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Highlighting Tax Costs to Minimize Trading Frequency

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## Abstract

We ask whether highlighting future tax consequences can be used to counter known biases in investor behavior and whether the reaction will be the same as we would expect in response to highlighting an equivalent non-tax cost. We observe that trading levels drop significantly when investors are notified of taxes owed prior to making an allocation change. We explore whether this reaction is likely to be general to making any cost salient or if it is instead likely to be specific to taxes, finding evidence consistent with a tax-specific response. Tax sensitivity varies as a function of both nationwide attention to taxes in the US and the political affiliation of the investor.

Views about taxes and tax policy can influence decisions ranging from small, daily purchases to decisions about where to live, how to vote, and whether to comply with the law. Sometimes, we go far out of our way to avoid a tax while otherwise achieving our initial goal. For example, if we want to purchase a new piece of jewelry, we might travel to a store in another state to avoid associated taxes. Although we might incur a high cost in terms of time, this could be offset by a lower tax cost, and the jewelry purchase itself could be identical. In this context, people might methodically calculate the value of their time and make a rational decision based purely on the dollar value of the tax. In some cases, however, the decision to avoid a tax can alter choices in excess of the tax avoidance costs. Returning to the jewelry example, people may inadequately account for time costs; additionally, the decision to avoid the tax may lead people to purchase a piece of jewelry they like less. Investment choices present a case in which the primary goal should presumably be to maximize total financial returns net of taxes. However, we propose that focusing on the tax component of the transaction can shift attention from this goal of maximizing overall returns and alter investment decisions in fundamental ways, potentially leaving the investor with lower after-tax returns. In other words, taxes impose their stated cost with certainty if you incur them, but may pose even greater risk-adjusted financial costs if you aim to avoid them.

#### *Tax Salience and Tax Aversion*

For taxes to be relevant to consumer decisions, people must first notice and attend to the cost of the tax. Basic economic principles assume that investors incorporate all knowable costs and benefits into their decisions. However, research has shown that altering the salience of a tax can change behavior (Chetty, Looney, & Kroft, 2009; Finkelstein, 2009; Goldin, 2015; Goldin &

Homonoff, 2013). Consumers tend to respond more strongly to a tax when the good's after-tax price is prominently displayed.

The importance of tax salience plays out in a number of consumer contexts. Chetty, Looney, & Kroft (2009) examine a grocery store setting and show that purchasing declines less in response to taxes than to an equivalent increase in dollar price when these taxes are not made salient in the grocery aisle. However, when price tags explicitly state the cost of taxes for consumers, demand decreases by 8 percent relative to inclusion of the tax at the register. This finding is moderated by inattention, with low-income consumers being more likely to respond consistently to the full (after-tax) price of the product irrespective of where the tax-cost is displayed (Goldin & Homonoff, 2013). Consumer responses to tolls also vary as a result of their salience. Specifically, consumers are less likely to alter their driving routes to avoid tolls when they can pay through electronic toll collection, which minimizes the salience of the cost (Finkelstein, 2009).

People may dislike taxes for a range of cultural, political, and moral reasons (e.g., Hardisty, Johnson, & Weber 2010; Kirchler, 2007) in addition to financial ones. Consequently, when taxes *are* made salient, people can react strongly. Research has identified cases in which people alter their behavior more in response to taxes than to equivalent costs, a phenomenon known as tax aversion (Sussman & Olivola, 2011; see Olivola & Sussman, 2016 for a review of consumer behavior regarding taxes). For example, when a sale is described as being “tax-free, which is equivalent to an 8% discount,” people are more likely to purchase a sale item than when it is described as having a larger, “9% discount” with no mention of taxes. Although there are likely to be many reasons why people dislike taxes, one key factor is that people often fail to couple tax benefits with associated tax costs. Correspondingly, research has found that

encouraging people to consider how their tax dollars will be used, or giving them say in the allocation process, leads to increases in tax compliance (Lamberton, De Neve, & Norton, 2017; Sussman & Olivola, 2011).

Consistent with reactions to taxes extending beyond financial elements, reactions tend to differ as a function of political affiliation (e.g., Cullen, Turner, & Washington; Hardisty, Johnson, & Weber, 2010; Sussman & Olivola, 2011). Those reporting to be members of anti-tax parties (e.g., Republicans) tend to display higher levels of tax aversion than do members of pro-tax parties (e.g., Democrats; Sussman & Olivola, 2011). For example, while encouraging Republicans to consider uses of approved tax dollars mitigates tax aversion, this exercise does not affect Democrats, who may already be aware of these positive uses or who may favor taxes based on principle. Consistent with this pattern of differential negativity towards taxes across political affiliations, framing a charge on carbon emissions as a tax versus an offset reduces favorability among Republicans but has no effect among Democrats (Hardisty, Johnson, & Weber, 2010).

### *Taxes and Investment Behavior*

The government uses taxes to incentivize certain behaviors over others. For example, state and local bonds are issued tax free, which encourages their purchase over corporate bonds offering the same pre-tax rates. As in the case of consumer goods, investors appear to be more sensitive to taxes than traditional economics would predict. Investors' responses to municipal bonds serve as one example of this sensitivity. When choosing between a taxable corporate bond and a tax-exempt municipal bond, an investor should choose the bond that offers the higher after-tax yield, *ceteris paribus*. Since taxes are determined by investor's marginal tax brackets, the benefits to holding tax-exempt municipal bonds increases as this marginal tax-rate increases.

However, nearly twenty percent of interest from tax-exempt municipal bonds goes to households for which the bonds are suboptimal, given the households' low marginal tax-rates (Feenberg & Poterba, 1991). Several different factors, such as investors being slow to adjust their portfolios after changing tax brackets, could help explain this behavior. One additional possibility is that people have a preference for avoiding taxes, even when this is not justified from a calculation based on financial outcomes alone. Sussman and Olivola (2011) provide support for the latter explanation, showing that people strongly prefer bonds that are financially equivalent on an after-tax basis when they never have to pay tax on the earnings.

Taxes have also been shown to have privileged status in other investing contexts, altering people's decision of when to buy or sell certain stocks. According to the efficient markets hypothesis, past price behavior should not be useful for predicting future price patterns. However, seasonal price patterns were found in stocks on the New York Stock Exchange (Rozeff & Kinney, 1976). Over a 70 year period, the average monthly return in January was about three percent higher than in other months (3.5% in January vs. 0.5% otherwise), driven primarily by differences in stock prices of small firms in the first few trading days of January. Reinganum (1983) provides evidence that one reason for this pattern is the desire to harvest tax losses at the end of the year, and to repurchase stocks after receiving the tax benefit the December before. Thus, taxes appear to motivate investment behavior, above and beyond expectations about future stock performance. Stocks that have previously declined in value will be more likely to be sold just before the end of the year so stockholders can realize capital losses.

### *Current Research*

Since taxes tend to elicit strong responses, strategically highlighting tax costs could plausibly be used to encourage desired behaviors, even without any changes to the presence or

amount of these costs. In the current research, we explore investing as a highly consequential setting in which increasing tax salience may be used to alter behavior. In this context, investors typically face a long temporal gap between when taxes are incurred (i.e., at the time of the trade) and when they are paid (i.e., typically for individuals, upon filing tax returns the following calendar year). We propose that consumers do not automatically incorporate taxes into their investment decisions throughout the year. This could occur either because they are unaware of the amount or because they do not attend to the taxes at the time of making the trade.

Consequently, we hypothesize that strategically highlighting tax costs in this setting could encourage desired behaviors, even without any changes to the presence or amount of these costs.

In this investment context, we target overtrading as an established bias. As demonstrated by Barber and Odean (Barber & Odean, 2000; Odean, 1999), many individual investors engage in excessive levels of trading. This frequent stock trading is correlated with significantly lower returns than the overall market. For example, an investigation of all trading history in Taiwan documented that high levels of trading activity led to a performance loss equivalent to 2.8% of total personal income in an aggregate portfolio (Barber, Lee, Liu, & Odean, 2009). Transaction costs – including tax costs, commissions, bid-ask spreads and potentially load fees—are one factor underlying the lower returns associated with high levels of trading. In addition to these transaction costs, excessive trading often corresponds to unsuccessful attempts to time the market resulting in negative gross relative returns. For example, in a mutual fund setting, investors who timed the market had portfolios with returns that were 1.56% lower than a buy-and-hold-strategy annually (Friesen & Sapp, 2007).

Further exaggerating costs of frequent trading, investors are more likely to sell stocks that have gains than losses, a tendency known as the disposition effect (Odean, 1998; Shefrin &

Statman, 1985). Since investors need to pay taxes on their gains, excessive trading often creates tax obligations. One possible way to reconcile a general aversion to taxes with the tendency to sell winning positions at a tax cost is to suggest that investors may not be aware of or focused on these tax consequences when they engage in trading. Expected taxes are difficult to calculate at the time of the trade and are not typically due until the following April, which may contribute to the lack of attention to this factor. Thus, a mechanism for highlighting tax consequences could leverage consumers' reactions to taxes to increase the perceived costs of trading with the aim of reducing trading activity and increasing investor returns.

In this paper, we examine a unique data set of retail investors' behavior through a period when the availability of a real-time tax impact preview (TImP) feature was tested and released. This data combines a 20 day window in which the feature was displayed to a randomized subset of customers with a longer term analysis of more than two years of investor behavior after the feature completed its full launch. Through this feature, investors were encouraged to view the tax impact of certain actions before committing to them. Importantly, while this feature did not change the value of the taxes, it did make taxes salient and allowed customers to moderate their allocation changes in response to the information. During the period we observe, the ability to view tax information through the tax preview feature changed from optional to mandatory.

We investigate whether it is possible to use tax salience as a lever for encouraging behavior change. We hypothesize that a reminder of any cost that is not otherwise salient will lead behavior to change in line with the goal of minimizing the additional cost. Additionally, we propose that consumers differentially react to the presence of taxes relative to other costs. While we would ideally test investors' reactions to taxes versus non-tax costs by introducing a separate experimental condition, the field setting that we explore does not allow us to do so. Instead, we



examine field data to test whether we observe patterns that we would expect in response to taxes but not to non-tax costs. The main patterns we explore pertain to differential reactions to taxes as a function of both overall attention to taxes and of political affiliation, neither of which we would expect in response to non-tax costs.

First, we propose that sensitivity to taxes will vary throughout the year as a function of how much an individual is considering taxes outside of the specific investment setting. To the extent that taxes are already top-of-mind, we hypothesize that investors will be more sensitive to salient information about tax costs. We use searches for taxes on Google as a proxy for general focus on tax costs and predict that reactions to taxes will be stronger during periods when national attention to taxes is higher. This pattern would be consistent with research on behavioral priming (Weingarten et al., 2016), as well as with the possibility that consideration of alternative and potentially current tax costs makes the future tax cost identified from the trade seem more concrete or immediate. For example, if someone is in the process of submitting their annual tax returns, they may be focused on tax costs not only for the present filing, but also concerned with tax costs more generally.

Next, consistent with prior literature on attitudes towards taxes, we propose that differences in political affiliation will correspond to differential reactions to tax information. At the most basic level, we hypothesize that investors who vote for Republican (vs. Democratic) candidates will be more sensitive to tax costs displayed (i.e., will be less likely to complete a trade as the amount of taxes displayed increases). This pattern would be consistent with Republicans disliking taxes more than Democrats. Additionally, we examine whether the relative sensitivity to tax costs changes as a function of political party when viewing tax information becomes mandatory (versus optional) for completing a trade. This change would be

suggestive evidence of differential selection into viewing during the period when viewing was optional.

We begin by providing an overview of the investment context and research setting. Next, we examine the experimental rollout of TImP at Betterment, an online investment advisor. This experiment allows us to test causally whether varying tax salience acts as an effective tool for behavior change in a highly consequential setting. Data support the conclusion that provision of real-time, individualized tax information significantly reduced the likelihood of trading among retail investors. Next, we examine more than two years of data from Betterment that includes richer detail and a larger number of observations as well as variation across time. Using this data, we provide additional detail on responses to taxes as a function of the amount displayed, finding large responses even in response to low levels of taxes.

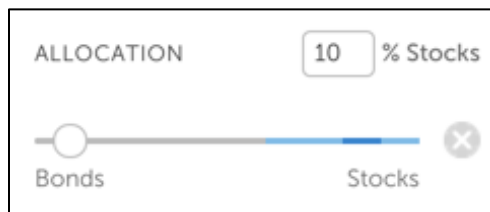
Furthermore, we explore whether reactions to salient taxes are more consistent with a pure cost-based account or with a tax-specific account, finding evidence consistent with the latter. We examine whether reactions to taxes vary as a function of overall attention to taxes and find that tax sensitivity increases during times when overall attention to taxes is high. Next, we find that making TImP viewing mandatory (vs. optional) corresponds to a greater decrease in completion rates among Republicans than Democrats. Additionally, we find that Republicans respond more strongly to the specific tax information provided than do Democrats.

### Background on Research Setting

Our data comes from Betterment, an online financial advisor and investment manager with more than 14 billion dollars in assets under management. Rather than choosing specific stocks, Betterment customers select their risk level using a simple stocks versus bonds slider, see Figure 1. In the context of this platform, investors “trade” by shifting the allocation of stocks

relative to bonds in their accounts. Consequently, this platform provides a clear investigation into preferences for portfolio changes without intrusion of stock-specific factors.

Figure 1. Betterment user interface for selecting portfolio allocations.



Betterment markets itself as an independent online advisor and investment manager that seeks to maximize returns through smart rebalancing, low fees, and tax-efficient portfolio management. One goal of Betterment is to reduce the “behavior gap” that results from overtrading, as described above, often through behaviorally informed site design. Close to half of Betterment customers trade (i.e., shift their risk allocation) less than once a year, and only 22% of customers make more than one trade a year. Internal data<sup>1</sup> shows, in a correlational analysis, that the minority of Betterment customers who trade more frequently tend to have portfolios that perform worse than those who do not make allocation changes. This data is consistent with existing research on overtrading leading to negative returns (Barber & Odean, 2000; Odean, 1999) and suggests that reducing trading levels may correspond to positive outcomes for investors in this context.

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<sup>1</sup> A description can be found at: <https://www.betterment.com/resources/betterment-customers-stay-the-course-steer-clear-of-behavior-gap/>

### *The Tax Impact Preview Feature*

Sales transactions in taxable accounts can generate taxable gains that customers may not be aware of or focused on. The Tax Impact Preview (TImP) feature gives customers an estimate of tax consequences of a given transaction before they execute it. Estimated taxes displayed to customers are based on estimated gains and losses assuming the highest potential tax rates<sup>2</sup>. During the period from October 8-28, 2014, a randomized subset of customers were exposed to TImP and could choose to view the feature when they initiated an allocation change. Once the customer moved the allocation slider or entered a number in the withdrawal text box, a button appeared with the text, “Estimate Tax Impact”, see Figure 2a. If the customer clicked that button they were shown a window with short and long term gains and losses and the estimated tax implications of the action, see Figure 2b<sup>3</sup>.

After viewing tax information, customers had the option to finalize the trade, revise their allocation change, or exit the allocation change page without completing the transaction. Tax amounts displayed varied as a function of the magnitude of the allocation change (smaller changes correspond to lower tax amounts, holding direction constant) and of the direction of the change (moving towards a more risky portfolio typically corresponded to lower tax amounts, holding magnitude of change constant). Beginning on October 29, 2014, this optional feature became available to all Betterment customers, and beginning on December 14<sup>th</sup>, 2015, viewing tax information was mandatory for completing a trade.

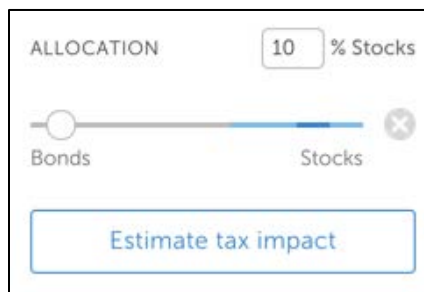
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<sup>2</sup> Additional details on this feature are provided at: <https://www.betterment.com/resources/inside-betterment/product-news/tax-impact-helps-you-get-the-full-picture/>

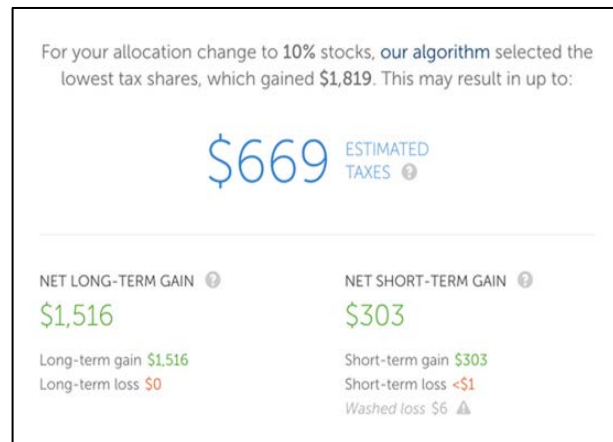
<sup>3</sup> The exact format of the display changed periodically throughout our observational period, but the core characteristic of including the net tax amount stays the same. We do not observe the timing of these display changes.

Figure 2. Betterment user interface (a) offering optional tax information and (b) displaying tax impact information during a pending allocation change decision.

(a)



(b)



## Experiment

We ran an experiment to test the effects of the tax impact preview feature for 20 days in October, 2014. Customers were randomly assigned to either the treatment condition in which they could press a button to view tax information prior to completing an allocation change, or the control condition in which the tax preview button was unavailable. Customers were assigned a condition when they visited the allocation change page for the first time, and they stayed in the same condition over the full 20 day period. We were primarily interested in whether providing this tax reminder affected the completion rate of the pending allocation change.

In addition to basic demographic information, we are able to observe whether a given customer was assigned to the treatment or the control group, the number of visits to the site, the number of TImP views and corresponding tax information, and whether they completed an

allocation change. Information was recorded at the customer-day level, the collection of views, clicks, and actions for a given customer within a given day. Each observation is, at minimum, a customer who logged in and visited the relevant page on the site on a given day. We have 22,112 customer-day observations from 12,292 unique customers.

### *Customer Demographics*

During the experimental period, our sample is 80% male, with a mean age of 36.30 ( $SD = 10.12$ ), mean self-reported income of \$112,200 ( $SD = 87,475$ ), and mean self-reported investible assets of \$123,500 ( $SD = \$325,695$ )<sup>4</sup>.

### *Results and Discussion*

The primary purpose of this experiment is to test whether providing the tax preview feature to customers had a causal effect on allocation changes. Specifically, we test whether customers in the experimental condition made more or fewer allocation changes relative to the control condition during the test period. Although 50% of customers were assigned to the tax preview condition of the experiment, only 13% of customers in the experimental condition clicked to view the tax information. We examine the treatment and control groups, irrespective of who chose to view the additional tax information within the treated arm. We rely on intent to treat analysis both because of non-random selection into viewing and because of possible direct effects of the viewing the tax estimate button in and of itself.

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<sup>4</sup> Users who chose not to self-report or who entered 0 or 1 for age, income or asset measures were excluded from this statistic.

Table 1. Summary of observations by treatment and exposure

<b>Condition</b>	<b>Viewed TImP</b>	<b>N Obs (Customer- Days)</b>	<b>Unique Customers</b>	<b>Visits</b>	<b>TImP Views</b>
Control	No	11,438	6,361	20,664	0
TImP	No	9,767	5,637	16,715	0
TImP	Yes	907	750	2,376	1,592

Customers in the TImP condition performed 14.9% fewer allocation changes per customer than customers in the control group ( $M_{Control} = 0.329$ ,  $SD = 0.991$  vs.  $M_{TImP} = 0.280$ ,  $SD = 0.908$  changes during the experimental period;  $t(12,290) = 2.875$ ,  $d = 0.05$ ,  $p = 0.004$ ). If we instead examine the average number of allocation changes per day when there was a visit to the allocation change page, the same pattern emerges. Specifically, the average number of changes is lower on a daily basis for those in the treatment condition ( $M = 0.156$ ,  $SE = 0.0049$ ) than those in the control condition ( $M = 0.183$ ,  $SE = 0.0050$ ; logistic regression with individual random effects  $B = 0.20$ ,  $z = 3.04$ ,  $p = 0.002$ ).

This data supports the hypothesis that access to real time tax information reduces trading behavior, and this pattern holds even though most customers in the treatment condition did not avail themselves of that information.

### Field Behavior

After implementation, the tax preview feature became a standard element of the Betterment site for all customers. Any customer who visited the allocation change page on the site saw the tax preview button and had the option of viewing the tax implications of their allocation change before completing it. Additionally, beginning December 14<sup>th</sup>, 2015, all customers were required to click the tax preview button and view tax information prior to

finalizing an allocation change. In addition to observing tax information, we observe the potentially iterative process through which customers proposed multiple allocation changes in series and had the option to view the tax implications of each before deciding whether to finalize, revise, or abandon the changes.

### *Data Description*

Our data consists of customers who visit the allocation change page and view tax information between October 2014 and July, 2017<sup>5</sup>. During this period, we observe tax information displayed to customers through the desktop app, and allocation changes made. We observe allocation slider locations conditional on movement, but do not observe the initial allocation. We are unable to observe the amount of money held in a specific trading account, or portfolio performance. Demographic variables available, which are controlled for in subsequent analysis, are investor age, gender, natural log of self-reported income and assets, likely party affiliation, and user tenure at Betterment.

We conduct analysis at the level of the TIMP view. This analysis allows us to examine allocation changes in response to specific tax information displayed and to observe whether the action directly following viewing specific tax information is to complete the allocation change, make an adjustment, or exit before a change<sup>6</sup>.

### **Population**

Our sample consists of 84,046 customers who view tax preview information 277,494 times throughout the study period. The population is 76% male, with a mean age of 36.18 ( $SD = 10.99$ ), mean self-reported income of \$105,603 ( $SD = 92,075$ ), and mean self-reported investible

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<sup>5</sup> We analyze all observations obtained from Betterment that include tax amounts, with the exception of those with negative tax values (18,605) indicative of reporting errors. Findings are robust to inclusion of these observations.

<sup>6</sup> We define an exit as a 20 minute period between actions as well as an explicit click away from the page.



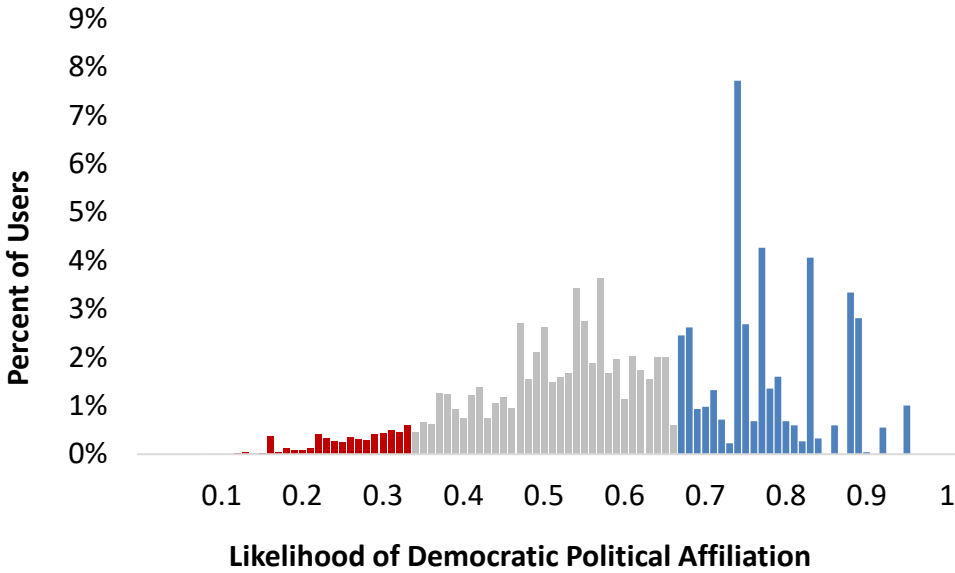
assets of \$119,361 ( $SD = 369,469$ ). For our investigation of tax aversion, we would also like to examine reactions to taxes as a function of political affiliation. Although we cannot interview customers about their political beliefs, we can assign a likelihood score based on their geography.

We use each customer's zip code, and 2012 and 2016 presidential election results to create a proxy for likely political ideology. Vote counts for the 2012 and 2016 presidential elections are available at the county level for 49 states. We calculate the two-party vote share for each county as a uni-dimensional measure of local political ideology. Counties can be mapped to the zip codes we have for each user with reasonable fidelity<sup>7</sup>. The imputed political ideology is thus the average vote-share associated with the customers' zip code averaged across the 2012 and 2016 presidential elections. This metric is bounded between 0 (Republican) and 1 (Democrat). It represents the likelihood that a given customer voted for a Democrat, which we will refer to in shorthand as the estimated probability that a given person is a Democrat. Figure 3 illustrates the distribution of our sample of Betterment customers' political affiliation as inferred by their zip code. Notably, the sample of Betterment customers is skewed Democrat ( $M = 0.62$ ,  $SD = 0.17$ ), indicating an additional dimension by which our sample is not representative relative to the overall US population. This distribution is consistent with an overall customer base that is skewed younger than the overall population in the US.

Figure 3. Distribution of Betterment customers as a function of inferred political affiliation. One indicates the highest probability of affiliation as a Democrat, zero indicates the highest probability of affiliation as a Republican.

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<sup>7</sup> Some zip codes span two or more county boundaries, and in these cases the zip code's political identity is considered as the average of the contributing counties.



### Descriptive statistics

In our data set, we observe 277,494 TImP views from 84,046 unique customers. The tax estimates displayed to customers over the full period range from \$0 to \$812,500, but have a strong positive skew. Forty-two percent of customers observe \$0 in taxes, with the median tax amount of \$0.32, and the 95<sup>th</sup> percentile of \$451.49<sup>8</sup>. We examine raw data for the purpose of descriptive and categorical analysis. However, as a result of the strong positive skew and large number of zeroes in our tax estimate data, we transform the tax estimate data using an inverse hyperbolic sine transformation<sup>9</sup> for all continuous statistical analysis. Unless otherwise specified, logistic regressions with random effects for the customer are employed to examine relationships between key variables. Estimates from linear probability models are substantively the same.

<sup>8</sup> As a result of tax-efficiencies such as tax-loss harvesting as well as other account specific characteristics, Betterment customers often face very low levels of taxes. For additional information, see <https://www.betterment.com/resources/lowering-your-tax-bill-by-improving-our-cost-basis-accounting-methods/>

<sup>9</sup> This is similar to a log-transformation, but used in situations with large numbers of zeroes (See Burbidge & Robb, 1988; MacKinnon & Magee, 1990; Pence, 2006)

## *Reaction to Tax Information*

### **Mandatory Viewing**

Given that only a minority of investors chose to view the tax preview when it was available during the experimental period, we begin our analysis of the observational period by examining how trading levels vary as a function of being required to view tax information. We leverage the policy change at Betterment in which viewing tax information went from being optional to mandatory—close to midway through our observational period—as a quasi-experiment. If all investors, or if a perfectly representative sample of investors, who viewed the tax preview button clicked on it and viewed information about tax amount during the optional period, we would not expect to see a difference between the optional and mandatory periods. To the extent that the policy change led different types of investors to view the tax information—which we cannot directly observe in our data—we would expect to observe an impact of the policy change on the likelihood of completing a trade. If investors who cared about (i.e., would respond to) the information viewed while those who did not care about the information abstained during the optional period, we would expect investors in our sample to be more likely to complete trades after viewing became mandatory. Finally, if investors who cared more about the tax information chose not to view (e.g., were engaging in information avoidance; Golman, Hagmann, & Loewenstein, 2017) then we would expect investors in our sample to be less likely to complete trades after viewing became mandatory.

Using pre-post analysis, we find that investors were significantly less likely to trade when they were required to view this information (logistic regression with individual random effects;  $B = -0.92$ ,  $SE = 0.016$ ;  $z = -58.35$ ,  $p < .001$ ). This pattern remains robust after accounting for a

variety of controls including investor age, gender, likely political affiliation, natural log of self-reported income and assets, time as a Betterment customer, and state-level fixed effects ( $B = -0.71$ ,  $SE = 0.016$ ;  $t = -43.68$ ,  $p < .001$ ). These findings suggest that viewing tax information reduces trading activity above and beyond the effect of making this information available, consistent with the notion that investors who cared about the information initially were not viewing this information when it was optional.

### **Reactions by Tax Amount**

We next examine how the specific tax information shown to participants corresponded to subsequent allocation change decisions. We hypothesized that customers' likelihood of completing an allocation change would decrease as the estimated taxes displayed increase, a reaction consistent with being reminded or informed of any cost that was not previously salient. Correspondingly, we would expect that the likelihood of revising an allocation change downwards (i.e., reducing the magnitude of the change and the corresponding taxes) or of exiting before completing a change would increase in the presence of higher taxes displayed.

Customers who choose to view the TImP information after initiating a change typically see very small tax consequences. Sixty-five percent of TImP views revealed an estimated tax of \$5 or less (see Table 2). Even very small estimated tax burdens corresponded to a lower likelihood that the next action would be to complete an allocation change. The likelihood of completing the change as the next action dropped from 16.62% to 13.28% when the taxes displayed increased from \$0 to a value between \$0 and \$5 ( $B = -0.06$ ,  $SE = 0.0033$ ;  $z = -18.94$ ,  $p < .001$ ). Recognizing that a variety of factors influence the tax amount shown, we include controls for differences we observe in our data including investor age, gender, natural log of self-

reported income and assets, likely party affiliation, user tenure at Betterment, and state and month fixed effects and find a similar result ( $B = -0.049$ ,  $SE = 0.0038$ ;  $z = -13.03$ ,  $p < .001$ ).

The likelihood of trade completion drops again, down to 6.26%, when moving from a tax estimate between \$0 and \$5 to a tax estimate between \$5 and \$10 ( $B = -0.188$ ,  $SE = 0.0082$ ;  $z = -22.90$ ,  $p < .001$ ; including controls  $B = -0.151$ ,  $SE = 0.0087$ ;  $z = -17.31$ ,  $p < .001$ ). If we examine similar results on a continuous basis across the full spectrum of taxes displayed, we find that the likelihood of completing a trade drops as a function of the tax amount displayed ( $B = -0.011$ ,  $SE = 0.00026$ ;  $z = -42.37$ ;  $p < .001$ ; with controls:  $B = -0.0074$ ,  $SE = 0.00025$ ;  $z = -29.73$ ;  $p < .001$ ). This pattern persists even when restricting the data to tax values between \$0 and \$1 ( $B = -0.122$ ,  $SE = 0.0097$ ;  $z = -12.60$ ;  $p < .001$ ; with controls:  $B = -0.064$ ,  $SE = 0.0034$ ;  $z = -18.94$ ;  $p < .001$ ).

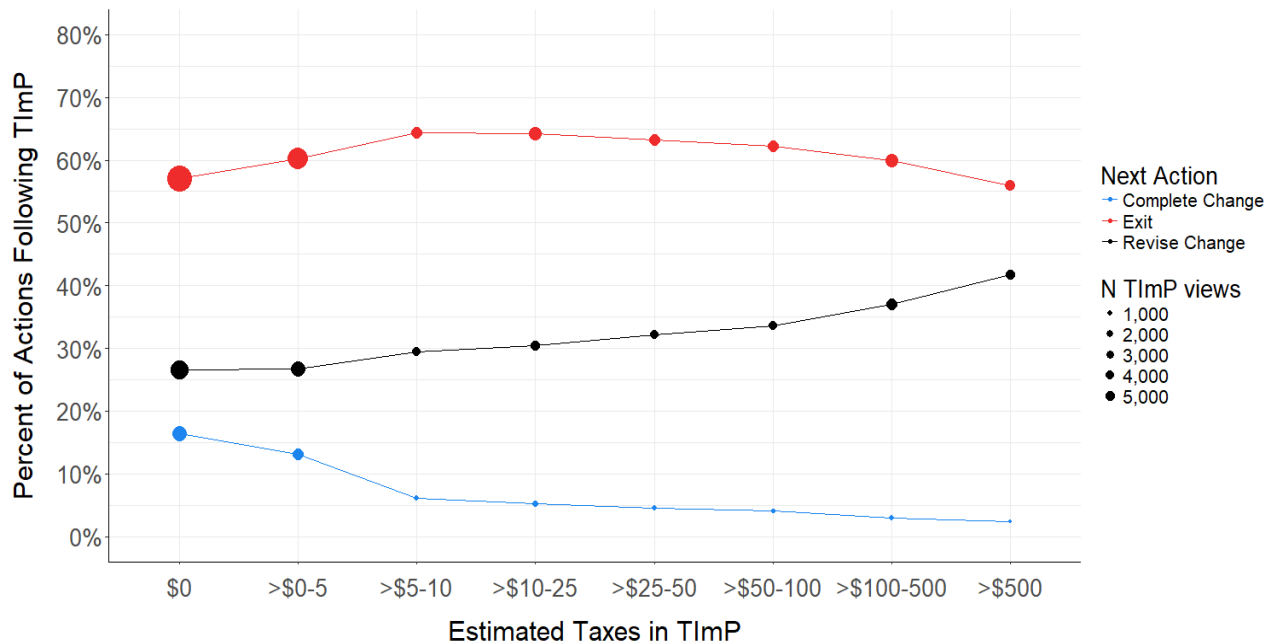
Table 2. Distribution of tax amounts displayed and completion rates. Unstandardized beta coefficients from a logistic regression and standard errors correspond to the likelihood of completing the trade as the next action as a function of viewing tax amount represented as a categorical variable relative to a zero dollar estimate. \* $p < .05$ , \*\* $p < .01$ , \*\*\* $p < .001$ .

Tax Bin	Percent	Cum.	Completion Rate	B	SE
<b>T = 0</b>	41.51	41.51	16.62	-	-
<b>0 &lt; T ≤ 5</b>	23.48	64.99	13.28	-0.217***	0.0183
<b>5 &lt; T ≤ 10</b>	5.34	70.33	6.26	-0.951***	0.0413
<b>10 &lt; T ≤ 25</b>	7.29	77.62	5.42	-1.067***	0.0383
<b>25 &lt; T ≤ 50</b>	5.22	82.85	4.76	-1.242***	0.0472
<b>50 &lt; T ≤ 100</b>	4.71	87.56	4.18	-1.362***	0.0518
<b>100 &lt; T ≤ 500</b>	7.8	95.35	3.07	-1.690***	0.0478
<b>500 &lt; T</b>	4.65	100	2.41	-1.918***	0.0696

We next include the possibility of revising allocation changes in response to the costs displayed. A customer could take one of three actions after viewing the tax estimate of their

pending allocation change: complete the change, revise the change (i.e., move the allocation slider to a different value), or exit (i.e., click away from the page or allow 20 minutes to elapse between actions). Figure 4 illustrates the likelihood of each of these actions as a function of the magnitude of the estimated taxes that customers initially see.

Figure 4. Actions taken by users after viewing TImP by estimated tax magnitude.



To the extent that displaying tax information minimizes overtrading, we would expect that displaying a higher tax amount corresponds not only to a lower likelihood of completing a trade but also to a smaller magnitude of change. We observe that the likelihood of revising the trade increases with the amount of the initial tax displayed in a session ( $B = 0.0013$ ,  $SE = 0.00011$ ;  $z = 11.30$ ,  $p < .001$ ). Furthermore, customers who do view taxes multiple times before exiting or completing an allocation change are more likely to move the slider such that it displays a smaller tax amount (difference between the first and last tax amount displayed:  $B = 0.81$ ,  $SE = 0.22$ ;  $z = 3.73$ ,  $p < .001$ ), consistent with movement to a smaller allocation change.

### *Tax-Specific Reaction*

Thus far, we have been examining how customers behave as a function of the tax information displayed. These results could also be consistent with a reaction to non-tax costs, such as trading fees. However, we hypothesize that although the reactions we observe incorporate reactions to a generic cost, they contain a tax-specific element. Ideally, we would be able to test this experimentally by varying the label of the cost information displayed to customers and observing differences in their responses as a function of the label. In the current setting, we are not able to run such an experiment. Instead, we examine whether there is support for a tax-specific reaction through a series of converging analyses. We first examine whether customers are more sensitive to tax costs at times when taxes (but not other costs) are likely to be top of mind. Second, we exploit prior research on the role of political affiliation in tax attitudes to examine whether we observe differential responses as a function of the investor's likely political affiliation.

### **National Attention to Taxes**

We hypothesize that, if investors were responding to tax costs, they would be more sensitive to information about these costs at times when they are generally considering taxes (e.g., around tax-time). If instead, investors were responding to generic non-tax costs, we would expect the response to be the same irrespective of the external level of tax consideration. This hypothesis stems from research showing that initial exposure to a stimulus (e.g., an article about tax policy) can increase the response to a related stimulus (e.g., tax consequences of an investment decision; see Weingarten et al., 2016). It would also be consistent with the possibility that consideration of taxes in one context that may have immediate consequences

makes consideration of taxes in the investment context similarly seem more concrete or immediate.

Rather than making unwarranted assumptions about when taxes are particularly salient to investors, we use Google Trends search data for “Tax” in the US as a proxy for attention to taxes, determined on a weekly basis. Our Google Trends values fall between 0 and 100, where 100 indicates the week with the most searches for “Tax” between October of 2014 and July of 2017, and all other values are relative to that point, see Figure 5. Although we are agnostic to the timing of general attention to taxes, we tend to see large spikes in February, at the time when employers are required to mail employees their tax forms, and in April, when tax returns are due.

Figure 5: Google Trends search popularity for the term “Tax” in the US between October, 2014 and July, 2017.





Table 3. Trade completion rates as a function of tax amount displayed and national attention to taxes, measured by Google search popularity for the term “Tax” on a given week in the US.

Unstandardized beta coefficients from a logistic regression are presented, with standard errors in parentheses.

\* $p < .05$ , \*\* $p < .01$ , \*\*\* $p < .001$ .

	Google Search Popularity for “Tax”		
	(1)	(2)	(3)
<b>Tax</b>	-0.00895*** (0.000649)	-0.00899*** (0.000653)	-0.00901*** (0.000654)
<b>Tax Popularity</b>	0.00194*** (0.000395)	0.00199*** (0.000407)	0.00200*** (0.000407)
<b>Tax X Tax Popularity</b>	-0.0000442** (0.0000135)	-0.0000425*** (0.0000136)	-0.0000423** (0.0000136)
<b>Constant</b>	-2.171*** (0.0213)	-2.986*** (0.112)	-1.668 (1.245)
<b>Demographic Controls</b>	No	Yes	Yes
<b>State FE</b>	No	No	Yes
$\chi^2$	1,814.60	1,983.60	2,033
<b>N</b>	248,703	236,473	236,261

We find a significant interaction between relative search volume and tax sensitivity, see Table 3. As hypothesized, as attention to taxes increases so does sensitivity to the tax amount displayed in the TImP feature on Betterment ( $B = -0.0000442$ ,  $t = 3.27$ ,  $p < .01$ ). These patterns persist after including demographic controls ( $B = -0.0000425$ ,  $t = 3.12$ ,  $p < .01$ ) and state-level fixed effects ( $B = -0.0000423$ ,  $t = 3.11$ ,  $p < .01$ ). This variation in response to broader attention to taxes seems difficult to explain without appealing to a tax-specific response.

### Interaction with Political Affiliation

To the extent that the tax preview alters investor behavior in a manner that is specific to taxes, we would anticipate that Republicans and Democrats would respond differently to the tax information. This prediction stems primarily from prior research on tax aversion and tax framing in which Republicans have a stronger negative reaction to taxes of equal magnitude (Hardisty, Johnson, & Weber, 2010; Sussman & Olivola, 2011; see Olivola & Sussman, 2016 for a review), and is also broadly consistent with Republicans' more negative attitudes towards taxes when compared to Democrats (Democrats.org, 2018; GOP.com, 2018). We propose that this differential response may take two forms. First, we hypothesize that Republicans will have a stronger reaction to the policy change making viewing mandatory relative to Democrats. Second, we predict that Republicans will be more sensitive to the specific tax amount displayed relative to Democrats.

First, we predict that Republicans (vs. Democrats) will be more likely to avoid tax information when viewing is optional. This would be consistent with Republicans' greater dislike of taxes coupled with research demonstrating that people aim to avoid unpleasant information (Golman, Hagmann, & Loewenstein, 2017). While we are not able to directly compare the population of investors who choose to view with those who do not, we can infer this pattern by examining how responses to tax information change when viewing becomes mandatory. An information avoidance account would predict that making viewing mandatory (vs. optional) should have a stronger impact on Republicans' behavior to the extent they were previously avoiding this information compared to Democrats.

We observe the hypothesized interaction between an indicator for the period during which tax viewing is optional versus mandatory and likely political affiliation ( $B = 0.208$ ,  $SE = 0.0927$ ;  $t = 2.24$ ,  $p < .05$ ; see Table 4). This interaction implies that Republicans reduced their

trading levels more than Democrats when viewing became mandatory. However, our measure of political affiliation is a rough one, and it is of course possible that a variety of other correlated factors are responsible for the predicted interaction, rather than political affiliation itself. Column 2 includes controls for customer age, gender, natural log of income, natural log of assets, and tenure as a Betterment customer while Column 3 includes state-level fixed effects and shows that the results do not change materially when adding these controls ( $B = 0.318$ ,  $SE = 0.0951$ ;  $t = 3.35$ ,  $p < .001$ ) in predicting trade completion.

Table 4. Likelihood of completing a trade as a function of likely political affiliation and whether viewing was optional or mandatory. Unstandardized beta coefficients from a logistic regression are presented, with standard errors in parentheses. \* $p < .05$ , \*\* $p < .01$ , \*\*\* $p < .001$ .

	<b>Mandatory TIMP</b>		
	(1)	(2)	(3)
<b>Mandatory</b>	-1.042*** (0.0593)	-0.907*** (0.0608)	-0.909*** (0.0609)
<b>Democrat Likelihood</b>	-0.273*** (0.0705)	-0.280*** (0.0722)	-0.302*** (0.0863)
<b>Mandatory X Democrat Likelihood</b>	0.208* (0.0927)	0.315*** (0.0950)	0.318*** (0.0951)
<b>Constant</b>	-1.721*** (0.0453)	-1.847*** (0.113)	-1.896*** (0.157)
<b>Demographic Controls</b>	No	Yes	Yes
<b>State FE</b>	No	No	Yes
$\chi^2$	3,290.9	6,058.3	6,095.5
<b>N</b>	272,839	262,526	262,526

Next, we turn to tax sensitivity, predicting that Republicans will be more sensitive to the specific tax amount displayed than will Democrats, i.e., there will be a stronger negative

relationship between tax amount viewed and the likelihood of trade completion. Column 1 of Table 5 displays the results of a regression including a continuous measure of tax amount, the likelihood that an investor is a Democrat, and the interaction of the two in predicting trade completion. Importantly, we observe the predicted interaction between tax amount and political affiliation ( $B = 0.00826, t = 5.32, p < .001$ ). This interaction shows that the negative relationship between tax amount and completion rate is stronger for Republicans than for Democrats. Columns 2 and 3 include demographic variables and fixed effects for the investor' state within the US and for the calendar month of the observation. We find that the interaction between political affiliation and tax amount remains after the inclusion of these fixed effects ( $B = 0.00550, t = 3.56, p < .001$ ).

Table 5: Completion rate as a function of tax amount, likelihood of being a Democrat, and their interaction. Unstandardized beta coefficients from a logistic regression are presented, with standard errors in parentheses.

\* $p < .05$ , \*\* $p < .01$ , \*\*\* $p < .001$ .

	<b>Likelihood of Being a Democrat</b>		
	(1)	(2)	(3)
<b>Tax</b>	-0.0160*** (0.00108)	-0.0162*** (0.00109)	-0.0122*** (0.00105)
<b>Democrat Likelihood</b>	0.0238 (0.0538)	-0.0570 (0.0564)	-0.148 (0.0758)
<b>Tax X Democrat Likelihood</b>	0.00826** (0.00158)	0.00820*** (0.0016)	0.00550*** (0.00154)
<b>Constant</b>	-2.123*** (0.035)	-2.881*** (0.0113)	-3.751*** (0.192)
<b>Demographic Controls</b>	No	Yes	Yes
<b>State and Month FE</b>	No	No	Yes
$\chi^2$	1,723.60	1,955.40	5,621.50
<b>N</b>	244,384	235,100	235,100

To better understand this pattern, we also examine tax amount as a categorical variable, see Table 6. This analysis shows that the interaction between political affiliation and tax amount is driven by tax values between \$0 and \$25 ( $B_s \geq 0.576$ ,  $SEs \leq 0.308$ ;  $t_s \geq 2.78$ ,  $ps < .01$ ; with controls  $B = 0.488$ ,  $SE \leq 0.324$ ;  $t_s \geq 2.86$ ,  $ps < .01$ ), with the size of the interaction decreasing in values above \$25. Since the economic cost of the tax may border on trivial relative to the consequences of the trade for investors when the value is low, this lower range may be the one for which non-economic factors play the greatest role and consequently there is the largest differential reaction across party lines. This pattern also aligns with recent research on tax salience documenting that consumers pay greater attention to taxes of larger amounts (Taubinsky & Rees-Jones, 2018). This finding could parallel the data presented here, to the extent that members of both parties attend to the large economic costs of high dollar taxes and these factors outweigh the non-economic factors.

Table 6. Completion rate as a function of categorical tax amount, likelihood of being a Democrat, and their interaction. Unstandardized beta coefficients from a logistic regression are presented, with standard errors in parentheses. \* $p < .05$ , \*\* $p < .01$ , \*\*\* $p < .001$

	Tax Amount as a Categorical Variable		
	(1)	(2)	(3)
<b>0 &lt; Tax ≤ 5</b>	-0.467*** (0.0949)	-0.388*** (0.0970)	-0.370*** (0.101)
<b>5 &lt; Tax ≤ 10</b>	-1.468*** (0.198)	-1.392*** (0.203)	-1.266*** (0.209)
<b>10 &lt; Tax ≤ 25</b>	-1.833*** (0.190)	-1.707*** (0.193)	-1.466*** (0.199)
<b>25 &lt; Tax ≤ 50</b>	-1.746*** (0.227)	-1.525*** (0.230)	-1.110*** (0.237)
<b>50 &lt; Tax ≤ 100</b>	-1.854*** (0.245)	-1.757*** (0.248)	-1.383*** (0.258)
<b>100 &lt; Tax ≤ 500</b>	-1.865*** (0.225)	-1.721*** (0.228)	-1.492*** (0.236)
<b>500 &lt; Tax</b>	-1.978*** (0.311)	-2.072*** (0.321)	-1.820*** (0.333)
<b>Democrat Likelihood</b>	-0.111 (0.103)	-0.238* (0.106)	-0.301* (0.128)
<b>0 &lt; Tax ≤ 5 X Democrat Likelihood</b>	0.576*** (0.151)	0.553*** (0.154)	0.488** (0.159)
<b>5 &lt; Tax ≤ 10 X Democrat Likelihood</b>	0.854** (0.308)	0.945** (0.315)	0.929** (0.324)
<b>10 &lt; Tax ≤ 25 X Democrat Likelihood</b>	1.048*** (0.290)	1.091*** (0.294)	0.960** (0.302)
<b>25 &lt; Tax ≤ 50 X Democrat Likelihood</b>	0.674 (0.347)	0.572 (0.353)	0.236 (0.362)
<b>50 &lt; Tax ≤ 100 X Democrat Likelihood</b>	0.665 (0.373)	0.73 (0.377)	0.488 (0.391)
<b>100 &lt; Tax ≤ 500 X Democrat Likelihood</b>	0.0536 (0.340)	0.00864 (0.345)	0.0385 (0.357)
<b>500 &lt; Tax X Democrat Likelihood</b>	0.0594 (0.459)	0.262 (0.472)	0.322 (0.489)
<b>Constant</b>	-2.350*** (0.0663)	-3.639*** (0.175)	-3.457*** (0.245)
<b>Demographic Controls</b>	No	Yes	Yes
<b>State and Month FE</b>	No	No	Yes
$\chi^2$	2,650.20	3,936	5,569.30
N	161,103	155,565	155,558

The data presented here has provided evidence for differences in reactions to the tax information displayed as a function of political party and corresponding political activity. Being a likely Democrat (vs. Republican) corresponds to a smaller change in reaction when viewing tax information becomes mandatory as well as lower sensitivity to taxes across the full period. These differential reactions by political affiliation are consistent with a reaction to taxes that would be harder to explain by appealing to reaction to a generic non-tax cost. Moreover, the collection of findings presented here – differential sensitivity as a function of national attention to taxes, the interaction between political affiliation and the optionality of the tax preview feature, and differential reaction to tax amount as a function of political affiliation– would require multiple explanations. Thus, the combination of these findings requires that people respond differentially to taxes for a parsimonious explanation.

#### General Discussion

Across a randomized field experiment as well as analysis of observational data, we provide evidence that investors display tax-avoidant behavior when they are informed of the tax consequences of their actions. Specifically, tax estimates presented prior to committing to an allocation change decision reduced the likelihood that investors followed through with the changes. Reminders of even small dollar costs triggered this response. This reaction demonstrates that investors do not spontaneously incorporate full knowledge of tax consequences when the costs are not made salient. In the current context, this change in behavior result from either of lack of awareness of the tax amount, lack of attention, or a combination of the two. Additionally, findings support the hypothesis that the reaction to tax costs is distinct from reactions to other costs, as examined through differences in tax sensitivity as a function of both overall attention to taxes and likely political affiliation.

The presence of the Tax Impact Preview (TImP) provides decision-relevant information that is difficult for consumers to estimate. The tool takes advantage of one consumer bias in an effort to help offset others. First, it recognizes that consumers do not automatically incorporate the cost of the tax into their investment decisions. Second, it uses consumers' aversion to taxes (e.g., Sussman & Olivola, 2011) in an effort to reduce overtrading, which has previously been identified as a costly bias (e.g., Barber & Odean, 2000; Odean, 1999). Our intervention operates by shifting the overall level of trading downwards. While this should be beneficial on average, there may be some investors who do not benefit from lower trading levels. Furthermore, although we find differential reactions to this tax feature as a function of political affiliation, we do not have reason to believe that Republicans are in greater need of a reduction in trading than are Democrats.

In this context, tax preview information and the subsequent reduction in portfolio allocation changes may also lead to higher levels of risk. Highlighting tax implications may lead investors to be less likely to sell stocks and make a move towards bonds, but no less likely to sell bonds to make a move towards stocks, since investors are likely to see lower tax estimates in the latter case.

One additional caveat in this research is that the population of Betterment customers is not representative of all investors, nor of the average individual investor. Importantly, the setting does represent a highly consequential investment setting for those who use the platform, and there is no clear reason to believe that our results would not generalize to a broader set of retail investors. We do not investigate whether, nor claim that results of our investigation would extend to a set of sophisticated or institutional investors.

*Conclusions and Future Directions*



Overall this research has demonstrated the ability of tax information to change investment behavior, even when these taxes are less than a single dollar. Making these taxes salient influenced decision making above and beyond the presence of the taxes themselves. While tax-motivated selling may lead to suboptimal decisions in some cases, our examination has demonstrated that the investor bias against paying taxes can be used to counter other known investor biases such as overtrading. Furthermore, we document a range of results that provide evidence that the responses we observe are specific to taxes and go beyond displaying an alternative, unnoticed cost.

Critically, although this tax-salience nudge was operationalized in an investment context, we would expect findings presented here to have implications for a much broader range of settings. Tax benefits are often used by the government as a lever to encourage favorable activity while tax costs are used to discourage unwanted activity. Our findings suggest that these tax incentives may actually be less effective than they could be as a result of inattention to their amount. In an employment context, employees may be unaware of the presence or level of tax benefits associated with various benefits such as subsidies for commuting or tax-incentivized savings plans. Highlighting these tax benefits may increase take-up of important programs such as these. Future research should examine whether and how tax-salience can be used to influence a broader range of behavior.

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