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Behavioral Finance, Decumulation, and the Regulatory Strategy for Robo-Advice

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This working paper surveys the decumulation services offered by investment robo-advisors as a case study with which to examine regulatory and market structure issues raised by automated financial advice. Based on this case study, we reach two provisional conclusions. First, the principles-based regulatory approach of the Investment Advisers Act of 1940 appears adequate and sufficiently flexible to address the new issues raised by automation, at least for now. Second, there is a pressing need to develop new mechanisms for encouraging investment robo-advisors (and financial advisors generally) to provide high quality decumulation services to their customers, because neither of the two prevailing compensation approaches – assets under management and commissions – provides sufficient incentive at present, and consumers are poorly equipped to evaluate the quality of decumulation services on their own.

After introducing investment robo-advisors, we provide a short introduction to decumulation, describing some of the uncertainties involved in identifying optimal decumulation strategies and sketching a few of the 'rules of thumb' that financial advisors have developed in this area in the face of this uncertainty. Next we describe behavioral effects that could inhibit consumers from following an optimal decumulation strategy, concluding that, left to their own devices, consumers are likely to make sub-optimal decumulation decisions. Then we describe some potentially useful automated decumulation services that are available on the market and present the results of a survey assessing whether those services are offered by investment robo-advisors. Finally, we discuss market structures that may inhibit financial advisors from implementing optimal decumulation strategies for their clients and explore whether there are regulatory strategies that could encourage financial advisors to provide better decumulation

services. Two promising strategies are (1) adopting a record-keeping requirement for robo-advisors that is conceptually similar to the 'black box' requirement for commercial airlines, and (2) developing a set of robo-advice 'do's and don'ts' and related input/output tests to confirm that these requirements are met.

Investment Robo-Advisors

We define a 'robo-advisor' as an automated service that ranks or matches consumers to financial products on a personalized basis. In the popular press and the financial planning community, the term 'robo-advisor' is most often used to refer to automated investment services that assemble and manage an investment portfolio for consumers. The technology, organizational structure, marketing, and many other aspects of investment robo-advising present a common set of public policy issues across the financial services sector (Baker and Dellaert 2018). In the present working paper, we focus on investment robo-advisors, but some of the conclusions we draw also have application in the insurance and banking contexts.

The intellectual history of investment robo-advice begins with modern portfolio theory (Lam 2016), which provided a mathematically-based and empirically-tested method for constructing and maintaining a passive investment portfolio on an automated basis. The resulting automated tools could create portfolios, rebalance and otherwise modify them, and (for taxable accounts) engage in tax loss harvesting. The modern asset management industry makes these tools available to consumers in a variety of ways. In the robo context, media attention has focused on the fully-automated, consumer-facing systems pioneered by companies like Betterment and Wealthfront, and on the 'hybrid robos' offered by established asset managers like Vanguard and Schwab (the latter of which provides investors with access to human financial advisors in addition

to direct access to automated services). Nevertheless, traditional registered investment advisors also use automated tools to construct and maintain portfolios for their clients on a behind-the-scenes basis (FINRA 2016, SEC 2017). Additionally, the increasingly-popular target date funds (TDFs) typically are 'funds of funds' that use an algorithmic approach to portfolio management that could also be considered an investment robo-advisor. Whether accessed directly or indirectly, these robo-advisors have the potential to provide quality investment services at a lower cost than traditional financial advising services (Lam 2016, Baker, and Dellaert 2018).

Accumulation and Decumulation

Modern portfolio theory and passive investing strategies have become increasingly important to the asset *accumulation* phase of life cycle investing, ever since the historic shift to defined contribution (DC) retirement plans in the United States and elsewhere (Zelinsky 2012, Baker and Simon 2002). This shift to passive investing did not occur overnight, but it is now widespread in financial markets. Eventually, the shift may produce opportunities for active investing that will slow, and then halt, the increase in the share of assets under management in passive funds. But even then, finance theory and empirical research on market performance and investing behavior will continue to play a significant role in helping individuals manage the investment risk aspects of their DC retirement plans. One among many reasons is that theory and research produce the investment strategies programmed into investment robo-advisors.[1]

Finance theory and empirical research have had less of an impact in helping individuals manage longevity risk or in managing other aspects of the *decumulation* phase of lifecycle investing. Although retirement research has contributed significantly to our understanding of the 'annuity puzzle' (Benartzi et al. 2011, Yaari 1965), these and other insights have not yet influenced

decumulation advice comparable with the influence of finance theory and research on accumulation. For example, despite repeated demonstrations of the theoretical benefits of annuitization, only a very small share (under 9%) of private US retirement assets are in annuity reserves (Salisbury and Nenkov 2016).

This lack of influence may be attributable to the fact that researchers have begun focusing on the decumulation phase of the life cycle only relatively recently (e.g. Mitchell and Moore 1997). Prior to the shift from defined benefit to DC retirement plans, decumulation (or the avoidance thereof) was largely of concern to the wealthy and, thus, of primary interest to the wealth management industry, but not to retirement researchers or the social welfare policy community. In the absence of authoritative guidance from the research community, financial planning professionals have yet to reach as much consensus regarding decumulation strategies that they have reached regarding accumulation strategies.

Providing decumulation advice involves guiding clients through numerous complex decisions including:

(1) Whether client assets should be annuitized and, if so, in what forms and when;

(2) Assessing the potential exposures to uncertain, unavoidable costs such as health care expenses, and the risk management strategies that exist to address them;

(3) How much money can be withdrawn from the available assets each year without unduly exposing people to the risk of outliving their assets; and

(4) The order in which money should be withdrawn from different categories of accounts.

Making the wrong decision can have dire consequences: causing clients to draw down their portfolio too quickly, under-consuming when their preference would be to spend, or losing money

by choosing a poor annuity or Medicare insurance product. People can also purse a tax-inefficient withdrawal strategy. Broadly speaking, these decisions are complicated because they depend on uncertain future states of the world, they consist of many different components that are difficult to understand, and the clients making these decisions have heterogeneous needs and preferences.

In the face of such uncertainty, financial planners have developed some rules of thumb about decumulation. The most famous is the 'Bengen 4 Percent Rule,' which stated that retirees who withdrew 4 percent of their portfolios annually (adjusting for inflation) would not outlive their wealth (Bengen 1994) (Bengen later revised his rule, suggesting that retirees could withdraw 4.5 of their portfolio if the withdrawals were tax-free and 4.1% if the withdrawals were taxed; Scott et al. 2009). An alternative to the 4 percent rule is a family of actuarial methods of spending advice which incorporate the client's life expectancy and adjust spending amounts each year based on assets remaining in the portfolio.

The 4 percent rule has been criticized for several reasons. Some advisors argue that retiree spending usually follows a 'smile curve' pattern, where retirees spend more early on in retirement, less halfway through, and then more again late in life. Also, retirees often face spending shocks – for example from a hospitalization or other significant health care event – when they will need to withdraw an unusual amount to cover costs. As a result, some financial advisors consider it imprudent to recommend a spending plan based around relatively constant spending. Financial advisors also complain that the Bengen rule can be too conservative, leading clients to chronically underconsume (e.g. JP Morgan 2014). Other financial advisors contend that the Bengen rule is too aggressive in a long term, low interest environment (Blanchett et al. 2013).

Another 'rule of thumb' in decumulation is the retirement withdrawal sequence. Consider this excerpt from the Fidelity (2018: n.p.) website:

> A straightforward strategy is to withdraw money from your retirement and investment accounts in the following order:
> - Required minimum distributions (RMDs), from traditional IRA, 401(k), 403(b), or 457 and Roth 401(k), 403(b), or 457 retirement accounts;
> - Taxable accounts, such as brokerage accounts;
> - Tax-deferred traditional IRA and 401(k), 403(b), or 457 retirement accounts;
> - Tax-exempt Roth IRA and 401(k).
>
> Why in this order? First, it ensures that you take any RMDs if you're older than 70½. (Roth IRAs don't have RMDs while the original owner is alive.) If you don't take the full RMD, in most cases you'll pay a penalty of half the amount you failed to withdraw.

While some financial advisors recommend such a strategy, it may not be optimal for everyone, especially for people whose top income tax bracket changes over the course of their retirement (Cook et al. 2015).

These rules of thumb and debates about their reliability suggest three important things about the development and dissemination of optimal decumulation strategies. First, there remains significant work to be done to develop theoretically-sound and empirically-tested decumulation strategies. Second, as even these simple rules of thumb demonstrate, decumulation decisions involve calculation-heavy, future-oriented decisions that people are not very good at making, but that algorithms can do quite well, provided of course that there is an optimal decumulation strategy to follow. Third, recent advances in optimal life cycle portfolios (e.g., Horneff et al. 2009; Horneff et al. 2015; Hubener & Mitchell 2015; Chai, et al. 2011) have yet to be incorporated in much of the prevailing decumulation advice provided to consumers.

Behavioral Effects and Retirement Decumulation

An optimal decumulation model would maximize utility over the life cycle (Chen et al. 2017; Chai et al. 2011). Yet maximizing life time utility is a hard problem to solve: it not only imposes large cognitive demands, but it also requires people to make decisions that are subject to

behavioral effects that could lead to suboptimal decisions. In this section, we review various behavioral effects that can impact individuals' decisions regarding capital decumulation. To do so, we follow a broad classification of these effects into three domains that reflect different aspects of individuals' decision-making processes.

First, individuals draw on their knowledge of their situations, their larger economic and social environments, and the alternatives that are available to compose a *mental representation* of the decumulation decision that they face (Johnson-Laird 1983). These mental representations are likely to be incomplete or inaccurate due to high cognitive costs that are involved in mentally representing many different components (Gershman et al. 2015), or because of emotional reactions to thinking about the decision, for example because it involves contemplating death. As a result, individuals do not fully and accurately anticipate the future (Huffman et al. 2017). These biases in mental representations are the first domain of behavioral effect.

Second, individuals must process information about the choice alternatives that are available to *evaluate* those alternatives. In particular, people must make judgments about the attractiveness of each alternative based on how well it matches their preferences (Lancaster 1966). This process is unlikely to reflect the fully rational process underlying the normative model (e.g., Tversky and Kahneman 1992), among other reasons because individuals may have incorrect perceptions of the values of alternatives (e.g., they may overweigh certain probabilities), or they may have non-normative preferences (e.g., they may be strongly loss averse) (Dimmock et al. 2016). These evaluation-based biases constitute the second domain of behavioral effects.

Third, individuals need to come to a decision by applying a *decision rule* that allows them to compare and decide among alternatives (Payne et al. 1993). These rules are unlikely to reflect the fully rational process underlying the normative model, among other reasons because

individuals can be confused by the complexity or the sheer number of the alternatives that they face (Chernev et al. 2015). The use of such non-normative decision rules or heuristics constitutes a third domain of behavioral effects.

In the remainder of this section, we review specific examples in each of these domains of possible behavioral effects to set up our subsequent discussion of how automated advice can help individuals counter these effects to make more optimal decumulation decisions. Note that while we distinguish these three behavioral effect domains conceptually, they overlap in practice. For example, the strength of the *evaluation* of a feature of an alternative may influence whether this feature and alternatives are activated in a *mental representation* and how the feature and alternatives are captured in a *decision rule*.

Mental representation effects. One important way in which mental representations affect decisions is by making it easier or harder for individuals to access relevant knowledge. For example, the availability heuristic refers to the fact that individuals tend to confuse how easily they can recall an event with the likelihood of the event occurring (Schwarz et al., 1991). Because of these and other heuristics, mental representations are almost certainly incomplete, biasing the decisions that individuals make using these representations (Hegarty and Just 1993).

Differential mental representation of the components that affect decisions can also generate behavioral effects. Recent research on construal level theory is an excellent example of this mechanism (Liberman and Trope 2008). For example, individuals may cognitively represent events and alternatives that are further away in time (or some other dimension such as space) differently than those that are close. These findings have implications for retirement related decision-making as many decisions span considerable periods of time (e.g., Van Schie et al. 2015; Gottlieb and Mitchell 2015).

Goals represent a third aspect of mental representations that can affect individuals decumulation decisions (Austin and Vancouver 1996). Depending on the goals that are activated in an individual's mind, his evaluation of alternatives and choice between alternatives may differ. For example, individuals who mainly think about the health consequences of aging may assess their decumulation and other retirement alternatives differently from individuals who mainly think about the fun and enjoyment that they can get out of retirement. This may influence for example the investment, savings and insurance decisions that they make, such that individuals who are more focused on potential health consequences may spend more on health insurance and saving for health care support, while individuals who are more focused on enjoyment may spend more on travel and regular housing.

Evaluation effects. In the evaluation domain, the best known behavioral effects relate to the evaluation of risky alternatives (Tversky and Kahneman 1992). Individuals often exhibit biased perceptions of probabilities (e.g., probability weighting) and biased preferences for alternatives (e.g., loss aversion), and they prefer not to choose alternatives when they lack information about the risks involved, or when they are not knowledgeable about a specific domain (ambiguity aversion; see) (Fox and Tversky 1995; Borghans et al. 2009).

Anticipated regret is another important example of behavioral effects in the evaluation of alternatives. Research shows that regret avoidance can impact individuals' evaluations, for example by making inaction more attractive than action, guiding behavior towards deviation from a normative decision model (Zeelenberg and Pieters 2007). In retirement decisions, individuals may fear experiencing more regret when the self-chosen option turns out to be sub-optimal (Bodie and Prast 2011; Muermann et al. 2006).

Finally, individuals may exhibit non-normative inter-temporal discounting (trade-offs between the present and the future). For example, people may too quickly discount future events compared to a normative discounting model, known as hyberbolic discounting (Laibson 1997). In particular, in the context of retirement, individuals may discount future returns at a higher rate than economic models would prescribe (Brown et al. 2017a). This may lead them to commit less of their current income to long term savings for retirement.

Decision rule effects. Another behavioral decision rule that can lead to potentially suboptimal retirement decisions is acceptance of a default. Default effects are often observed in the retirement investment domain: for instance, Choi et al. (2003) showed that 56-87 percent of employees participated in a 401k plan because of automatic enrolment, and these employees tended to stick with the default contribution rate. Beshears et al. (2009) showed that when a company changed its default retirement savings rate for new employees from 3 to 6 percent, the participation rate did not change, despite the doubling of the default rate.

In addition, decision rules may differ depending on the number of alternatives that an individual faces. Research has also shown that more choice is not always better in terms of promoting individuals' active decision making. Iyengar, Jiang and Huberman (2004) illustrate that more individuals participate in a pension plan when fewer choices were offered. More generally, individuals may avoid making complex decisions (Agnew and Szykman 2011; Brown et al. 2017b). When analyzing the savings contribution rate and the asset allocation of a retirement savings portfolio, research has shown that many individuals do not reallocate their investment funds throughout their working lives (Beshears et al., 2009).

What do Robo-Advisors Say About Decumulation?

Next we identify automated decumulation services available on the market and report the results of our survey of investment robo-advisors that provided these automated services. We included in our survey the two independent consumer-facing investment robo-advisors with the largest amount of assets under management (Wealthfront and Betterment), two investment company direct-to-consumer robo-advisors with the largest amount of assets under management (Vanguard Personal Advisor Services and Schwab Intelligent Portfolios), two consumer-facing investment robo-advisors with a target market of older Americans (United Income and True Link), and two companies that provide automated decumulation tools for advisors (BlackRock's iRetire and Income Discovery). We included the latter companies because most general-purpose investment robo-advisors do not currently provide comparable automated decumulation services; thus, we had to look elsewhere to gain insight into the kinds of decumulation robo-advice available in the market.

Several automated decumulation services are available at present:

(1) Services that adjust the allocation of retirement assets as the expected lifespan of the individual declines or milestones (such as stopping work) are reached. This service is embedded in target date funds, is presently offered by most of the consumer-facing robo advisors we surveyed, and could easily be offered by the others;

(2) Services that assist individuals in making annuitization decisions. This service appears to be presently available on an automated basis only in decision support tools marketed to advisors;

(3) Services that help individuals optimize their social security claiming decisions. This service is available in several consumer-facing investment robo-advisors and in one of

the support tools marketed to advisors. We consider this to be a decumulation service because the timing of the social security claiming decision can have a significant impact on the lifetime value of social security retirement benefits and, thus, on the amount of money available to an individual for consumption in any given year;

(4) Services that help individuals optimize their Medicare plan selections and predict their out-of-pocket medical expenses. This service is available on private health insurance exchanges offered by health benefit companies such as Aon Hewitt and Willis Towers Watson and (a less sophisticated version) at Medicare.gov. We consider this to be a decumulation service because of the impact that healthcare expenses can have on financial security (Hoffman and Jackson 2013), the significant differences in the benefits available under different Medicare plans (which can have a financial impact that exceeds the lifetime value of making the wrong social security claiming decision), and the high level of difficulty involved in choosing among plans without expert assistance (Handel & Kolstad 2016). Two of the consumer-facing investment robo advisors have such tools in production, and two others implicitly recognize the importance of such tools by offering human advice about Medicare choices.

(5) Services that help individuals with multiple retirement accounts determine which to draw from and when. This service is available from certain robo-advisors and in advisor facing decision support tools.

(6) Services that help individuals calculate the amount of money they can safely withdraw from savings to use for consumption on an ongoing basis. This service is also available from certain robo-advisors and in advisor facing decision support tools.

At the time of our survey, we found no investment robo-advisor offering all these services. None of the consumer-facing robo-advisors surveyed offered Medicare decision support tools, and none offered annuitization decision support tools, although several of the robo-advisors employed human advisors who could provide advice about annuities and Medicare plans.

Some companies have developed software services embedding most or all of these tools, but most sell the services to human financial advisors. Accordingly, it appears that a well-equipped traditional financial advisor can today provide more complete decumulation services than can a robo-advisor. The larger investment companies with robo-advisor services do offer all or most of these decumulation services, but the fact that they do so in many cases through humans providing general advice calls the quality of that advice into question, at least in relation to computationally difficult topics like selecting the right Medicare plan and making the right annuitization decision.

We should be clear that we are not criticizing the consumer-facing robo-advisors for business decisions about which automated services to offer. For example, Wealthfront focuses entirely on Millennials who do not yet need decumulation services; we have no basis for second-guessing other firms' decisions about what to automate and when. United Income and True Link would seem to be the best candidates to offer all these services because of their focus on the senior market, but they are new companies and are still growing. (We note that United Income has most of the automated tools in operation and has the two missing ones in production.)

In our survey, we coded the robo-advisors according to their characteristics within the following categories: business model, whether they receive side payments, human assistance, whether asset allocation changes automatically with age, and whether they offer the following decumulation services: a retirement income calculator, a social security decision tool, and a

Medicare decision tool (see appendix for description of these characteristics and the coding). The results appear in Table 1.

Table 1 here.

Robo-Advice Market Structure and Regulatory Issues

As our survey makes clear, robo-advisors have only recently begun to address decumulation. None of the market leaders surveyed offered the full range of automated decumulation services needed by someone depending primarily on a DC retirement plan to fund retirement consumption. We expect that expert knowledge about decumulation will increase significantly over the next decade, and that the quality of, and confidence in, expert decumulation advice will rise. Because the advice will involve the kinds of calculations, rankings, and predictions that can be automated and incorporated into robo-advice services, robo-advisors are likely to play an important role in disseminating that advice.

It is worth considering whether there are market structures offering the potential to inhibit the development and dissemination of unbiased, high-quality decumulation robo advice. If so, we also ask whether the existing regulatory frameworks are adequate to address these market structures.

Robo-advisors present a contemporary example of the trilateral dilemma in financial regulation first generalized by Jackson (2008). Like other financial advisors, robo-advisors present a principal-agent problem, namely the problem of agents whose interests are not fully aligned with the principals that retain them. Robo-advice presents a *trilateral* principal-agent problem because there are three categories of parties involved in the robo-advice relationship: the client seeking the advice, the entity providing the advice, and the companies providing the financial products whose purchase is affected by the advice.

Ideally, robo-advice would be fully aligned with consumers' interests and would aim to overcome the various behavioral decision-making challenges that they face. Two of the main ways that robo-advisors can do this are: (1) using algorithms to solve complex optimization problems that consumers cannot easily solve on their own; and (2) providing choice architectures and online interfaces that help consumers develop a better understanding of their situations and make better decisions about complex decumulation products and strategies (Baker and Dellaert 2018, Philippon 2019).

These two types of support have the potential to help consumers avoid the behavioral limitations due to the behavioral domains identified above. In the mental representation domain, a robo-advisor could consider all available options in the market, taking into account all key attributes of those options and tailor the outcome to the individual's circumstances. Robo-advisors could also provide consumers with empirically validated projections of likely future developments in the financial markets and in their own lives (e.g., life span and medical expenses). In the evaluations domain, robo-advisors can allow consumers to systematically weight the attributes of the options that they face, and robo-advisors can be designed to allow consumers to choose their own weighting. A robo-advisor can also offer digital environments that help consumers better understand the options, including future scenarios to allow more informed trade-offs between different attributes. Finally, in the decision rule domain, robo-advisors can offer balanced decision rules that include all attributes of the different options and that rank these options in order of predicted attractiveness to the consumer. This would facilitate a decision-making process that focused the consumers' attention on the most important options and attributes, helping them make better use of their cognitive capacities (Dellaert et al. 2018).

Because decumulation decisions are so difficult for people to make and evaluate on their own, however, there is a concern that robo-advisors (like their human counterparts) could selectively adapt the emerging expert advice on decumulation to increase their compensation at the expense of their clients. In that regard, financial product companies may be motivated to persuade advisors to be a less-than-fully faithful to their clients. Financial product companies understand the financial product domain much better than the advisors' clients. They also understand the behavioral effects described above better than those clients, so they can design their products to exploit those effects. Moreover, because financial product companies are repeat players with advisors, they can monitor their advisors more effectively than can the advisors' clients, and they have greater ability to adjust the terms of their contracts with the advisors in response to this feedback.

Even if robo-advisors steadfastly refuse to be influenced by financial product companies, there is still no guarantee that their interests will be fully aligned with those of their customers'. A more strategic, short-term profit-oriented type of robo-advisor could exploit the behavioral effects to influence consumer decision making in a direction that is in the interest of the advisor, but not of the consumer. For instance, in the mental representation domain, a robo-advisor might restrict consumer access to available options in the market by only surveying a strategic subset of options that are most profitable for the firm. The advice could also focus on a certain subset of attributes of these options that guide consumers towards more profitable options (e.g., by focusing on attributes correlated with higher profit margins), or provide projections of future scenarios that highlight these attributes. In the evaluation domain, a robo-advisor could selectively apply weightings to the evaluations of attributes that guide consumers towards more profitable options. A robo-advisor could also apply behavioral strategies such as framing and selective highlighting

that make consumers more sensitive to profitable options for the firm. Finally, in the decision rule domain, a robo-advisor could apply selective decision rules or strategic defaults making it more burdensome for consumers to select their most valuable options.

We are by no means making the claim that robo-advisors in the market are currently applying these behavioral techniques, merely that there is ample opportunity to do so and, based on experience in other markets, reason for concern that some market actors will do so. For example, when Jackson (2009) surveyed a wide range of financial products and services from real estate sales to financial institutions' sale of customer data to third parties, he reported that, in every financial product market considered, advisors were receiving side payments from financial product companies that had led (at least some of) the advisors to act contrary to their clients' interests. Not surprisingly, lawmakers had intervened in all these markets except one to try to align the advisors' interests more fully with those of their clients, following a modal regulatory strategy that combined fiduciary and transparency obligations.[2]

Jackson (2008: 107-108) also raised concerns – which we share – about whether these obligations were sufficient to protect consumers, saying:

> In contexts where the underlying problems arise – that is, where market forces are not sufficient to protect consumers – one wonders whether the mere imposition of fiduciary obligations, which typically call upon the recipients of side payments to assess their reasonableness in light of numerous factors, is likely to be effective. … One could raise similar concerns about generalized disclosure regarding the existence of payments to consumers. It is hard to argue how vaguely worded disclosure can assist most consumers.

This is the same regulatory strategy – disclosure plus fiduciary obligations – that is the primary regulatory strategy today for investment robo-advisors. Consumer-facing investment robo-advisors are subject to SEC registration, supervision, and enforcement procedures under the Investment Advisers' Act (SEC 2017).[3] The Act imposes certain fiduciary and transparency

obligations, often referred to in short hand as ‘suitability’ and ‘disclosure’ obligations, and it authorizes the SEC to examine advisors to determine whether they are meeting those obligations. Although investment robo-advisors that sell their services to other financial advisors are not subject to this oversight directly, the SEC (2017) can evaluate these ‘B2B’ robo-advisors when examining their financial advisor customers (see also Mottola et al. 2019 and Klass & Perelman 2019), as can FINRA (2016) when examining the broker-dealers that it regulates.

In this short working paper, we cannot fully consider whether this principles-based regulatory strategy makes sense for all financial advisors, as this is a larger question affecting much more than robo-advising. Instead, we focus on how the known limits of this strategy interact with two special features of the financial advice we are examining here: the automated nature of robo-advice and the decumulation context.

Automation. The automated nature of robo-advice has several potential consequences for a regulatory strategy that employs fiduciary and transparency obligations. First, the automated nature of the advice has the potential to make the content of, and potential biases in, the advice more transparent to regulators, both ex ante and ex post.[4] This should be the case even with hybrid systems (i.e. when there is a human who interacts with the client), provided that those systems record both the automated advice and the subsequent action, thereby permitting examination of the reasons for systematic variations between advice and action (in order to check whether the human is introducing a bias – e.g., in favor of high commissions – not present in the automated part of the system). This provides reason to be optimistic that the growth of robo-advisors will increase the ability of existing disclosure and suitability requirements to mitigate the trilateral dilemma of financial advisors (Schwarcz and Siegelman 2015), provided of course that regulators develop the expertise needed to examine robo advice (Baker and Dellaert 2018, Philippon 2019).

Second, because the disclosures that consumer-facing robo-advisors make to consumers are also automated, they should be subject to collection, tracking, and comparison by third parties better-equipped than individual consumers to evaluate and compare them. This second difference also provides reason for optimism about improvements in transparency based on existing disclosure obligations. Of course, if robo-advisors were to make side payments to such third parties, this market development could simply relocate the trilateral dilemma rather than mitigate it. For this reason, it will be important to consider whether the receipt of such side payments is consistent with existing fiduciary obligations and, if so, whether those obligations should be modified to regulate or even prohibit such payments.

Third, unless the robo-advisors themselves win the competition to become consumers' primary financial platforms, the winners of that competition will receive recurring data feeds from robo-advisors and will be able to monitor, compare, and report the robo-advisors' fidelity to their customers. These platforms will also be subject to their own trilateral dilemma, as all the financial platforms of which we are aware are either owned by, or receive side payments from, financial product companies. Accordingly, as with the more limited third-party advice platforms just discussed, this market development may simply relocate the robo-advisor trilateral dilemma. Thus, it will be important for regulators to monitor developments in the financial platform market and to consider whether they have the authority they need to examine the business practices of the entities that are likely to succeed and, if so, whether their existing statutory authority provides them with the tools needed to protect consumers facing this trilateral dilemma.

Fourth, because of the 'weapons of math destruction' problem – for example, the problem of widely-used models that turn out to have unanticipated flaws – there are reasons to be wary of safe harbors and other prescriptive alternatives to fiduciary obligations in the context of automated

advice (O'Neil 2016). Especially because of the market concentration potential of robo-advice (Brandt and Yeltekin 2017), there is a significant risk that a prescriptive approach to robo-advice could lead to convergence on a single model that could have negative effects as robo-advice scales. For this reason, as we have argued elsewhere, regulators should consider relying on competitions (and competitions of competitions) to enhance the quality of robo-advice, rather than prescription (Baker and Dellaert 2018).

Decumulation. Decumulation services present different incentives for financial advisors than asset accumulation services. The practice of paying fees that are based on assets under management (AUM) is generally understood to align the incentives of financial advisors and their clients in the accumulation phase. Although the AUM fee structure gives advisors an incentive to recommend excessive savings, most of the behavioral effects discussed earlier lead individuals to save less than would be optimal, making it unlikely that investment advisors' clients in fact generally save too much. Indeed, as Barr et al. (2009) have argued, the market for saving products is an example of a market in which the compensation incentives may reduce the negative impacts of behavioral effects.

Decumulation services present a more difficult alignment problem. As our survey suggests, there is demand for decumulation services and some financial advisors provide those services, if only to stand out in the market for financial advice. Unfortunately, none of the existing models for financial advisor compensation are well-calibrated to the quality of decumulation services.

On the one hand, AUM-based compensation partially aligns the interests of financial advisors with their clients' interests in not outliving their assets. On the other hand, AUM-based compensation does not provide an incentive to recommend annuity products (because they reduce AUM), nor does it provide any obvious incentives for other decumulation services, except as

needed to satisfy consumer demand in the advisors' target market. Commission-based compensation provides an incentive to offer annuities and Medicare plans, but that incentive is not well tailored to quality. One suggestive illustration of the lack of demand for quality can be seen in the Medicare insurance market, in which, based on our scan of that market, we conclude that the only advisors that are using available high-quality advice tools are those whose clients are large employers that are transitioning retirees from a traditional retirement health plan to a private exchange and who demand high quality decision support for their retirees. (In that regard it is worth noting that we learned from our survey that Vanguard is developing its Medicare tools in cooperation with Mercer, which is one such advisor (Thornton 2018).) Because individuals are poorly equipped to evaluate the quality of decumulation services, the market does not appear to provide incentives to develop high quality decumulation services. Moreover, because decumulation presents some difficult modeling challenges that have not yet been well-implemented in real-world models, there remains significant uncertainty about which decumulation strategies are best for which consumers. These challenges include questions that are purely technical, such as the potential role of loans in addressing large unexpected expenses, or the special role of the home as a largely illiquid asset that is not purely financial in nature.

These challenges also involve questions that present a challenging combination of normative and behavioral considerations that may be hard to elicit from retirees and may be highly heterogeneous, such as bequest motives and the ability of individuals to adapt to changed circumstances (which would affect the weighting of downside outcomes in a predictive model). The resulting uncertainty presents opportunities for robo-advisors (or financial advisors choosing among robo-advisors) to take their own interests into account in how they resolve that uncertainty in their models, for example by recommending (or not recommending) the purchase of annuities,

or certain kinds of annuities, if doing so increased the compensation (or decreased the compensation) of the advisor.

As with automated investment advice more generally, the principles-based approach of the Investment Advisers Act provides the SEC with authority to examine advisors' decumulation tools and perhaps even to raise questions about why advisors are not making use of such tools, and FINRA appears to have similar authority in the broker dealer domain (SEC 2017a and FINRA 2016). The SEC's examination priorities now include 'electronic investment advice,' and examinations 'focus on registrants' compliance programs, marketing, formulation of investment recommendations, data protection, and disclosures relating to conflicts of interest' (SEC 2017b at 2). FINRA appears similarly to have concluded that its existing authority is sufficient for this purpose. The FINRA Report on Digital Investment Advice identifies 'practices that we believe firms should consider and tailor to their business model' without the need for 'any new legal requirements' or change to 'any existing broker-dealer regulatory obligations' (FINRA 2016 at 1).

Thus, in our view, the difficult challenge in moving forward along the regulatory trajectory for robo-advice does not lie in obtaining the legal authority to consider these questions (see also Klass & Perelman 2019). Indeed, on the regulatory front, we are encouraged by Polansky et al. (2019). Although these authors are of course presenting their personal views and not those of FINRA, their investigation of digital investment advice and decumulation demonstrates that this important topic could easily be put on the financial regulatory agenda. Instead, the pressing decumulation challenge lies in research and development, so that there can be the kind of reliable 'best practices' regarding decumulation that FINRA referred to in its 2016 Report.

Conclusion

The decumulation stage of the life cycle presents difficult theoretical and behavioral challenges. The theoretical challenges lie in developing optimal decumulation strategies given real-world tax, transfer, insurance, medical care, and other institutional rules. The behavioral challenges lie, first, in recognizing the behavioral effects that could prevent consumers from following these strategies and that could be exploited by firms and, second, in developing strategies to address these behavioral effects. Robo-advice, whether provided direct-to-consumer or indirectly through human advisors, has great potential in this regard, and our market survey demonstrates that decumulation tools have begun to emerge. Moreover, recent SEC and FINRA attention to digital investment advice indicates that financial services regulators have both the authority and the willingness to examine these emerging tools.

Accordingly, we conclude this working paper with two concrete observations for regulatory consideration. First, regulators could adopt a requirement that Advisers and Broker Dealers only use automated tools that incorporate the robo-advisor equivalent of the 'black box' that commercial airplanes carry to record what happens on the plane and, thus, create and maintain a record that will permit after-the-fact evaluation of any recommendation. Second, regulators should begin the process of developing a list of simple requirements – 'do's and don'ts' – for robo-advice, and for developing tests to determine whether those requirements are followed. The inputs would be standard (but changing and secret) individual scenarios that could be used to test whether the outputs vary in a manner consistent with the requirements and to compare different advisor tools.

The first approach would facilitate after-the-fact evaluation of failures, just like black boxes on airplanes. Given the early stage of the development of the technology and the significant risks from adopting a highly prescriptive *ex ante* regulatory approach, there is a need for an *ex post*

liability approach. A record-keeping requirement would facilitate that approach. Like airline black boxes, comparable record-keeping practices are unlikely to be implemented across the robo-advice market on a voluntary basis, because of the potential liability risks such records could create for individual firms. Thus, a black-box mandate represents a solution to a collective action problem. This record-keeping requirement is important because firms update their algorithms, models, and data sources over time. Thus, absent a requirement to keep a record of exactly how a given recommendation was made, it may be impossible for it to be determined after the fact.

Our second approach is a concrete example of the 'regulatory trajectory' referred to in prior work (Baker and Dellaert 2018). Although it would be a mistake to tightly prescribe the data sources and algorithms that robo-advice must use (among other reasons because of the weapons of math destruction problem discussed above), the efforts that the SEC and FINRA are undertaking to study automated advice are certain to produce actionable do's and don'ts. One benefit of automated advice is that it can be tested in a way that human advice cannot. While getting from here to there is obviously not a simple task, policymakers should at the very least consider developing simple input/output tests that their examiners can use to determine whether those do's and don'ts are being followed.

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Appendix: Characteristics Used to Code Robo-advisor Attributes

(1) **Business model**. Categories are: independent consumer-facing investment advisor (indep. B2C); fund company consumer-facing investment advisor (FundCo B2C); fund company advisor tool (FundCo B2B2C); and independent advisor tool (SAAS B2B).

(2) **Side payments**. Here we report what we could discern about whether the advisor received payments from parties other than their customers that could provide an incentive to bias the services. Categories are: none; fees from related funds that are included in the asset allocation; and commissions from annuities.

(3) **Human assistance**. Categories are: Pure robo (no human assistance offered as an option); Pure hybrid (human assistance always included at no extra charge); Robo/Hybrid (option to purchase human assistance); and Adviser tool (automated tool licensed to human advisors for their use with clients)

(4) **Automatic reallocation**. Here we report whether the asset allocation changes automatically as individuals age or reach milestones (such as no longer working). Categories are: yes, no, and advisor dependent. The latter category is for the advisor tools, which supplement whatever asset allocation method the advisor is using.

(5) **Retirement income calculator**. Categories are: yes or no. A 'yes' means the service has an automated decision tool that recommends a retirement paycheck or similar personalized spending recommendation, based on all assets and income sources that the individual discloses.

(6) **Annuity support.** Categories are: yes, no, human advisor. A 'yes' means that the service includes annuitization options in the automated retirement income calculator. A 'human adviser' means that human advisors who work for the service can provide advice about annuitization.

(7) **Social security tool**. Categories are: yes or no. A 'yes' means that the service offers a tool that helps individuals decide when to claim and includes social security income in any retirement income tool.

(8) **Medicare tool**. Categories are: no, human adviser, and under development. A 'human advisor' means that human advisors who work for the service can provide general advice about Medicare plans. 'Under development' means that the robo advisor informed us that they are working on an automated decision tool that is similar to that presently offered through the Aon Hewitt and Willis Towers Watson retirement health insurance exchanges.

End Notes

[1] Of note, the Department of Labor Rule regarding the use of investment robo-advisors in the employee benefits context requires the robo-advisor to use 'generally accepted investment theories that take into account the historic risks and returns of different asset classes over defined periods of time.' Investment advice - participants and beneficiaries, 29 CFR 2550.408g-1(4), https://www.law.cornell.edu/cfr/text/29/2550.408g-1.

[2] The one exception at the time was university financial aid offices' relationships with private lenders, and that relationship is no longer an exception. (Barr, Jackson and Tahyar 2017)

[3] State securities regulators have primary responsibility for regulating robo-advisors with less than $100 million assets. Because of the economies of scale in robo-advising, we focus on federal regulation in this working paper.

[4] Aspects of robo-advice that are based on machine learning models may be less transparent because of the interpretability problems that accompany such models. We set those problems aside here for two reasons. First, our understanding is that the current generation of investment robo-advisors uses intelligible models. Second, this interpretability problem is a more general one that is receiving significant attention elsewhere (Selbst and Barocas 2018).

Table 1: Survey of decumulation features of leading investment robo advisors

Firm	Business Model	Side Payments	Human Assist	Auto reallocate with age?	Retirement income tool?	Annuity support?	Soc. Sec. tool?	Medicare tool?
United Income	Indep. B2C Senior focus	None	Robo or Hybrid	Yes	Yes	Human advisor; tool in production	Yes	Human advisor; tool in production
True Link	Indep. B2C Senior focus	Annuity commissions	Pure hybrid	Yes	Yes	Human advisor	No	No
Betterment	Indep. B2C	None	Robo or Hybrid	Yes	Yes	Human advisor	Yes	Human advisor
Wealthfront	Indep. B2C Millenial focus	Fees from related fund (can opt out)	Pure robo	No	No	No	No	No
Vanguard	FundCo B2C	Fees from related funds & annuity commissions	Pure hybrid	Yes	Yes	Human advisor	Yes	Human advisor; tool in production
Schwab	FundCo B2C	Fees from related funds & annuity commissions	Pure hybrid	No	Yes	Human advisor	Human advisor	Human advisor
BlackRock iRetire	FundCo B2B2C	Fees from related funds	Adviser tool	Advisor dependent	Yes	Yes	No	No
Income Discovery	SAAS B2B & B2B2C	None	Adviser tool	Yes	Yes	Yes	Yes	No