower fee rates, this can decrease the cost of asset acquisition for the digital advice firm. That said, the value of the larger accounts has to be weighed against the cost of the promotional offers, lower fee schedule, and cost of providing extra services.

Exhibit 23 Each Client Asset Acquisition Strategy Has Drawbacks

Strategy	**Drawback**
Advertising	Expensive
3rd PartyPartnering	Lack of Control, Economics Sharing
Cross-Sell to Existing Customers	Cannibalization
Lead Generation Product	Development and Maintenance Costs
Higher Account Balance	Various

Source: Morningstar

Robo-Advisors Need to Build for Operating Leverage

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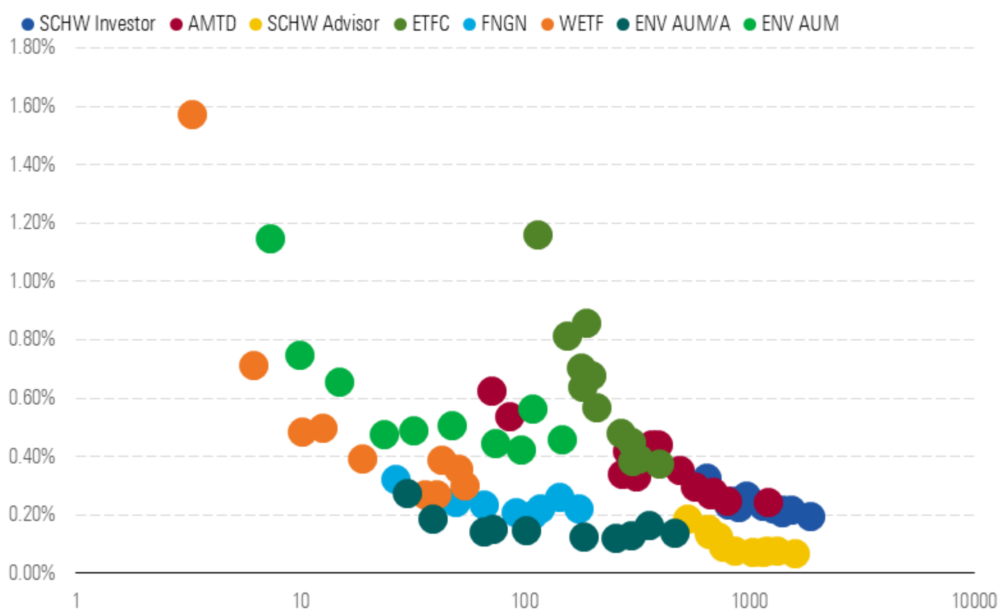
One of the primary values that digital advice firms add to society is serving individuals with account balances that are too low for most traditional wealth management firms. These low-account-balance individuals are unprofitable for traditional financial advisors under their current business model. In order for robo-advisors to profitably serve this client base, they need to bring their costs far below those of traditional wealth management firms, and the way to do that is by building for scale and achieving high operating leverage.

Looking at a group of more technology-oriented brokerage and asset management firms that we believe are reasonable proxies for robo-advisors (Charles Schwab, TD Ameritrade, E*Trade, Financial Engines, WisdomTree Investments, and Envestnet), we see there's a strong relationship between higher client assets and lower operating expenses per dollar of client assets.

Exhibit 24 Technology-Based Financial Services Firms Are Built for Scale and Exhibit Decreasing Expenses as a Percentage of Client Assets
(Operating Expense as Percentage of Client Assets; $ Billions)

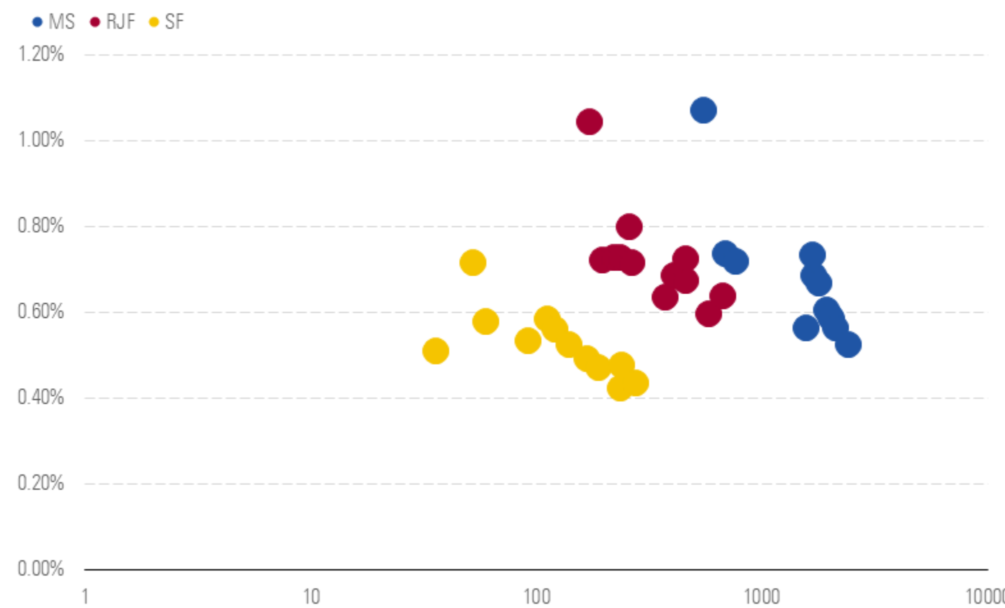


Source: Company filings, Morningstar

If we look at traditional wealth management firms, the relationship isn't nearly as strong and their expense ratio doesn't decrease nearly as quickly. For example, Morgan Stanley has over $2 trillion in assets but an expense ratio above 50 basis points. However, many technology-oriented asset management and brokerage firms reached an expense ratio below 50 basis points before they hit even $1 trillion in assets, such as Financial Engines and TD Ameritrade.

Exhibit 25 Expenses at Traditional Wealth Management Firms

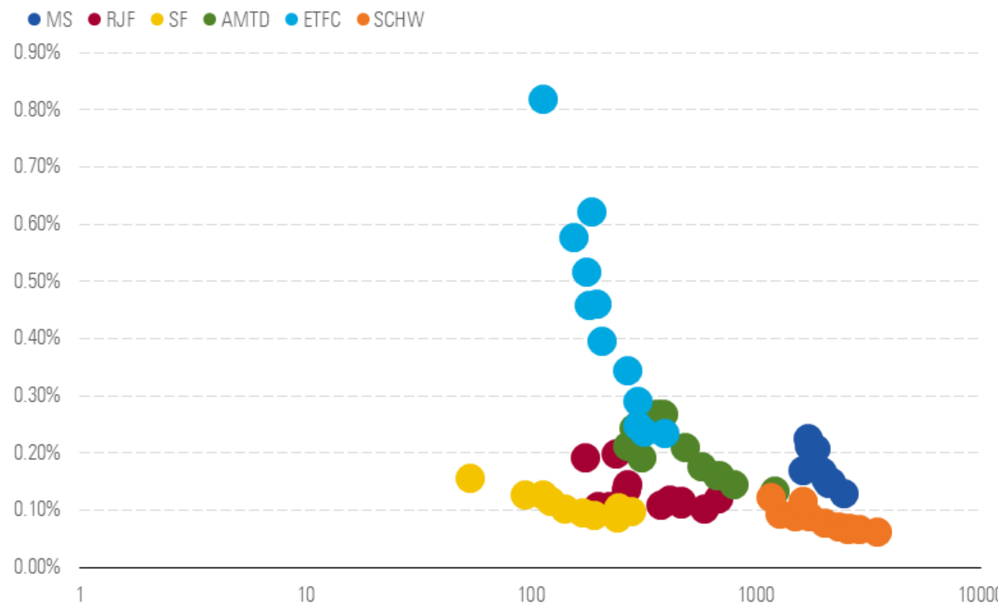
Don't Decrease Nearly as Much as Technology-Oriented Firms With Client Assets
(Operating Expense as Percentage of Client Assets; $ Billions)



Source: Company filings, Morningstar

Going one level deeper, we can separate expenses into noncompensation expenses and compensation-related expenses. The noncompensation expense/client assets ratio is relatively close for traditional wealth management firms (Morgan Stanley, Raymond James Financial, and Stifel Financial) and technology-oriented online brokerages (Charles Schwab, E*Trade, and TD Ameritrade) at around 10-20 basis points.

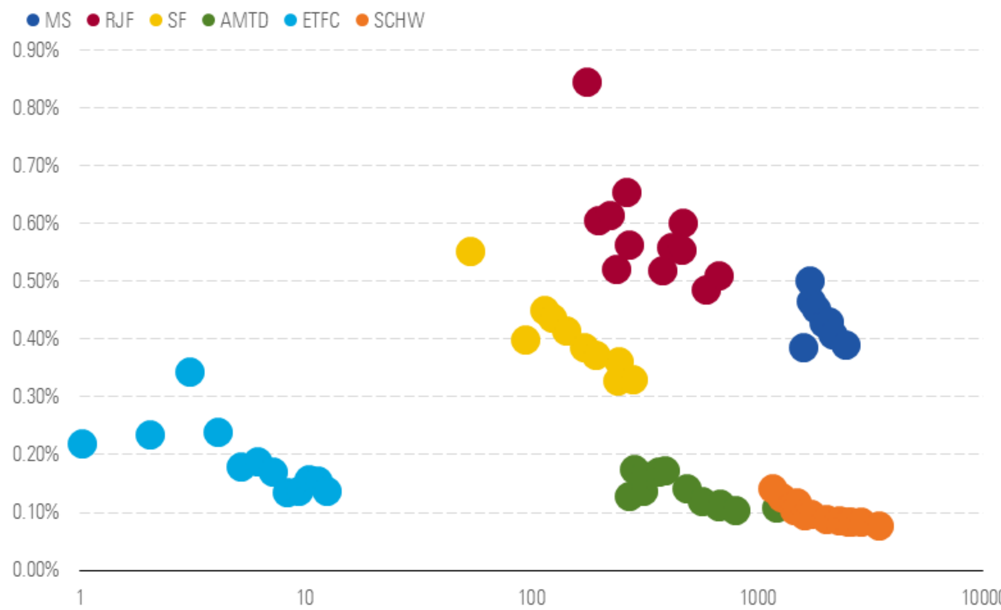
Exhibit 26 The Noncompensation Expense/Client Assets Ratio of Traditional Wealth Management Firms and Online Brokerages Is Close
(Operating Expense as Percentage of Client Assets; $ Billions)



Source: Company filings, Morningstar

The compensation/client assets ratio is where the majority of the difference between the traditional wealth management firms and online brokerages is apparent. The compensation ratio for the traditional wealth management firms has recently been 30-50 basis points, while the compensation ratio for the online brokerages is 8-20 basis points over the past several years.

Exhibit 27 Compensation Is the Largest Driver of the Expense Ratio Difference Between Traditional Wealth Management Firms and Online Brokerages
(Operating Expense as Percentage of Client Assets; $ Billions)



Source: Company filings, Morningstar

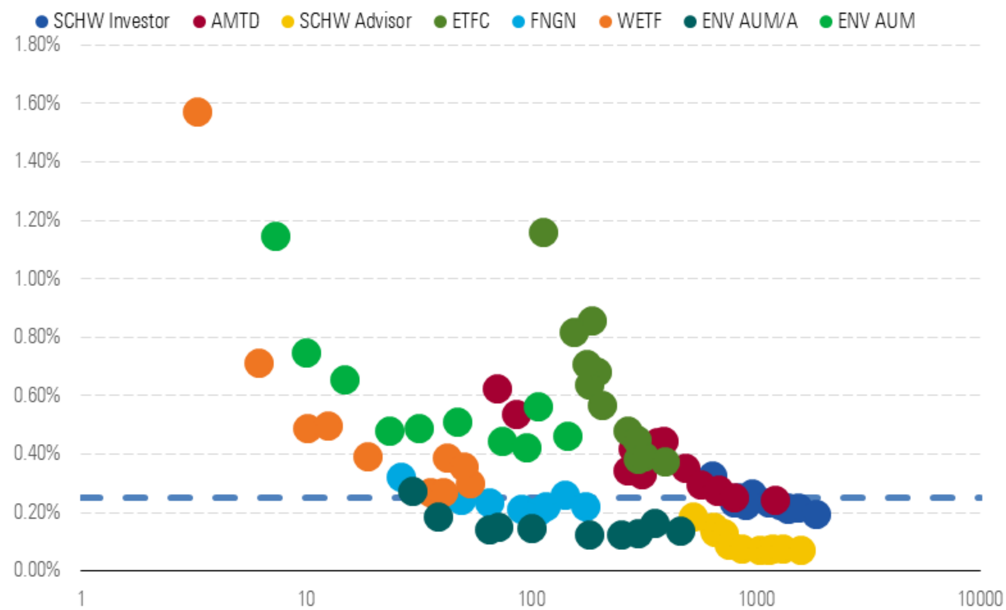
The primary reason that the compensation expense ratio for traditional wealth management firms remains relatively high is that the vast majority of financial advisors are compensated based on a percentage of the revenue that they generate for their firm. In other words, compensation expense is highly variable for traditional wealth management firms, while at technology-oriented online brokerages it is more fixed.

Completely Digital Robo-Advisors Need Sub-25-Basis-Point Expense Ratios and Likely $40 Billion of Assets to Be Profitable

The purer robo-advisors have to gain scale and achieve a total operating expense ratio of less than 25 basis points to be profitable. We use 25 basis points as the bogy, as that is where robo-advisor leaders, such as Betterment, SigFig, and Wealthfront, have set pricing for their primarily digital offerings.

In line with our previous research, the point at which some of the technology-oriented asset management and brokerage firms that we believe are reasonable comparables to robo-advisors (Envestnet, Financial Engines, and WisdomTree Investments specifically) reached a ratio of operating expenses/client assets of 25 basis points is about $40 billion.

Exhibit 28 Robo-Advisors May Need $40 Billion of Client Assets to Become Profitable at a 25-Basis-Point Fee
(Operating Expense as Percentage of Client Assets; $ Billions)



Source: Company filings, Morningstar

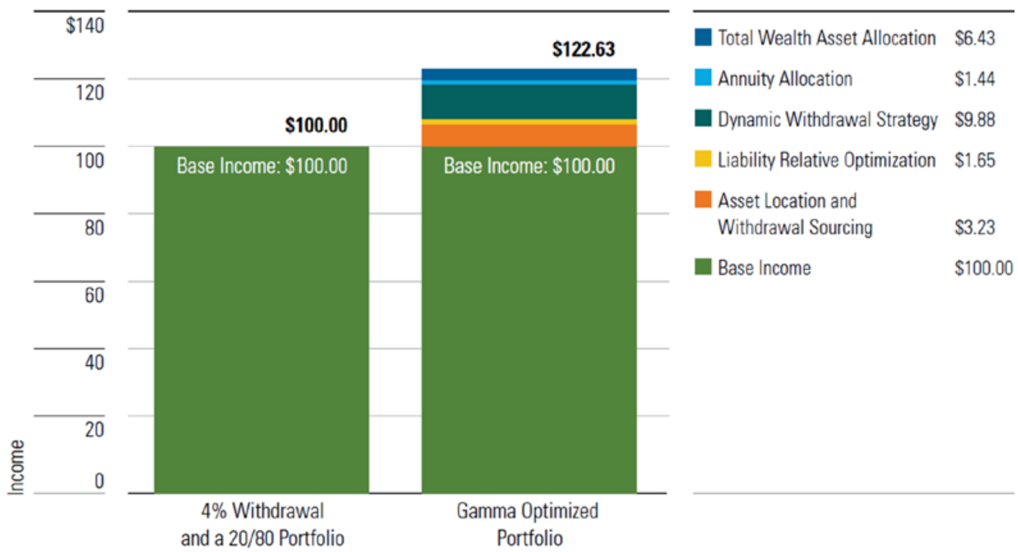
We Believe Hybrid Robo-Advisors Will Adopt a Salary Plus Bonus Compensation Plan for Their Financial Advisors to Build Operating Leverage

We believe hybrid robo-advisors or digital advice firms where human advisors can be accessed will still have to develop a cost structure closer to the technology-oriented asset management and brokerage firms than the traditional wealth management firms. They will have to achieve this higher-fixed-cost and higher-operating-leverage structure despite employing human financial advisors. We believe this likely means that financial advisors employed by hybrid robo-advisors will have to be paid on a salary plus discretionary bonus type of compensation plan and not the largely variable compensation plan that traditional wealth management firms use.

Not only is the salary plus discretionary bonus compensation plan for advisors at hybrid robo-advisors likely necessary for the business model to be profitable, it's also fair and practical to implement. This model is needed by hybrid robo-advisors because it creates the operating leverage necessary for robo-advisor firms to bring their total costs low enough to be profitable at the relatively low fee rates that they charge. For example, Vanguard's hybrid robo-advisor offering, Vanguard Personal Advisor Services, starts with a fee of 30 basis points compared with most traditional wealth management firms with a fee rate around 100 basis points.

It's fair, because the hybrid robo-advisor firm is the one that enrolled the client, collected the assets, and is making the majority of the investment decisions. We agree that financial advisors generate significant value for clients who gain from financial planning and behavioral coaching. Morningstar's head of retirement research David Blanchett, CFA, CFP, and research director Paul Kaplan, PhD, CFA, estimated that a retiree could generate 22.6% more certainty-equivalent income compared with a base case with five financial planning decisions: liability-relative investing, a dynamic withdrawal strategy, annuity allocation, total wealth asset allocation, and asset location and withdrawal sourcing in their 2013 paper "Alpha, Beta, and Now…Gamma." Blanchett and Kaplan further developed these concepts in their 2017 paper "The Value of a Gamma-Efficient Portfolio."

Exhibit 29 The Potential Benefit of Various Financial Planning Services



Source: Morningstar

However, much of the reason that financial advisors are paid on a variable compensation plan is because at the traditional wealth management firms, it's primarily the financial advisor and not the wealth management firm that invested the time and effort to acquire the client.

The salary plus bonus plan is also more practical to implement than the variable compensation plan. It would be difficult to directly attribute revenue that the robo-advisor makes to individual financial advisors. Many of the hybrid robo-advisors direct clients to a team of financial advisors. The client will often not have an ongoing, direct relationship with one financial advisor, so the client and the revenue it generates can't be attributed to any one advisor to base compensation on. Even if a client had a dedicated financial advisor, it was still the digital advice firm that expended the most effort and likely money to acquire the client.

Expanded Service Offerings and Higher Revenue Yields Underpin Our More Positive View on Robo-Advisor Profitability

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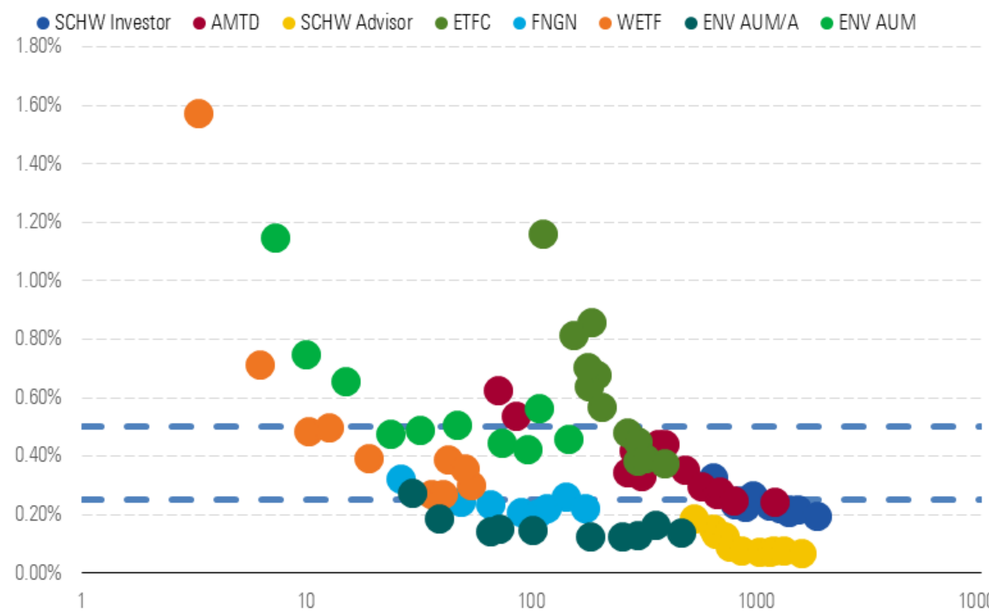
More than client acquisition or operating costs, changes on the revenue side of robo-advisor business models over the past several years have made us more optimistic that they can be profitable. While we've outlined numerous strategies that robo-advisors can implement to bring their costs down, the 25-basis-point expense ratio and likely $16 billion-$40 billion of client assets needed to reach the break-even point with the original robo-advisor business models are difficult hurdles to clear. However, by finding creative ways to increase revenue, hurdles to reach profitability are lowered and the profitability goal moves into sight for multiple robo-advisor and digital advice firms.

Our previous assessment that robo-advisors would need $16 billion-$40 billion of assets to reach break-even profitability was based on a fee rate of 25 basis points, which was then and arguably still is the most prevalent charge for pure robo-advisor services. However, this break-even client asset level is dramatically reduced for robo-advisors that can sustain higher price points.

If a robo-advisor were able to sustain a fee rate of 50 basis points instead of 25 basis points, we estimate that its client asset break-even point could be reduced by 38%-63%. Looking at our group of comparable technology-oriented asset management and brokerage firms that have reached an operating expense/client assets ratio of less than 50 basis points, WisdomTree Investments reached that point at less than $15 billion in client assets and Envestnet reached it at less than $25 billion of client assets under management. These client asset levels are substantially lower than the $40 billion where firms reached an operating expense/client assets ratio of 25 basis points.

Exhibit 30 The Break-Even Point for a Robo-Advisor That Charges 50 Basis Points Could Be 38%-63% Lower Than a Robo-Advisor That Charges 25 Basis Points
(Operating Expense as Percentage of Client Assets; $ Billions)



Source: Company filings, Morningstar

Over the past several years, we've seen four categories of revenue-enhancing strategies at robo-advisors:

- Charge more.
- Upsell clients from a pure robo-advisor offering to a hybrid digital advice offering.
- Cross-sell products and services.
- Utilize proprietary products in investment portfolios.

Charging More Is a Straightforward Strategy for Being More Profitable

While 25 basis points can be thought of as the industry standard fee because it's what Betterment and Wealthfront charge, numerous players have higher fee schedules. FutureAdvisor charges 50 basis points for its service and has a minimum account size requirement of $10,000, while Nutmeg charges 45 basis points on the first GBP 100,000 that it manages for a client and 25 basis points on amounts above that.

Exhibit 31 FutureAdvisor and Nutmeg Charge More Than the Industry 'Standard' 25 Basis Points

Firm	**Account Balance**	**Fee Rate**
FutureAdvisor	$10,000 Minimum	0.50%
Nutmeg- Fixed Allocation Portfolios	GBP 0 - GBP 100,000	0.45%
	>GBP 100,000	0.25%

Source: FutureAdvisor, Nutmeg

While Betterment and Wealthfront are still primarily charging a 25-basis-point management fee, their fee structures have changed over the past several years and can fall into the "charge more" category.

Wealthfront previously didn't charge for the first $10,000 and only charged 25 basis points on account balances above $10,000. However, for people who didn't sign up before April 1, 2018, the first $10,000 is no longer free and the company charges 25 basis points on all balances.

Exhibit 32 Wealthfront Is Charging More by No Longer Waiving Fees on the First $10,000

	Account Balance	Fee Rate
Wealthfront in 2015	$0 - $10,000	0%
	>$10,000	0.25%
Wealthfront in 2018	All Balances	0.25%

Source: Wealthfront

Given that the average account balances at robo-advisors are relatively low—approximately $40,000 at Wealthfront and $30,000 at Betterment—not waiving fees on the first $10,000 in assets would increase the revenue yield on new accounts at Wealthfront by about 33%.

Exhibit 33 Wealthfront's New Pricing Can Increase Revenue on the Average New Account by 33%

	Account Balance	Fee Rate	Fee In Dollars
Previous Pricing	$10,000	0%	$0
	$30,000	0.25%	$75
Total	$40,000	0.19%	$75
New Pricing	$40,000	0.25%	$100
Total	$40,000	0.25%	$100

Source: Wealthfront

Betterment's pricing change and its economic effect are more nuanced. The company collapsed its fee schedule and now charges 0.25% on all account balances. Previously, it charged 0.35% for accounts with less than $10,000 with an auto-deposit set up, 0.25% for accounts with $10,000-$100,000 in assets, and 0.15% for accounts over $100,000.

Exhibit 34 Betterment Collapsed Its Pricing Tiers, Which Has Interesting Offsets

	Account Balance	Fee Rate
Betterment in 2015	<$10,000	0.35%
	$10,000 - $100,000	0.25%
	>$100,000	0.15%
Betterment in 2018	All Balances	0.25%

Source: Betterment

The new pricing plan will lead to a reduction in fees charged on small-balance accounts. For a $10,000 account, fees will decrease $10, or 29%, to $25.

Exhibit 35 Betterment Will Lose a Small Amount on Each Low-Balance Account

	Account Balance	Fee Rate	Fee In Dollars
Previous Pricing	$10,000	0.35%	$35
Total	$10,000	0.35%	$35
New Pricing	$10,000	0.25%	$25
Total	$10,000	0.25%	$25
Net Gain (Loss)			($10)

Source: Betterment, Morningstar

However, Betterment will be able to offset the fees on low-balance accounts by raising fees on high-balance accounts. For a $100,000 account, fees will increase by $100, or 40%, to $250.

Exhibit 36 Increased Fees on High-Balance Accounts Can More Than Offset the Loss on Low-Balance Accounts

	Account Balance	Fee Rate	Fee In Dollars
Previous Pricing	$100,000	0.15%	$150
Total	$100,000	0.15%	$150
New Pricing	$100,000	0.25%	$250
Total	$100,000	0.25%	$250
Net Gain (Loss)			$100

Source: Betterment, Morningstar

We see the pricing change at Betterment as having two key points:

- The increase in fee for every $100,000 account can offset the fee decrease on 10 or more accounts with a balance less than $10,000.
- Increasing the fee on accounts greater than $100,000 in Betterment's digital service offering may psychologically reduce the friction in moving up to the company's premium digital advice offering.

Robo-Advisors Are Upselling Digital Advice and Cross-Selling Additional Services

Robo-advisors are increasingly segmenting their client base and providing more sophisticated financial advice or guidance to those willing to pay for it. Robo-advisors have also introduced other products and services related to portfolio management that they're now making available to their clients.

Betterment was one of the first to pivot from pure robo-advisory focused on automated portfolio construction to offering access to human advisors to help with financial planning. Betterment's premium offering has a minimum account balance of $100,000, has a 40-basis-point annual fee rate, and gives access to certified financial planners.

The 40-basis-point fee rate for Betterment's premium offering is a substantial increase in the revenue fee rate while looking like a bargain with the company's new fee structure. On a $100,000 account, a client can gain access to human financial advice for an additional 0.15%, or $150. This is relatively cheap for access to a human financial advisor from the client's perspective, as this may not even buy one hour of time with a fee-only financial planner. The $150 is also a nice boost from Betterment's perspective, as it's a 60% increase in the fee rate.

Exhibit 37 The Move to a Premium Account With Human Advice From a Digital Account Can Be Mutually Beneficial to the Client and Betterment

	Account Balance	Fee Rate	Fee In Dollars
Digital	$100,000	0.25%	$250
Premium	$100,000	0.40%	$400
Net Gain (Loss)			$150

Source: Betterment, Morningstar

It's interesting to note that Betterment rolled out its premium advice offerings at the same time that it collapsed the fee structure on its purely digital robo-advisor product. The collapse in the fee structure increased the fee rate on $100,000 accounts, which coincidently is the minimum account balance to qualify for the premium account offering, to 0.25% from 0.15%. The jump from the digital offering at 0.25% to a human advice offering at 0.4% optically seems more palatable than under the previous fee plan, where it would have been a move from 0.15% to 0.4%.

Another firm that has recently segmented its offerings is TD Ameritrade with its Essential, Selective, and Personalized Portfolios.[3] Personalized Portfolios is the firm's hybrid advice offering that gives access to financial and portfolio consultants. Personalized Portfolios comes with a fee rate that is also 2-3 times higher than the fee rate on its more digital Essential Portfolios offering.

3 Morningstar Investment Management LLC is a consultant to TD Ameritrade Investment Management

Exhibit 38 Personalized Portfolios Can Cost 2-3 Times More Than a Digital Offering

	Minimum Account Balance	Fee Rate	Sample Services
Essential Portfolios	$5,000	0.30%	Risk-based Strategic Asset Allocation
			Automatic Rebalancing
			Tax-loss Harvesting
Selective Portfolios	$25,000	0.30%-1.25%	Selective Portfolios Specialists
			Specialized Portfolios, such as Supplemental Income and Opportunistic
Personalized Portfolios	$250,000	0.60%-0.90%	Financial and Portfolio Consultants
			Customized Portfolios

Source: TD Ameritrade

Related Portfolio Services

While creating a higher-priced hybrid robo-advisor offering is quickly becoming a de facto offering, other revenue-enhancing products and services haven't been as widely adopted.

Nutmeg has its fully managed portfolios offering in addition to its fixed-allocation portfolios. Fully managed portfolios cost 75 basis points, 30 basis points more than the fixed-allocation portfolio offering, on the first GBP 100,000. On amounts greater than GBP 100,000, the fee rate is 35 basis points, 10 basis points higher than the fixed-allocation portfolios.

Exhibit 39 Nutmeg Charges More For Human-Initiated Tactical Portfolio Shifts

Firm	Account Balance	Fee Rate
Fixed Allocation Portfolios	GBP 0 - GBP 100,000	0.45%
	>GBP 100,000	0.25%
Fully Managed Portfolios	GBP 0 - GBP 100,000	0.75%
	>GBP 100,000	0.35%

Source: Nutmeg

The primary difference between the fully managed and fixed-allocation portfolios is that fully managed has humans making tactical shifts in the portfolio allocation. Examples given by Nutmeg include defensive portfolio changes made for the Scottish referendum and Brexit vote.

Wealthfront has introduced a product that has been trending at wealth management firms: its Portfolio Line of Credit. For accounts that have at least a $100,000 balance, up to 25% of the value of the account can be borrowed. The rate as of June 4, 2018, is 4.05%-5.30% on borrowed amounts.

Exhibit 40 Wealthfront Has Jumped on the Bandwagon of Loans Backed by an Investment Portfolio

	Account Balance	Interest Rate
Portfolio Line of Credit	$100,000 - $499,999	Fed Funds Rate +3.60%
	$500,000 - $999,999	Fed Funds Rate +2.85%
	>$1,000,000	Fed Funds Rate +2.35%

Source: Wealthfront

The revenue opportunity on accounts that use the Portfolio Line of Credit is substantial. The revenue yield for an account can increase to a total of 1.58% compared with a base management fee of 0.25%.

Exhibit 41 Loans Can Supercharge an Account's Revenue Yield

	Account Balance	Rate	Fee In Dollars
Management Fee	$100,000	0.25%	$250
Portfolio Line of Credit	*$25,000	5.30%	$1,325
Total	$100,000	1.58%	$1,575

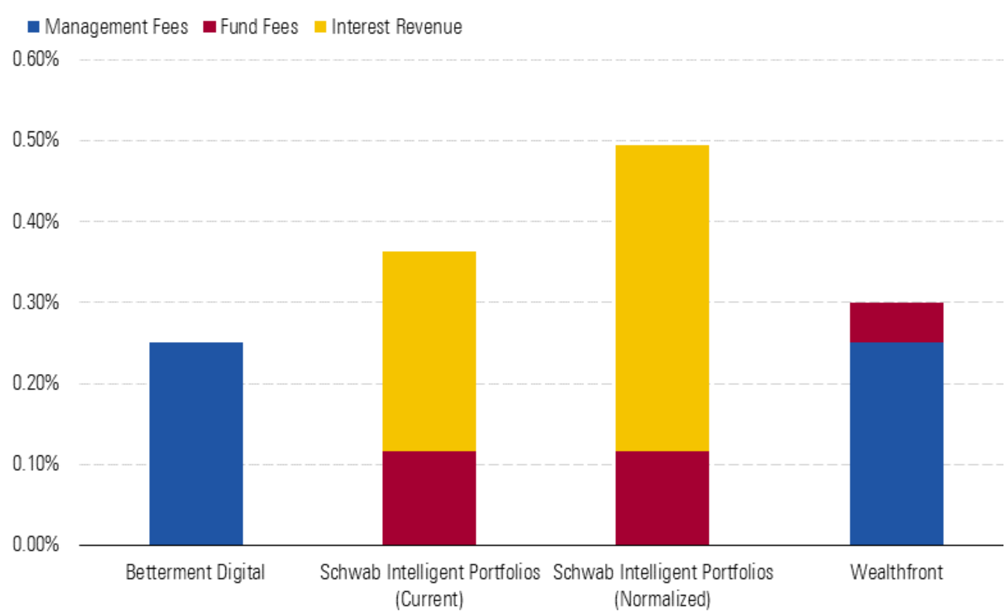
Source: Wealthfront, Morningstar

Judicious Use of Proprietary Products in Portfolios Demonstrates Asset Manager Synergies

There is a natural synergy in combining robo-advisors and asset management product manufacturers, as robo-advisors can serve as product distribution channels. The recognition of this synergy is probably why financial product manufacturers such as BlackRock, Charles Schwab, Invesco, and Vanguard were relatively early to acquire or develop their own robo-advisors compared with banks and wealth management firms.

Comparing three service offerings from Betterment, Charles Schwab, and Wealthfront, we can see material differences in their revenue composition and revenue yields.

Exhibit 42 Proprietary Products Can Drastically Change Revenue Composition and Yields
(Revenue as Percentage of Client Assets)



Source: Betterment, Morningstar, Charles Schwab, Wealthfront
Schwab Intelligent Portfolios revenue yield estimate is based on a moderate-risk portfolio

Betterment with its digital service only charges a 25-basis-point management fee. To our knowledge, Betterment doesn't use any proprietary products or receive any material revenue share from financial product providers.

We estimate that Charles Schwab's moderate asset allocation portfolio in Schwab Intelligent Portfolios currently has a total revenue yield of approximately 36 basis points. Of the 36 basis points, we believe approximately 12 basis points comes from Schwab proprietary funds or revenue-sharing agreements with other asset managers and 24 basis points is from net interest income from the portfolio's cash allocation that is deposited in Charles Schwab's bank subsidiary. In a normalized interest rate environment, we believe the revenue yield on the moderate portfolio will rise to 49 basis points as the contribution from net interest income increases.

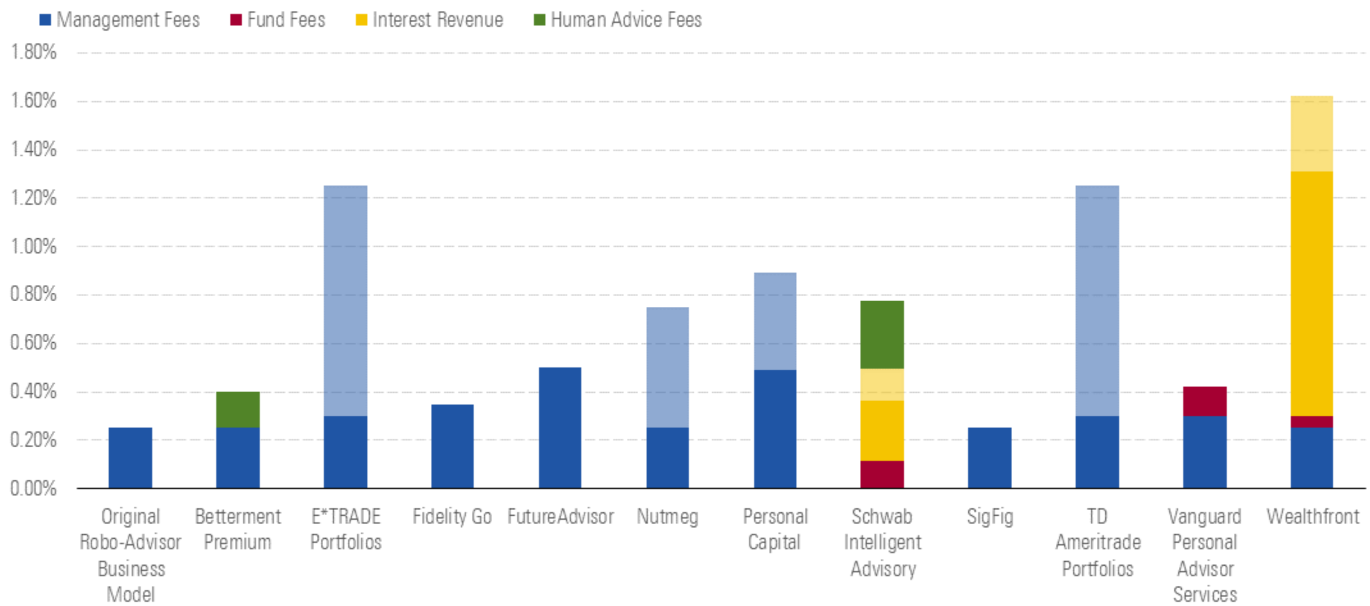
In February 2018, Wealthfront introduced a Risk Parity Fund with an expense ratio of 25 basis points that can be used in accounts with a balance of $100,000 or more. At most, a Wealthfront portfolio can have a 20% allocation to the fund. This means that a portfolio with the maximum allocation to the Risk Parity Fund will garner Wealthfront the general management fee of 25 basis points and an additional 5 basis points (20% allocation x 25 basis points Risk Parity Fund expense ratio) from the Risk Parity Fund for a total revenue yield of 30 basis points.

Proprietary products in investment portfolios can increase revenue but can also be controversial. Many articles have been written about the cash allocation and potential cash drag in Schwab Intelligent Portfolios. Our general take is that cash is a safe asset, it's uncorrelated to other assets, clients are being paid interest on their cash balances, and there's not much difference between the cash allocation in Schwab's portfolios and cashlike substitutes in other firms' portfolios, such as Treasury Inflation-Protected Securities or U.S. short-term Treasury bonds. Wealthfront was also in the headlines for opting customers into its Risk Parity Fund, which had a 50-basis-point expense ratio when it was introduced. Eventually, Wealthfront chose to reduce the expense ratio on its Risk Parity Fund to 25 basis points.

Illuminating the Path to Profitability

While we continue to believe the original robo-advisor business model with a 25-basis-point fee is like walking on the edge of a cliff, robo-advisor and digital advice firms that decrease their cost of acquiring client assets, generate operating leverage, and maintain higher revenue yields are solidly on the path to profitability.

Exhibit 43 New Business Models Are Transforming Robo-Advisors Into Moneymaking Machines
(Revenue as Percentage of Client Assets)



Source: Betterment, Charles Schwab, E*Trade, Fidelity, FutureAdvisor, Morningstar, Nutmeg, Personal Capital, SigFig, TD Ameritrade, Vanguard, Wealthfront
Schwab Intelligent Advisory revenue yield estimate is based on the asset allocation of a moderate-risk Schwab Intelligent Portfolio
Wealthfront revenue yield assumes maximum use of Portfolio Line of Credit

Morningstar Equity Research 31 May 2018

Invesco (IVZ)

★★★★★

Last Price	Fair Value	Uncertainty	Stewardship	Economic Moat	Moat Trend	Morningstar Credit Rating
27.53 USD	40 USD	Medium	Standard	Narrow	Positive	N/A

Analyst	Gregg Warren, CFA
Phone & Email	312-384-4015
greggory.warren@morningstar.com	
Sector	Financial Services
Industry	Asset Management

Five-Star Price	28.00
Fair Value Estimate	40.00
One-Star Price	54.00
Market Price	27.53
P / FVE	0.69

Estimated COE	9.0%
Pre-Tax Cost of Debt	5.8%
Estimated WACC	8.5%
ROIC *	11.8%
Adjusted ROIC *	41.3%

* 5-Yr Projected Average

Adjusted P / E	9.9	14.3
EV / Adjusted EBITDA	7.2	10.6
EV / Sales	1.9	2.8
Price / Book	1.2	1.7
FCF Yield	11.2%	7.7%
Dividend Yield	4.3%	3.0%
(2018 Estimates)	(Price)	(Fair Value)

All values (except per share amounts) in: USD Millions	3-Yr Historical CAGR/AV	2017	Forecast 2018	2019	2020	2021	2022	5-Yr Projected CAGR/AVG
Income Statement								
Revenue		5,160	5,451	5,664	5,621	5,667	5,952	
Gross Profit		5,160	5,451	5,664	5,621	5,667	5,952	
Operating Income		1,277	1,358	1,461	1,440	1,520	1,606	
Net Income		1,127	1,128	1,202	1,202	1,256	1,342	
Adjusted Income		1,107	1,128	1,202	1,202	1,256	1,342	
Adjusted EPS		2.70	2.79	3.04	3.10	3.31	3.61	
Adjusted EBITDA		1,767	1,459	1,558	1,532	1,611	1,699	
Growth (% YoY)								
Revenue	0.1%	9.0%	5.6%	3.9%	-0.8%	0.8%	5.0%	2.9%
Gross Profit	0.1%	9.0%	5.6%	3.9%	-0.8%	0.8%	5.0%	2.9%
Operating Income	-1.1%	8.6%	6.3%	7.6%	-1.4%	5.5%	5.7%	4.7%
Net Income	4.5%	32.0%	0.0%	6.6%	-0.0%	4.5%	6.8%	3.5%
Adjusted EPS	2.5%	21.3%	3.5%	8.6%	2.0%	6.8%	9.2%	6.0%
Adjusted EBITDA	2.1%	13.3%	-17.4%	6.8%	-1.6%	5.2%	5.4%	-0.8%
Profitability (%)								
Gross Margin	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
Operating Margin	25.4%	24.7%	24.9%	25.8%	25.6%	26.8%	27.0%	26.0%
Net Margin	19.6%	21.8%	20.7%	21.2%	21.4%	22.2%	22.5%	21.6%
Adjusted EBITDA Margin	33.6%	34.2%	26.8%	27.5%	27.3%	28.4%	28.5%	27.7%
Return on Equity	12.3%	13.9%	12.5%	12.4%	11.7%	11.6%	11.8%	12.0%
Adjusted ROIC	87.3%	86.5%	55.0%	44.5%	38.0%	35.6%	33.4%	41.3%
Adjusted RONIC	25.9%	186.9%	-25.2%	17.8%	-5.1%	15.7%	15.0%	3.7%
Leverage								
Debt / Capital	20.7%	19.3%	18.3%	22.5%	21.6%	20.7%	19.9%	20.6%
Debt / EBITDA	1.5	1.5	1.4	1.9	1.9	1.8	1.7	1.7
EBITDA / Interest Expense	15.4	14.7	12.6	13.5	13.3	14.0	14.7	13.6
FCFE / Total Debt	0.36	0.58	0.59	0.42	0.43	0.44	0.46	0.47
Cash Flow								
Dividends per Share		1.15	1.19	1.27	1.36	1.46	1.57	
Free Cash Flow to the Firm		86	(338)	876	891	939	967	
FCFE (CFO-Capex)		1,196	1,239	1,214	1,252	1,280	1,343	
Dividend Franking		0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	
Dividend Payout Ratio		41.8%	42.6%	41.7%	44.0%	44.3%	43.6%	

Credit Suisse Group (CS)

Market Cap: $38.97B | Sector: Financial Services | Industry: Banks | Stewardship: Standard

Five-Star Price	$ 13.80	Economic Moat	Narrow	Multiples (2018 Estimates)	
Fair Value Estimate	$ 23.00	Moat Trend	Stable	Price/Earnings (2018)	15.22
One-Star Price	$ 35.65	Uncertainty	High	Price/Book	1.27
				Price/Tangible Book	1.45
Market Price	$ 15.58	Estimated COE	10.00%		
Price/Fair Value Estimate	0.68				
Morningstar Credit Rating	NA				

FY Ends: December

	3-Yr Historical CAGR/AVG	2015	2016	2017	*Forecast* 2018	2019	2020	2021	2022	5-Yr Projected CAGR/AVG
All values (except per share amounts) in millions										
Income Statement										
Revenue (net of Provisions)		23,473	20,071	20,690	22,390	22,915	23,911	24,957	26,045	
Net Interest Income		9,299	7,562	6,557	6,895	7,150	7,436	7,734	8,043	
Operating Income		(2,422)	(2,266)	1,300	4,752	5,560	6,320	6,901	7,502	
Net Income		(2,944)	(2,710)	(1,476)	3,707	4,281	4,867	5,313	5,777	
Adjusted EPS		(1.75)	(1.27)	(0.61)	1.45	1.68	1.91	2.08	2.27	
Growth										
Revenue (net of Provisions)	-4.1%	-9.9%	-14.5%	3.1%	8.2%	2.3%	4.3%	4.4%	4.4%	5.5%
Net Interest Income	-11.0%	2.9%	-18.7%	-13.3%	5.2%	3.7%	4.0%	4.0%	4.0%	2.6%
Operating Income	-181.3%	-	-6.4%	-157.4%	265.6%	17.0%	13.7%	9.2%	8.7%	-
Net Income	-20.6%	-266.0%	-7.9%	-45.5%	-351.1%	15.5%	13.7%	9.2%	8.7%	31.1%
Adjusted EPS	-29.6%	-256.8%	-27.7%	-51.8%	-337.7%	15.5%	13.7%	9.2%	8.7%	30.2%
Profitability										
Net Interest Margin (NIMs)	1.2%	1.3%	1.2%	1.0%	1.1%	1.1%	1.1%	1.1%	1.1%	1.1%
Efficiency Ratio	98.5%	92.9%	109.9%	92.8%	78.4%	74.8%	72.6%	71.5%	70.4%	69.1%
Net Margin	-11.1%	-12.5%	-13.5%	-7.1%	16.6%	18.7%	20.4%	21.3%	22.2%	
ROA	-0.3%	-0.3%	-0.3%	-0.2%	0.5%	0.5%	0.6%	0.6%	0.6%	0.6%
ROE	-5.5%	-6.7%	-6.3%	-3.5%	8.8%	9.8%	10.7%	11.1%	11.6%	11.8%
ROIC	2.4%	2.4%	-2.7%	7.6%	5.4%	6.3%	6.9%	7.3%	7.8%	9.8%
Leverage										
Tangible Equity/Tangible Asse	4.7%	4.8%	4.5%	4.7%	4.7%	4.7%	4.8%	4.9%	4.9%	

UBS (UBS)

Market Cap: $58.73B | Sector: Financial Services | Industry: Banks | Stewardship: Exemplary

Five-Star Price	$ 12.60	Economic Moat	Narrow		Multiples (2018 Estimates)	
Fair Value Estimate	$ 21.00	Moat Trend	Stable		Price/Earnings (2018)	13.77
One-Star Price	$ 32.55	Uncertainty	High		Price/Book	1.49
					Price/Tangible Book	1.71
Market Price	$ 15.48	Estimated COE	10.00%			
Price/Fair Value Estimate	0.74					
Morningstar Credit Rating	NA					

FY Ends: December

	3-Yr Historical CAGR/AVG	2015	2016	2017	*Forecast* 2018	2019	2020	2021	2022	5-Yr Projected CAGR/AVG
All values (except per share amounts) in millions										
Income Statement										
Revenue (net of Provisions)		30,604	28,320	29,067	31,005	32,287	33,850	35,198	36,721	
Net Interest Income		6,732	6,413	6,528	6,218	6,775	7,043	7,752	8,059	
Operating Income		5,489	4,090	5,267	6,856	8,073	9,080	9,668	10,089	
Net Income		6,204	3,203	3,917	5,437	6,168	6,942	7,393	7,715	
Adjusted EPS		1.64	0.84	1.02	1.45	1.63	1.81	1.92	2.01	
Growth										
Revenue (net of Provisions)	-1.7%	9.2%	-7.5%	2.6%	6.7%	4.1%	4.8%	4.0%	4.3%	5.5%
Net Interest Income	-1.0%	2.7%	-4.7%	1.8%	-4.8%	9.0%	4.0%	10.1%	4.0%	2.6%
Operating Income	-1.4%	-	-25.5%	28.8%	30.2%	17.8%	12.5%	6.5%	4.3%	-
Net Income	-14.2%	79.0%	-48.4%	22.3%	38.8%	13.4%	12.5%	6.5%	4.4%	31.1%
Adjusted EPS	-14.6%	80.1%	-48.9%	21.9%	41.7%	12.3%	11.2%	6.5%	4.4%	30.2%
Profitability										
Net Interest Margin (NIMs)	0.8%	0.9%	0.8%	0.8%	0.8%	0.9%	0.9%	0.9%	0.9%	0.9%
Efficiency Ratio	82.6%	81.4%	85.1%	81.3%	77.4%	74.5%	72.7%	71.0%	71.0%	69.1%
Net Margin	15.0%	20.3%	11.3%	13.5%	17.5%	19.1%	20.5%	21.0%	21.0%	
ROA	0.5%	0.6%	0.3%	0.4%	0.6%	0.7%	0.7%	0.7%	0.7%	0.6%
ROE	8.4%	11.7%	5.9%	7.5%	10.5%	11.5%	12.4%	12.6%	12.7%	11.8%
ROIC	12.0%	9.6%	9.5%	17.0%	13.6%	13.5%	13.4%	13.0%	12.8%	9.8%
Leverage										
Tangible Equity/Tangible Asse	5.1%	5.2%	5.1%	4.9%	5.1%	5.1%	5.2%	5.2%	5.2%	

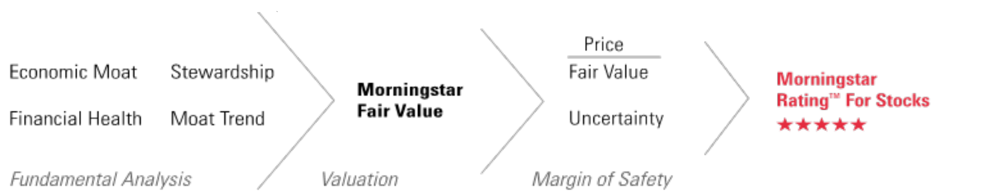
Research Methodology for Valuing Companies

Overview

At the heart of our valuation system is a detailed projection of a company's future cash flows, resulting from our analysts' research. Analysts create custom industry and company assumptions to feed income statement, balance sheet, and capital investment assumptions into our globally standardized, proprietary discounted cash flow, or DCF, modeling templates. We use scenario analysis, in-depth competitive advantage analysis, and a variety of other analytical tools to augment this process. Moreover, we think analyzing valuation through discounted cash flows presents a better lens for viewing cyclical companies, high-growth firms, businesses with finite lives (e.g., mines), or companies expected to generate negative earnings over the next few years. That said, we don't dismiss multiples altogether but rather use them as supporting cross-checks for our DCF-based fair value estimates. We also acknowledge that DCF models offer their own challenges (including a potential proliferation of estimated inputs and the possibility that the method may miss short-term market price movements), but we believe these negatives are mitigated by deep analysis and our long-term approach.

Morningstar's equity research group ("we," "our") believes that a company's intrinsic worth results from the future cash flows it can generate. The Morningstar Rating for stocks identifies stocks trading at a discount or premium to their intrinsic worth—or fair value estimate, in Morningstar terminology. Five-star stocks sell for the biggest risk-adjusted discount to their fair values, whereas 1-star stocks trade at premiums to their intrinsic worth.

Morningstar Research Methodology



Source: Morningstar.

Four key components drive the Morningstar rating: (1) our assessment of the firm's economic moat, (2) our estimate of the stock's fair value, (3) our uncertainty around that fair value estimate, and (4) the current market price. This process ultimately culminates in our single-point star rating.

Economic Moat

The concept of an economic moat plays a vital role not only in our qualitative assessment of a firm's long-term investment potential, but also in the actual calculation of our fair value estimates. An economic moat is a structural feature that allows a firm to sustain excess profits over a long period of time. We define economic profits as returns on invested capital (ROIC) over and above our estimate of a firm's cost of capital, or weighted average cost of capital (WACC). Without a moat, profits are more susceptible to competition. We have identified five sources of economic moats: intangible assets, switching costs, network effect, cost advantage, and efficient scale.

Companies with a narrow moat are those we believe are more likely than not to achieve normalized excess returns for at least the next 10 years. Wide-moat companies are those in which we have very high confidence that excess returns will remain for 10 years, with excess returns more likely than not to remain for at least 20 years. The longer a firm generates economic profits, the higher its intrinsic value. We believe low-quality, no-moat companies will see their normalized returns gravitate toward their cost of capital more quickly than companies with moats.

To assess the sustainability of excess profits, analysts perform ongoing assessments of the moat trend. A firm's moat trend is positive in cases where we think its sources of competitive advantage are growing stronger, stable where we don't anticipate changes to competitive advantages over the next several years, or negative where we see signs of deterioration.

Estimated Fair Value

Combining our analysts' financial forecasts with the firm's economic moat helps us assess how long returns on invested capital are likely to exceed the firm's cost of capital. Returns of firms with a wide economic moat rating are assumed to fade to the perpetuity period over a longer period of time than the returns of narrow-moat firms, and both will fade slower than no-moat firms, increasing our estimate of their intrinsic value.

Our model is divided into three distinct stages:

Stage I: Explicit Forecast

In this stage, which can last 5 to 10 years, analysts make full financial statement forecasts, including items such as revenue, profit margins, tax rates, changes in working capital accounts, and capital spending. Based on these projections, we calculate earnings before interest, after taxes (EBI) and net new investment (NNI) to derive our annual free cash flow forecast.

Stage II: Fade

The second stage of our model is the period it will take the company's return on new invested capital—the return on capital of the next dollar invested (RONIC)—to decline (or rise) to its cost of capital. During the Stage II period, we use a formula to approximate cash flows in lieu of explicitly modeling the income statement, balance sheet, and cash flow statement as we do in Stage I. The length of the second stage depends on the strength of the company's economic moat. We forecast this period to last anywhere from one year (for companies with no economic moat) to 10–15 years or more (for wide-moat companies). During this period, cash flows are forecast using four assumptions: an average growth rate for EBI over the period, a normalized investment rate, average return on new invested capital (RONIC), and the number of years until perpetuity, when excess returns cease. The investment rate and return on new invested capital decline until a perpetuity value is calculated. In the case of firms that do not earn their cost of capital, we assume marginal ROICs rise to the firm's cost of capital (usually attributable to less reinvestment), and we may truncate the second stage.

Stage III: Perpetuity

Once a company's marginal ROIC hits its cost of capital, we calculate a continuing value, using a standard perpetuity formula. At perpetuity, we assume that any growth or decline or investment in the business neither creates nor destroys value and that any new investment provides a return in line with estimated WACC.

Because a dollar earned today is worth more than a dollar earned tomorrow, we discount our projections of cash flows in stages I, II, and III to arrive at a total present value of expected future cash flows. Because we are modeling free cash flow to the firm—representing cash available to provide a return to all capital providers—we discount future cash flows using the WACC, which is a weighted average of the costs of equity, debt, and preferred stock (and any other funding sources), using expected future proportionate long-term, market value weights.

Uncertainty Around That Fair Value Estimate

Morningstar's uncertainty rating captures a range of likely potential intrinsic values for a company and uses it to assign the margin of safety required before investing, which in turn explicitly drives our stock star rating system. The uncertainty rating represents the analysts' ability to bound the estimated value of the shares in a company around the fair value estimate, based on the characteristics of the business underlying the stock, including operating and financial leverage, sales sensitivity to the overall economy, product concentration, pricing power, and other company-specific factors.

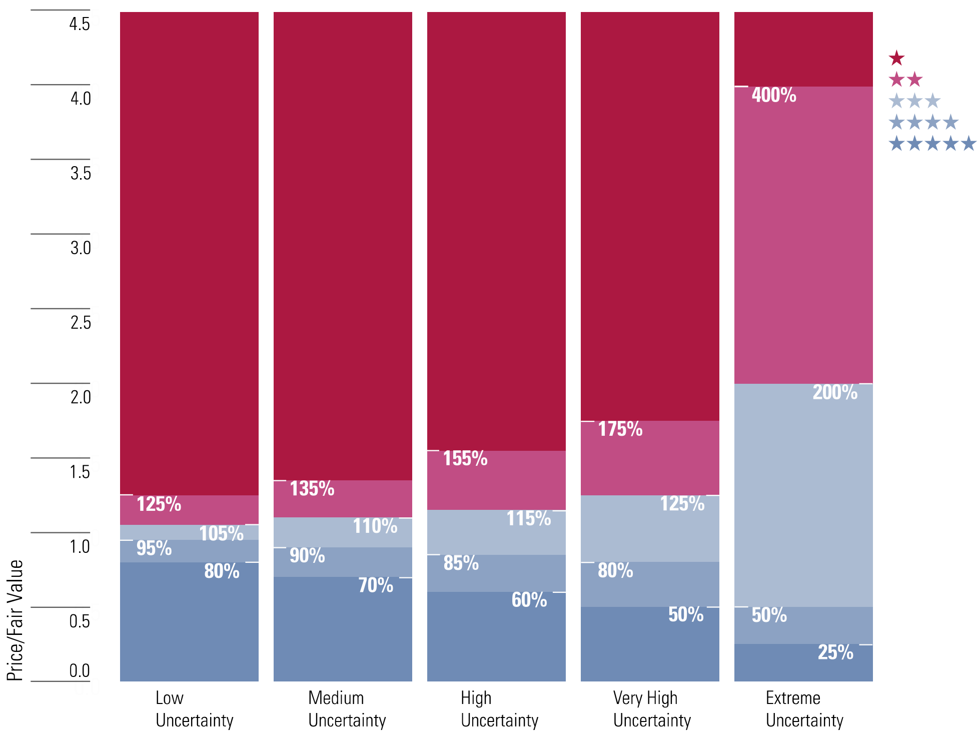
Analysts consider at least two scenarios in addition to their base case: a bull case and a bear case. Assumptions are chosen such that the analyst believes there is a 25% probability that the company will perform better than the bull case and a 25% probability that the company will perform worse than the bear case. The distance between the bull and bear cases is an important indicator of the uncertainty underlying the fair value estimate.

Our recommended margin of safety widens as our uncertainty regarding the estimated value of the equity increases. The more uncertain we are about the estimated value of the equity, the greater the discount we require relative to our estimate of the value of the firm before we would recommend the purchase of the shares. In addition, the uncertainty rating provides guidance in portfolio construction based on risk tolerance.

Our uncertainty ratings for our qualitative analysis are low, medium, high, very high, and extreme.

- Low: Margin of safety for 5-star rating is a 20% discount and for 1-star rating is a 25% premium.
- Medium: Margin of safety for 5-star rating is a 30% discount and for 1-star rating is a 35% premium.
- High: Margin of safety for 5-star rating is a 40% discount and for 1-star rating is a 55% premium.
- Very high: Margin of safety for 5-star rating is a 50% discount and for 1-star rating is a 75% premium.
- Extreme: Margin of safety for 5-star rating is a 75% discount and for 1-star rating is a 300% premium.

Morningstar Equity Research Star Rating Methodology



Market Price

The market prices used in this analysis and noted in the report come from the exchange on which the stock is listed, which we believe is a reliable source.

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Once we determine the fair value estimate of a stock, we compare it with the stock's current market price on a daily basis, and the star rating is automatically recalculated at the market close on every day the market on which the stock is listed is open. Our analysts keep close tabs on the companies they follow and, based on thorough and ongoing analysis, raise or lower their fair value estimates as warranted.

Please note, there is no predefined distribution of stars. That is, the percentage of stocks that earn 5 stars can fluctuate daily, so the star ratings, in the aggregate, can serve as a gauge of the broader market's valuation. When there are many 5-star stocks, the stock market as a whole is more undervalued, in our opinion, than when very few companies garner our highest rating.

We expect that if our base-case assumptions are true, the market price will converge on our fair value estimate over time, generally within three years (although it is impossible to predict the exact time frame in which market prices may adjust).

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★★★★★ We believe appreciation beyond a fair risk-adjusted return is highly likely over a multiyear time frame. Scenario analysis developed by our analysts indicates that the current market price represents an excessively pessimistic outlook, limiting downside risk and maximizing upside potential.

★★★★ We believe appreciation beyond a fair risk-adjusted return is likely.

★★★ Indicates our belief that investors are likely to receive a fair risk-adjusted return (approximately cost of equity).

★★ We believe investors are likely to receive a less than fair risk-adjusted return.

★ Indicates a high probability of undesirable risk-adjusted returns from the current market price over a multiyear time frame, based on our analysis. Scenario analysis by our analysts indicates that the market is pricing in an excessively optimistic outlook, limiting upside potential and leaving the investor exposed to capital loss.

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