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Smoking Hot Portfolios? Overtrading from Self-Control Failure

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Smoking hot portfolios?
Overtrading from self-control failure

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ABSTRACT

Psychology considers self-control failure, i.e., the inability to resist certain behaviors and impulses when seeking to achieve future goals as a major human pathology. The finance literature models and applies self-control failure to explain time-inconsistent behavior such as under-saving and non-participation decisions as a result of present bias due to hyperbolic discounting. However, literature does not investigate whether and to what extent self-control failure affects investment behavior among those who have positive savings and stockholdings. We fill this gap by identifying smoking as the most socially accepted example of present-biased preferences and link it to trading records. We compare trading behavior in the investment portfolio between 3,553 smokers and 10,091 nonsmokers over six years and show that the proportion and demographic characteristics of smokers are consistent with German survey data and federal statistics. Smoking as a proxy for self-control failure is associated with a higher number of trades per month, higher trading volume, and higher portfolio turnover and not explained by other biases such as overconfidence, social contagion, sensation seeking, or attention grabbing. But we find that self-control failure exacerbates these other biases. We show that self-control failure is costly because it increases the gap between the gross and net returns of smokers relative to nonsmokers.

JEL classification: G41; D14, G21; G11

Keywords: self-control; individual investor; trading behavior

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1 Introduction

I count him braver who overcomes his desires than him who conquers his enemies; for the hardest victory is over self. (Aristotle).

People are aware of the harmful consequences of behaviors such as smoking, drinking, or overeating, but many lack the willpower to resist these desires. Psychology calls this inability to resist self-control failure, which exhibits substantial individual heterogeneity in its ability to resist temptations due to an inability to resist impulses (Baumeister and Heatherton (1996)) and results in individuals selecting suboptimal behaviors (Ariely and Wertenbroch (2002)).

In economics, the term self-control was first introduced by Thaler and Shefrin (1981) through their dual-self model of a self-controlled planner with long-term preferences and a doer with myopic preferences. The two compete both at the same time and in the same person[1]. Subsequently, other authors have introduced self-control primarily as an explanation for present-biased preferences (or time inconsistency) to explain too high levels of debt and insufficient savings, and the term is operationalized by associating these effects with hyperbolic discounting (e.g., Laibson et al. (1998)). Another, but closely related, model of the dual-self posits that individual decisions are driven by two competing systems: an impulsive system and a reflective system. If they lack self-control, individuals with active impulsive systems tend to seek imminent rewards and ignore negative consequences (e.g., McClure et al. (2004), Bickel et al. (2007)).

Although the economic literature regarding self-control failures in the context of theoretical models or experiments on undersaving and nonparticipation is plentiful, there are no studies examining the behavior of people with self-control failures in individual trading decisions. It is reasonable to believe that self-control failure also affects the decisions of investors with positive savings and securities investments, as the literature has shown that such individuals are more impulsive (e.g., Hofmann, Friese, and Strack (2009), Bickel et al. (2007)). The question how and to what extent self-control failure in one area of life translates to trading behavior, particularly overtrading among private investors remains

[1] See e.g., Fudenberg and Levine (2006) and Hofmann, Friese, and Strack (2009) who expand the dual self-model.

unanswered. Moreover, there is no study examining how such self-control failure is explained and/or interacted with predispositions and factors such as overconfidence, sensation seeking, attention grabbing, or social contagion.

Our paper seeks to investigate the effect of observable self-control failures by individual investors on their trading behavior. This is possible because our data combine two crucial features. First, the data allow us to identify smokers, who are the prime example of self-control failure with time-inconsistent preferences and impulsive tendencies frequently used in the literature (e.g., Bickel, Odum, and Madden (1999), DellaVigna and Paserman (2005)). Smoking is also considered the most common and socially most accepted self-control failure (Baumeister, Heatherton, and Tice (1994))[2]. Second, we can observe the trading behavior and portfolio turnover of these smokers and a group of nonsmokers over a sufficiently long period of approximately six years. We contribute to the financial economics literature by demonstrating that self-control failure is an unexplored driver of private investors' behaviors that can be associated with impulsive trading. It is distinct from existing explanations for overtrading, such as overconfidence, attention, or sensation seeking. We show that the effects of existing predispositions, such as overconfidence, loom larger for investors with self-control issues.

The data at hand are obtained from a large German online brokerage and contain full trading records and all existing account transactions over six years. This allows us to identify clients as smokers who purchased cigarettes with their debit or credit cards. We also use data obtained from the German Socio-economic Panel (SOEP), because it is considered representative of the German population. We use these data to demonstrate that the average smoker in our sample is highly comparable to the smokers in the general population. The likelihood of smoking among men and woman by different age group is comparable between the two datasets. The findings indicate that smokers are younger, more likely to

[2] Although smokers are aware of the harmful consequences of smoking due to highly visible warning messages (e.g., "smoking kills", "smoking can kill", "smoking seriously harms you and those around you"), they lack the self-control to overcome their addiction. Statista (2019) reports that 66% of smokers in Germany have attempted to quit smoking and that 43% attempted to quit more than once. An estimated 7 million people die prematurely each year worldwide due to the impacts of smoking, meaning that a human dies every 8 seconds because of smoking.

be male, and more risk averse. Additionally, smokers in the brokerage sample are neither richer nor less financially literate than nonsmokers.

We use the trading records of smokers (N = 3,553) and nonsmokers (N = 10,091) to analyze their trading activity measured by monthly turnover, trade value, and months with trades between 2012 and 2018. The sample was restricted to fully self-directed retail investors with fund shares below 50%[3] who trade in risky securities (stocks, bonds, funds, options and other derivatives). Thus, we do not cover any clients who possess no risky holdings or delegate investment decisions. These restrictions ensure that we analyze trading behaviors that can be traced back to individual investors' decisions and are not biased by advisors' recommendations. Cross-sectional regressions are applied to trading patterns, and we find that there is a positive and statistically significant relationship between self-control failure and trading activity. Smokers make significantly more trades per month with a significantly higher turnover and higher trading values that hold for buying and selling. Sales turnover predicts more than 50% of buying turnover, i.e., smokers sell securities and use the money to purchase other securities, suggesting that neither liquidity needs nor higher savings are driving our findings. Our results even hold when we exclude any trades coming from savings plans or predetermined limit orders. We continue by showing that the effects of self-control failure are not driven by known explanations for overtrading. We find that the effect of self-control failure on trading activity remains statistically significant and of the same magnitude when including controls for overconfidence, sensation seeking, attention grabbing, gambling preferences, and social contagion. This shows that self-control failure is distinct from known and existing biases. However, when differentiating between smokers and nonsmokers, we find that the effect of an existing predisposition is larger (exacerbated) for investors who smoke. We formally test this by including an interaction term between smoking and a predisposition, to test differences between smokers and nonsmokers. For example, the effects of self-control failure on trading volume have the same magnitude for men and women. Hence, self-control failure is independent of gender and overconfidence. However, trading volume for male smokers is the largest, indicating that self-control

[3] High fund shares can be seen as another form of delegation (to the portfolio manager). Our study focuses on clients who administer at least the half of their portfolio volume personally to isolate the impact of individual decisions. Relaxing this restriction does not change the qualitative results.

failure positively affects the impulse to act and exacerbates overconfidence. The same logic applies for the effects of attention due to corporate announcements, framing and anchoring coming from price levels, and social contagion. Additionally, we show that self-control failure's effect on trading is costly because smokers have a 1.76% larger gap between gross and net returns per year than nonsmokers.

Our study shows that observable self-control failures in one area of life (smoking) carry over to apparently unrelated areas of life where costly consequences are not necessarily salient. Self-control failure affects financial decision making because it leads to an increase in trading activity. This finding is consistent with the idea that investors with self-control failure act more impulsively. Our results show that self-control failure looms larger if combined with existing behavioral biases. This is because self-control failure means that one is unable to suppress the impulse to act. It is likely true that the severity of self-control failure differs and that a higher degree of a self-control failure further aggravates the effect of predispositions. However, while it is possible to observe whether a client is a smoker, our setting does not provide reliable information on the overall smoking habits to further group smokers by their smoking intensity.

Consequently, the paper demonstrates that observable behaviors or self-control failures generated in one area of life are predictive of behavior in another area of life. Thus, the identification of observable self-control failures allows us to forecast further failures and underlines the usefulness of such an approach in, e.g., consumer protection applications. The extent to which such self-control failures and their severity are reflected in other behaviors should be examined by future studies. If this finding receives further support, policy makers and regulators could use such analyses to predict costumer groups that are in need of protection and information to prevent the spread of self-control failures in a consumer welfare-maximizing way and consider means to forestall the misuse of such information.

2 Related literature

2.1 Self-control from a psychological perspective

In psychology, the term self-control is regularly used in research to describe the preference for larger, delayed gratification over smaller, less delayed gratification as opposed to a behavior that is commonly called impulsiveness where people seek immediate satisfaction (Logue (1988)).

The marshmallow experiment is the most famous experiment on self-control (Mischel and Ebbesen (1970)). In this experiment, the authors examine children's reaction to a delayed reward and find the opposite of their expectations since higher attention to a delayed reward results in greater difficulties in resisting the offered temptation. This finding was the starting point for numerous studies on the influence of self-control on behavior in different areas of personal life (e.g., Gottfredson and Hirschi (1990), Nederkoorn et al. (2010), DeRidder et al. (2012)). An increasing number of empirical studies simultaneously emerged that addressed a group of theoretical concepts. Carver and Scheier (1982) introduce a framework presenting self-regulation as a goal-oriented process. Their model describes self-regulation as a discrepancy-reducing feedback loop in the tradition of test-operate-test-exit systems. According to this definition, a goal or expectation acts as the reference point for constant monitoring for mismatches between the desired state and the observed behavior. Kruglanski et al. (2002) expand this model by proposing an approach in which goal-systems are cognitive constructs consisting of several goals arranged in a hierarchy. According to their model, higher order, more important goals can improve self-control by crowding out short-term goal temptations.

Baumeister, Heatherton, and Tice (1994) change the view of self-control by shifting away from explaining its underlying processes to instead focus on its failure to reveal how such failure changes behavior (Baumeister and Heatherton (1996)). Explaining self-regulation failure by a model of strength, they show that self-regulation is the ability to resist impulses to achieve the desired goal, which helps to explain interpersonal differences in the ability to exert self-regulation. Impulses that arise can differ in strength, but the level of strength to obtain self-regulation needs to be higher to resist these impulses. The authors also show that self-regulation is a limited resource because the employment of strength

cannot be obtained for an unlimited number of tasks and/or impulses. However, studies have provided several other explanations for self-control failure including motivation or attention (e.g., Muraven and Slessareva (2003), Inzlicht and Schmeichel (2012)).

2.2 Self-control in financial economics

In economics, the concept of self-control is established in the research of decision making mainly to explain the observation of time-inconsistent behaviors. Samuelson (1937) proposes an intertemporal setting and introduces the discounted-utility model in which decision makers face interconnected decisions with payoffs at different points in time. The utility function of a decision maker is equal to the sum of forward-looking utilities in each period discounted by a person's discount factor (constant for every period) and characterizes the decision makers' intertemporal preferences. The model leads to an exponential function and implies the assumption of time consistency in preferences, which is compatible with rational choice theory.

Strotz (1955) argues that a constant discount rate is implausible and that people may experience a change in tastes over time because observations show that people do not have consistent preferences. He labels the inconsistency between previously planned future behavior and re-planned future behavior the intertemporal tussle. Although this definition is close to the psychological definition of self-regulation-failure, Thaler and Shefrin (1981) are the first to use the concept of self-control in an economic theory of self-control applied to savings decisions. They propose a dual-self framework in which the self consists of a planner and a doer that disagree with one another due to different preferences and lifetimes. The more patient planner represents the self, which has a long-run lifetime utility, while the doer has a lifetime of only one period and therefore a preference for short-run utility. The planner derives its utility from the actions that the multiple doers perform over time, while the doer maximizes only for a short lifetime. Thus, individuals limit the difficulties of self-control by restricting the options that the doer has (e.g., commitment, planning). Fudenberg and Levine (2006) generalize the dual-selves model by using a game theory approach. In a later model, they completely change the myopic short-run self to a myopic self that values future utility lower than the planner (Fudenberg and Levine (2012)).

While Thaler and Shefrin (1981) have less confidence in the above frameworks and propose an alternative approach without focusing on discounting, Ainslie (1992) remains closer to Samuelson (1937) and states that experimental findings show that discount functions are approximately hyperbolic. Hyperbolic discounting refers to falling discount rates over time, with relatively high discount rates in the short run and low discount rates in the long run. This creates a conflict between present and future preferences, as the preferences of the past and present selves could be reversed. Laibson et al. (1998) create a model of decision making with quasi-hyperbolic discounting. They use an intra-personal game to show that agents with quasi-hyperbolic discounting have dynamically inconsistent preferences in contrast to a game with exponential discounting. Their findings posit that all future selves have inconsistent preferences with the current selves.

Accepting inconsistent preferences as a fact, economists focus on how to overcome self-control issues by e.g., commitment devices (Ariely and Wertenbroch (2002)) rather than analyzing their impacts on behavior, which it is the prevalent strategy in psychology literature. The economic literature on the impact of self-control on behavior mainly focuses on wealth and savings showing that self-control increases the ability to save (e.g., Romal and Kaplan (1995), Gathergood (2012), Strömbäck et al. (2017)).

Although time-inconsistency seems prevalent among many individuals, there are no empirical studies exploring other aspects of financial decision making, such as overtrading or the interaction with other behavioral predispositions on trading that self-control failure may affect. Thus, in our study, we empirically analyze the impact of self-control failure on individual behavior in an investment context. The decision of how to invest, trade, and rebalance savings may also be affected by time-inconsistency, such as the permanent conflict between the planner and the doer.

3 Identification

3.1 Identification of self-control failure by identifying smokers

Although attributes related to self-control are essential determinants of decision making, there are still a limited number of studies about the impact of self-control and its failure that use field data due to

inherent difficulties in measuring self-control in a clean and reliable way. Measures commonly used for self-control such as the big five personality traits or directly asking in questionnaires, are known to have limited empirical support (e.g., Block (1995)), suffer from social desirability bias when asked for behavior indicative of lacking self-control, and often lack a time-series dimension. We propose measuring self-control failure by identifying people who smoke. The German Tobacco Tax Act, which leads to relatively unique prices of cigarette packs (see chapter 4.1), allows us to identify smokers. Alternative measures of self-control failure could be drinking[4] or obesity, but neither is identifiable in our data. However, smoking probably has the lowest impact on a person's ability to contemporaneously work and earn money, and cognitive abilities are less affected than in people with an alcohol addiction. Thus, wealth and current income should be more comparable between smokers and nonsmokers, which makes smoking a better measure because it biases investment decisions less. In our sample, these differences in income are insignificant when controlling for schooling and portfolio values, which are even larger for smokers.

Cigarette smoking is the most widespread and socially acceptable example of self-control failure in the contemporary world, with an estimated one billion smokers worldwide. Although smokers are aware[5] of the health risks of smoking[6] (Arnett (2000)), most lack the self-control strength to succeed in quitting.[7] (Baumeister, Heatherton, and Tice (1994)). DellaVigna and Paserman (2005) use factor analysis to create an aggregate measure of impatience for labor market analyses using various self-control failure indicators and find high factor loadings for smoking.

To identify smokers, we exploit the unique features of the pricing of tobacco products in Germany as outlined in chapter 4.1. We combine the time-series of cigarette prices, which a large supermarket chain

[4] A higher availability of temptation goods has found to increase impulsive consumption and consumer credit demand as shown by Ben-David and Bos (2017) using expanded opening hours of liquor stores in Sweden.
[5] The tobacco product law implemented the new European Union requirement of warning messages on tobacco packages in Germany beginning on 3 April 2014. As a requirement of this law, tobacco product packages need to be designed with a warning message of more than 60% of the package's size including one out of a determined list of the following messages (e.g., "smoking kills", "smoking can kill", "smoking seriously harms you and those around you"). Those messages need to be used alternatingly.
[6] An estimated 7 million people die prematurely each year worldwide due to the impacts of smoking, meaning that a human dies every 8 seconds because of smoking.
[7] Statista (2019) reports that 66% of the smokers in Germany attempted to quit smoking and that 43% of them attempted to quit more than once.

has provided, with the history of debit- and credit transactions in our sample. Specifically, an investor is defined as a smoker when he/she makes purchases more than two times per year for which prices are equal to the multiple price of a cigarette pack during the observation period from January 2016 to June 2018. It seems reasonable to assume that a single investor does not buy cigarettes for more than €100, which is approximately the value of the most expensive carton of cigarettes which usually contains 10 individual packs. Therefore, purchases of more than €100 are excluded. Note that our identification strategy is intended to identify smokers per se. As not all cigarette purchases (e.g., purchases in combination with other items at the supermarket, at gas stations or purchased with cash) can be observed, we are not able to observe the general smoking habits of our investors.

Using two cigarette purchases per year to identify a smoker seems to be relatively low when knowing that an average smoker consumes approximately 5 packs of cigarettes per week; thus, our strategy might be challenged in several ways. Setting the identification strategy is a general trade-off: Considering a high number of cigarette purchases that nearly reflect the average consumption of smokers would be misleading because this approach would require smokers to always purchase the same number of packs without any other items and, additionally, pay for them with a credit or debit card. It is likely that smokers (1) purchase their cigarettes at several point of sales which might also include point-of-sale transactions with additional items (e.g., purchasing cigarettes in the supermarket during grocery shopping) that do not allow any conclusion regarding cigarette purchases, (2) make cigarette purchases in cash,[8] which cannot be identified in the credit or debit card history, (3) pay for their purchases with another bank's credit or debit card that cannot be observed, and (4) use different scales that change the transaction amount (e.g., one cigarette pack for €6.50 in one week and five packs of the same brand for €32.50 in another). Thus, it makes sense to set the identification restriction low enough to identify smokers changing their habits or frequently paying in cash to avoid identifying only richer and potentially more sophisticated investors using credit and debit cards to purchase cigarettes. By contrast, setting the restriction too low may inadvertently classify investors as smokers for those making more

[8] Although there is a preference for cash in German households (Brancatelli (2019)), 85% of card-holders use their cards for payments in supermarkets, petrol stations or vending machines (GfK (2018)). Additionally, the cards are a prerequisite for being allowed to buy cigarettes at a vending machine. When the card is already inserted, it might be reasonably assumed that it is also used for paying.

than the limited number of purchases each year at the price equal to a multiple of a cigarette pack. Again, cigarette prices are set in increments of ten cents, and such transactions are rare in the transaction history for nonsmokers because retail prices are usually set below price thresholds (e.g., .99, .95).

Restricting to the consideration of a large number of cigarette purchases poses the risk of identifying a poorer smoker as a nonsmoker, whereas in the case of a low number of cigarette purchases, we would mistakenly identify a nonsmoker as a smoker. The first effect would reduce the estimates of the negative effect of self-control failure because we would expect more financially sophisticated investors to make fewer investment mistakes and tend to be less prone to overtrading. Smokers might have higher self-control if they buy their cigarettes in cash rather than by card to control their consumption or are at least be likely to use mechanisms to cope with their self-control issues. Therefore, including them in the nonsmoker sample would act as self-selection into the higher self-control group. This issue is addressed by excluding smokers who use commitment devices involving delegation. The second effect would add noise and consequently would reduce the findings' significance because the two groups would appear more similar. However, both strategies have advantages and disadvantages. In our identification strategy, we opted for the lowest possible and most conservative restriction with two cigarette purchases per year. False identification will tend to weaken our results unless they are related to engaging in numerous financial transactions. We will address this issue in the robustness section by restricting the analysis to main account users. Nevertheless, we repeat our analysis with a restriction of 21 cigarette purchases per year in the robustness section.

3.2 Identification of trading activity

To test whether self-control failure leads to an increase in trading activity, we consider three trading behavior measures. In the following section, we will describe how we distinguish our results from a set of alternative explanations for why smoking might drive trading.

To quantify trading behavior, we measure three variables. First, we identify whether an investor has traded in a given month. This variable, *trade month,* is equal to 1 when an investor makes one trade in a given month. The second variable, *trade size*, measures the absolute size of the trades made in a given

month conditional on an investor trading. We employ the absolute value of trades to treat purchases and sales equally. We follow Barber and Odean (2001) in selecting the third proxy of *portfolio turnover* and compute it for investor *i* for month *t*:

$$Portfolio\ turnover_{i,t} = 0.5 * \frac{purchases_{i,t}}{portfolio\ value_{i,t}} + 0.5 * \frac{sales_{i,t}}{portfolio\ value_{i,t-1}} \quad (1)$$

When the monthly portfolio turnover is larger than 1, the turnover is set to 1 (= 100%) for that month.

The related literature shows that smokers are generally viewed as exhibiting low self-control, which entails greater impulsivity and higher discount factors (e.g., Bickel, Odum, and Madden (1999), Bickel et al. (2007), Harrison, Lau, and Rutström (2010), Harrison et al. (2018), Bickel et al. (2008)) than nonsmokers. We utilize the following cross-sectional or pooled cross-sectional regressions to test for differences in trading behavior among investors with (smokers) and without (nonsmokers) self-control failures. They are defined as follows:

$$TM_{i,t} = \alpha + \beta_1 SMOKER\ dummy_i + \beta_2 C_{i,t} + \varepsilon_{i,t}\ . \quad (2)$$

TM represents the measures of trading behavior. $SMOKER\ dummy$ is our measure of smoking that is set to 1 when we identify an investor as a smoker. Regard smoker as our instrument for self-control failure. We will later show that smokers, at least in our sample, have similar characteristics, earnings and portfolio sizes which may be due to an online broker being the source of our data. It also proves true in the representative SOEP survey. Smokers are not less educated or poorer. C is a vector of control variables. As control variables, we include gender, age, risk class, log of the portfolio value, length of the relationship between a bank and client, and dummies equal to one for investors with doctoral degrees, who are employees, who are self-employed and who are retired investors. For the pooled cross-sections, we also include year-fixed effects, which are dummy variables for every year of our sample (2012-2018) omitting the first. The effect we are interested in is β_1.

Our results are robust to using different methods of clustered standard errors at the level of individual investors in case we have repeated observations for each person to account for heteroscedasticity and autocorrelation in the residuals. An alternative approach would involve clustering at the zip code level

to reflect regional commonalities between the portfolios of investors due to local bias (Ivković, Poterba, and Weisbenner (2005)) or the word-of-mouth effect (Hong, Kubik, and Stein (2004)). Using zip code clusters does not qualitatively affect the significance levels reported. As they all yield qualitatively unaltered results, we only use heteroskedasticity-robust standard errors.

3.3 Alternative explanations

To show that self-control failure is an additional factor, we use a set of measures to distinguish it from the following set of alternative explanations, which are usually found to predict overtrading. (1) It could be that self-control failure is just another measure of *overconfidence*. To alleviate this concern, we follow Barber and Odean (2001) and include a male dummy in any regression specification we use. This allows us to control for overconfidence. In addition, we also consider the effect of self-control failure for women only, as overconfidence is much less pronounced among women. (2) It could be that smokers who serve as our proxy for self-control failure are simply more sociable. To measure *social contagion*, we follow Ivković and Weisbenner (2007) and control for other investors' trading in a range of 50 kilometers around each investor based on the zip code of his or her residence. (3) It could be that self-control failure is simply another measure of attention. Therefore, we determine the total number of corporate announcements on a given day to measure *attention* following Hirshleifer, Lim, and Teoh (2009). Additionally, we follow Li and Yu (2012) and measure the over- or underreaction to large price movements or trends in the stock market. (4) It could be that self-control failure is simply another expression *sensation seeking* as ruled out by Grinblatt and Keloharju (2009). To address this issue, we use the lottery share to proxy for the potential gambling motives of private investors. To compute the lottery share, we follow Kumar (2009) and define as lottery stocks those stocks with above-median idiosyncratic volatility, above-median skewness, and below-median prices even when these stocks have lower mean returns. We also use jackpots and pools of the two largest lotteries (Lotto and Eurojackpot) in Germany following Dorn, Dorn, and Sengmueller (2014).

4 Data

4.1 Tobacco price data

According to the German "Tobacco Tax Act", manufacturers set tobacco prices. Prices for single packs of cigarettes must be the same at all retail outlets in Germany. Any promotion or added value in purchasing is prohibited. We use an item list of all tobacco products sold at a large supermarket chain, including price histories from January 2016 onwards, which display the overall supply of tobacco products in Germany. We focus on cigarettes, as they are the top-selling tobacco products, and exclude all other products, such as cigars, cigarillos, fine-cut tobacco, and accessories. We use a total set of 935 cigarette items from 45 different brands in our analysis. The prices for a single pack of cigarettes range between 3.60€ and 9.90€ with a mean price of 6.20€.

Tobacco products trade at prices set at increments of ten cents, e.g., €6.40, €7.50, whereas retail prices are usually set at x Euros plus 95 or 99 cents to signal lower values in retail sales to customers (Holdershaw, Gendall, and Garland (1997), Sonnemans (2006)). This special feature reduces the number of coin reserves needed in cigarette vending machines and thus tremendously reduces their operating costs. Currently, cigarette vending machines use the chip on debit or credit cards to ensure that a customer is over 18 years old, making those cards more prevalent payment options.

4.2 Investor data

We collaborated with an online brokerage bank that offers brokerage accounts in combination with checking accounts and debit and credit cards. Of their several hundreds of thousands of customers, we received data on a randomly chosen subset of 113,000 client ids from January 2012 until the end of June 2018. For these investors, we received data on time-stamped security transactions and monthly portfolio holdings. We were also granted access to a file listing socio-demographic information of the investors, a file describing the securities they hold and trade in terms of security type and asset class and a third file outlining whether a client has received financial advice and the frequency of interactions between clients and advisors. As a special feature, the data also include time-stamped checking account

bookings with the value of transactions, and transaction types (wire and point-of-sale-transactions (debit and credit cards) and ATM withdrawals).

Combining the client with the socio-demographic data and requiring the clients to be private clients, alive and over the age of 18, having information on age, gender, and length of relationship and having a securities portfolio during the period between January 2012 and the end of the sample in June 2018 and making at least two card transactions per year reduces our sample to roughly 15;000 investors. Our approach ensures that we are only considering clients who actively use their portfolios and also use their current accounts. In line with Barber and Odean (2001), we concentrate on self-directed investors by excluding investors with a financial advisor or fund share above 50%. This approach excludes smokers' potential higher demand for delegation as a pre-commitment device, which has been found in the recent literature[9]. Our analysis leaves us with 13,644 investors who make a total of 8 million credit and debit card transactions. The remaining investors can be described as follows: The average investor included in our sample is 50 years old and holds a portfolio of €51,927. The average investor is married (52%) and male (89%). Half of the investors work as employees (50%), while 10% are retired and 20% are self-employed. The average investor has a risk aversion score of 3.9, which is measured on a scale from 1 (indicating low risk) to 5 (indicating high risk). These descriptive statistics are closely comparable to those reported in household finance studies based on US data (cp. Odean (1998); Barber and Odean (2001)). Brokerage clients are generally expected (Cole, Paulson, and Shastry (2014)) and found to be more sophisticated than the overall population (Dorn and Huberman (2005)). Therefore, it is not surprising that 5% of our investors hold a doctoral degree. This value is higher than that of the German population (1.1%, German Federal Bureau of Statistics (2011)). The average investor in our

[9] The usage of commitment saving products is a popular and successful method to cope with self-control issues as shown by Thaler and Benartzi (2004). They demonstrate that the saving rates of employees increase from 3.5% to 13.6% after a firm switched to the so-called "save more tomorrow plan", in which people pre-commit parts of future salary increases to savings. Ashraf, Karlan, and Yin (2006) offer a commitment product with individually determined and subsequently unchangeable restrictions to 710 randomly chosen clients, of whom 28.4% ultimately subscribed to the product. Clients in this treatment show a 81% higher average savings balance after twelve months relative to the control group. In a recent experiment in India, Schilbach (2019) offers cycle-rickshaw drivers with alcohol problems financial incentives for sobriety and shows that they are willing to forgo unconditional monetary payments to set commitments for sobriety. Specifically considering smokers, Giné, Karlan, and Zinman (2010) show that they are willing to use costly contracts as a pre-commitment device and pay monthly deposits into a savings account that returns the money after six months if they successfully quit and donates the money accumulated in the savings account to a charity if they fail.

sample trades in 32.11% of months per year, approximately 4 months. The average turnover per month is 6.45%, and the average trade size conditional on trading is approximately €3,550. The monthly turnover is comparable to the monthly turnover reported by Barber and Odean (2001) for US brokerage clients (6.5%).

[Insert Table I about here]

Investor panel data sets based on administrative data are usually subject to the concern that they only observe play money accounts. To address this concern, we compare average portfolio values to official statistics. Deutsche Bundesbank (2013) reports an average portfolio value of a German stock market investor that is roughly in the same majority group as the average portfolio value in our sample which therefore seems to be comparable.

4.3 Survey data on smokers in Germany (SOEP)

We use the SOEP (version 33), which currently surveys approximately 30,000 individuals in approximately 11,000 households annually (Goebel et al. (2019)). The SOEP, which is nationally representative, is a longitudinal study of private households in Germany. The SOEP contains individual information on smoking status and a set of control variables for labor market, health, and socio-demographic information. The interviews take place at home, and participants are ensured anonymity. Both factors encourage people to disclose their addiction to smoking. We restrict our selection of variables available for individuals and choose demographic variables that are comparable to the demographics of the online brokerage sample. We include life satisfaction, worries about finances or health, willingness to take risks, personal impulsiveness, and sociability to analyze whether/how smokers differ in their preference structure. Additionally, we include examples (e.g., alcohol) of self-control failure to show whether individuals already failing in self-control are also prone to further failures.

Using these data allows us to compare the demographics of the investors identified as smokers with a representative reference control sample of smokers in Germany and to analyze whether further demographic variables affect the likelihood of being a smoker and whether smokers in our setting are

representative of the average smoker. Moreover, this analysis also contributes to the verification of our strategy to identify smokers from transactional price data.

4.4 Market and additional data

Some additional data are collected to distinguish the effects of self-control failure from other known investment biases. The reason we need these data items will be discussed in detail in the relevant section with alternative explanations.

Data that relate to corporate announcements stem from Thomson Reuters Eikon. We include corporate announcements for any stock for which we observe more than 50 trades in our sample. This provides us with slightly more than 5,000 different international stocks. We find data on earnings announcements for roughly 1,300 of them on Eikon. The measure we use is simply the total number of corporate announcements per day. Alternative aggregation methods such as value weighted (by market cap) or scaled by the total number of stocks in the previous year to control for a mechanical increase in sample size do not affect the results. Thus, we opted for this straightforward, simple specification.

Market data for computing the attention/anchoring measures according to Li and Yu (2012) requires data on a major stock market index. As they focus on the US, they use the Dow Jones. Our investors mainly come from Germany and have a home bias. Hence, instead of using the Dow Jones Index, we use the German DAX, which is the major stock market index in Germany and hence the closest proxy to the Dow Jones. It is widely known and featured in major television news at 8 am every day. The data for the DAX are obtained from Thomson Reuters Financial Datastream.

Additionally, data on gambling in state lotteries come from Lotto Germany. They provide us with data on betting amounts and jackpots for each individual draw of the two most popular lotteries in Germany: Eurojackpot and Lotto. Jackpots for Eurojackpot (Lotto) vary between 10 (0) and 90 (33) million and betting amounts are highly correlated with jackpots ranging between 14 (19) and 100 (67) million. The mean jackpot is 22 (6) million and the mean total betting amount is 29 (42) million.

Finally, information on peers is computed based on investors in our sample of 113,000 investors who live within a 50-kilometer diameter of each investor in our analysis. Distances are computed based on

zip codes. Data on the geographic coordinates come from the "opengeodb". Peer effects, of course, exclude the trading of the investor for which we compute the peer effect, following the procedure of Ivković and Weisbenner (2007).

5 Results and discussion

5.1 Identifying smokers and their demographics

The fraction of purchases identified as cigarettes per year is summarized in figure I for 2016 and 2017. Both charts rule out the idea of having a regular instalment of the same size as the multiple of the price of a cigarette pack, as we do not find peaks at two, four, or twelve. We identify a median of 10 cigarette purchases per year per identified smoker. This number appears to be relatively low compared to the smoking habits of the average smoker but there are two potential explanations for this. First, we identify smokers by the most common multiple price of a cigarette pack, which does not represent overall cigarette purchases. While a smoker might purchase, e.g., two packs of cigarettes five times while also purchasing one pack three times and three packs four times, that are all of the same brand, we code this individual as making twelve cigarette purchase transactions in our analysis to reduce computational burden. However, this choice does not affect our qualitative results. Second, although the vast majority of Germans possess a credit or debit card, they still prefer to purchase with cash (Brancatelli (2019)). The 13,644 individuals in our sample make approximately 2.76 million point-of-sale purchases with their credit or debit card over our sample period of approximately six years. Table I shows that the average individual uses his/her card approximately 200 times a year. The median is 14. Compared to the general use of credit and debit cards in point-of-sale purchases, the number of cigarette purchases seems reasonable.

[Insert Figure I about here]

With our initial approach, we identify 3,553 people as smokers. This means that the share of smokers is 26% (table I). This value is comparable to the value reported by the OECD, which reports a smoker share of slightly above 20% for Germany (Statista (2018)). However, the OECD report refers to smokers as those who smoke daily. We compare the marginal effects on smoking in men and women of different

age groups (figure II, number 1). The figures change only slightly and not qualitatively when we control for the total set of control variables we introduced in the data section (number 2). We find more male than female smokers under the age of 35, but the sexes converge after age 45. The propensity to smoke is highest for males below 25 and for females between 25 and 35 and decreases for both between 35 and 45. Comparing those results to federal statistics (Piontek et al. (2016)) reveals that our identified sample accurately reflects German smokers in terms of age groups and gender. Additionally, running and generating the same figures for the SOEP data reveals comparable trends in smoking across gender and age groups (numbers 3 and 4).

[Insert Figure II about here]

We continue by briefly discussing the anatomy of a smoker as the individual representing an investor with self-control failure in our sample (table II, columns 1 and 2) and comparing our findings to analyses of smokers from the SOEP, which we present in columns 3 and 4.

In a linear probability model, we find smokers identified in our brokerage data to be younger, more likely to be male, and more likely to be married. Rgarding occupation, smokers are typically not employed as civil servants, self-employed, or unemployed but work as employees or are retired. These findings are comparable to several federal statistics and represent the average German smoker. Because the average smoker pays €1,800 per year for cigarettes, smokers should have a lower net worth than nonsmokers (see e.g., Zagorsky (2004)). We find evidence that smoking does not affect financial investments like it affects general expenses, suggesting that smoking affects consumption and cash holdings rather than the investment portfolio. In fact, smokers have higher portfolio values than nonsmokers. Surprisingly, we find smokers to be significantly more risk averse in financial decision making; however, the following paragraph will show that these findings are consistent with the SOEP. We do not find holding a doctoral degree to affect the propensity to smoke. We control for financial literacy in the same linear probability model (column 2) and find smokers to be slightly more financially sophisticated than nonsmokers but this coefficient is not significant. We measure financial sophistication using a survey administered to 10,000 investors randomly drawn from our sample. Investors had to answer three major questions about financial literacy alongside their self-assessment

and questions on ambiguity aversion. Completing the survey took three minutes, and people participated in a lottery with an expected value of five euros to incentivize participation. We had 997 investors who completed the survey, of whom 160 are in our sample. We use the score of correct answers to the big-three literacy questions as our measure of financial literacy.

[Insert Table II about here]

Comparing those finding to similar demographic variables in the SOEP reveals that the smokers in our sample are representative of the average German smoker (table II, column 3). Smokers in the SOEP are also younger, more likely to be male, more likely to be employed, and have slightly higher risk aversion. We also do not find smokers to have significantly different salaries. This appears surprising at first glance, because smoking is costly. However, the effect becomes statistically significant and negative when we do not include years of education, which signals that smokers earn less because they have had less schooling and now have lower paid jobs. However, having fewer education years does not affect financial literacy. We include different variables for the willingness to take risks to disentangle the risk preferences of smokers, as economists typically attribute variations in addictive behavior among otherwise similar individuals to differing risk preferences (column 4). Knowing the negative consequences, the decision to smoke is a phenomenon caused by the higher risk-appetite of smokers which is an innate characteristic of addictive individuals (e.g., Khwaja, Sloan, and Salm (2006)).

In line with this idea and intuitive expectations, we find that smokers report a higher willingness to take risks in general and related to their health in particular. The finding of smokers being significantly more risk averse in financial decision making, however, is also supported in the SOEP. While the literature mainly focuses on the perception of health risks and shows that smokers underestimate their health risks relative to nonsmokers (e.g., Weber, Blais, and Betz (2002), Weinstein, Marcus, and Moser (2005)) and show a higher willingness to take risks in general, no study to our knowledge examines smokers' willingness to take risks in a financial context. The lack of clear evidence of the reasons for the higher willingness to take risks in general and less risks in financial matters leaves room for speculation. Khwaja, Sloan, and Salm (2006) use the Health and Retirement Study and show that smokers are more risk tolerant in general but more pessimistic about future macroeconomic events, which reinforces their

preference for current consumption. This finding might be combined with the findings of Malmendier and Nagel (2011) showing that the experience of macroeconomic shocks affects the willingness to take financial risks. However, if smokers are aware of their predisposition to fail and are anxious about further failures, for which their willingness to deploy commitment devices may be some evidence (e.g., Laibson et al. (1998)), they may also decrease their risk taking in financial matters to balance their overall risk-taking in life. Given these considerations, they substitute their higher willingness to take risks in general by taking fewer risks in their financial investments. While we believe that this is an interesting insight on its own, discussing and researching reasons for this behavior is beyond the scope of this paper and should be examined by future research.

We do not find a significant effect of smoking on the willingness to take risks while driving which is used as a measure of sensation seeking by Grinblatt and Keloharju (2009) suggesting that sensation seeking is not a driver of smoking and is therefore unrelated to it. However, as the traffic rules in Finland and Germany are different and there is no speed limit on German highways, it might be difficult to compare their results to ours. Thus, a search for sensation could still be the driver of overtrading in our results, and in a subsequent analysis, we will distinguish self-control failure from the search for sensation. In line with our conjecture that smokers are more impulsive, smokers significantly report themselves as being impulsive. While Room (2004) argues that smoking and alcohol abuse are complementary behaviors, we do not find that the consumption of alcoholic beverages predicts smoking. Moreover, we also did not find obesity to predict smoking.

5.2 Self-control and trading activity

We sort investors into monthly turnover terciles from low to high, as shown in figure III. The classification indicates that turnover increases from tercile one to tercile three. Along with the increase in turnover, the share of smokers in each bucket also increases monotonically. This increase is independent of the sorting procedure and documents the correlation between turnover and smoking. In tercile one, slightly more than 20% are smokers, whereas in tercile three, roughly 30% are smokers. This provides a descriptive evidence that smokers are prone to trading more.

[Insert Figure III about here]

More formally, table III reports pooled cross-sectional regression results with year fixed effects that explain three measures of trading behavior, including a smoker dummy variable as a proxy for self-control failure. All specifications include year fixed effects and a set of control variables. Note that a dummy for male is already included in this set of control variables. Column 1 shows the regression for the variable *months with trades*, which is equal to one when an investor makes a trade in a given month. The number of months with trades significantly increases by 1.34% (0.16 months) per year for investors who smoke. Thus, the average number of months with trades increases from 3.85 months per year (table I) to 4.01 months per year. This is equivalent to an increase in months with trades of 4.15% and is consistent with evidence in psychology that investors with self-control failure are prone to impulsive purchasing behavior. We also find that lacking self-control is positively related to *monthly turnover* (column 2). The monthly portfolio turnover of smokers is 0.57% (6.84% p.a.) higher than that of nonsmokers. In other words, the monthly portfolio turnover for all investors increases from an average value of 6.45% (77.4% p.a.) (table I) to 7.02% (84.24% p.a.) which is equal to an increase of 8.8% in turnover when an investor is a smoker.

[Insert Table III about here]

To determine whether smokers trade more but less volume, we utilize the same regression for the proxy *trade size* (column 3). In line with our findings for months with trades and monthly turnover, smokers are not only more likely to trade with higher turnover but also more likely to trade in larger volumes once we control for portfolio size. The average trade size of €3,551 (table I) increases by €288 to €3,839 conditional on trading. This is equivalent to an increase in portfolio size by 8.11% when an investor is a smoker. Both the size of the trade and the number of trades support the conjecture that smokers trade more. Because turnover is the standard measure in this respect in the literature, we focus on turnover in our subsequent analysis. Using the other measure yields the same conclusions. Note that the magnitudes for smokers are more than fourth of those for male investors for months with trades and more than half the size for turnover but roughly fivefold for trade size. In all specifications, self-control is highly statistically significant despite controlling for male investors. Our results are in line with psychology

(Baumeister, Heatherton, and Tice (1994)), and the idea of the dual-self model, indicating that individuals with self-control failure tend to be less able to resist impulses to trade. Therefore, and in line with the psychology literature and expectations, a lack of self-control appears to increase the trading volumes of private investors.

We conduct an additional specification in which we analyze whether the trading volumes of smokers are driven by higher liquidity needs (table IV). Therefore, we disentangle the monthly turnover into *buy turnover* and *sell turnover* and compute it for investor *i* for month *t*:

$$Buy\ turnover_{i,t} = \frac{purchases_{i,t}}{portfolio\ value_{i,t}} \tag{3}$$

$$Sell\ turnover_{i,t} = \frac{sales_{i,t}}{portfolio\ value_{i,t-1}} \tag{4}$$

We include the same control variables as in the specifications in table III. We find that smokers have a significantly higher buy and sell turnover. The monthly buy turnover is 0.69% (8.28% p.a.) higher than it is for nonsmokers, whereas the monthly sell turnover is 0.45% (5.4% p.a.) higher than for nonsmokers. Including sell turnover as a control variable in the specification for buy turnover reveals that sell turnover predicts more than 63% of buy turnover. This suggests that turnover is driven by active trading decisions and re-balancing within the portfolio, as securities that are sold are likely replaced by new ones that are bought. Liquidity needs, or the effect of higher savings seem to play a smaller role in our findings.

We find our results to be qualitatively unaltered when using *discretionary buy turnover* and *discretionary sell turnover*, which exclude any trades coming from savings plans or limit orders.

[Insert Table IV about here]

Overtrading is usually considered to be the consequence of overconfidence caused by a gender gap. Barber and Odean (2001) show that females are far less prone to overtrading than males. Self-control failure might thus only be a different version of overconfidence. Two arguments contradict this view. First, in all of our regression specifications, we include a male dummy and the results for smoking persist. Second, while it is true that males are more prone to smoking, the correlation between being a

smoker and being male is low (0.027). To shed further light on this issue, we run an additional analysis (table V) on monthly turnover for self-directed female investors (column 1) and self-directed male investors (column 2). We find the effect of smoking for females to be approximately the same size and statistically significant. Monthly portfolio turnover increases by 0.48% (5.76% p.a.) for female investors who smoke and by 0.58% (6.96% p.a.) for male investors who do. This result suggests that self-control is not synonymous with overconfidence.

[Insert Table V about here]

5.3 Is the effect of self-control explained by known predispositions?

Next, in table VI, we assess the argument that smoking is merely another measure of social contagion, attention, or sensation seeking. We utilize the same regressions on monthly turnover as in table III and report the results of specifications that include control variables for each alternative explanation and a specification that includes all alternative explanations.

As previously shown, overtrading is usually considered to be the consequence of overconfidence. We find the effect of the male dummy on monthly turnover to be large, positive and significant (column (1)). However, the smokers dummy remains statistically significant and half the size of the male dummy.

Some people (especially those who smoke) have claimed that smoking is a sociable activity. If smokers are indeed more sociable, they might be more susceptible to social contagion and peer effects might hence explain why smokers trade more. To rule out this conjecture we control for social contagion in column (2) by including peer effects on individual zip code levels following Ivković and Weisbenner (2007). With a one-percentage point increase in monthly turnover of peer portfolios within a 50-kilometer diameter, the monthly turnover increases significantly by one-third of a percentage point, which indicates that peer effects do matter. While this is true, the effect of self-control remains stable even after including peer-effects in our regression models[10].

[10] In unreported analysis, we also analyze whether our results are driven by smokers living in urban regions rather than in sparsely populated areas. We find that smokers are more likely to live in urban regions. However, including

Another concern is that smokers might be more easily attracted by salient information and trade more on attention-grabbing events than nonsmokers. If this were true, the higher turnover might be due to smokers' trading far too much in response to attention created by salient information. We establish two measures of attention. First, we follow Hirshleifer, Lim, and Teoh (2009) and measure the media coverage of firms by the number of corporate announcements (column 3) as attention triggers. Second, we follow Li and Yu (2012) and measure the over- or underreaction to large price movements or trends in the stock market (column 4). We find a significant and negative effect of closeness to the 52-week high on monthly turnover, whereas closeness to historical high, and the days of a new 52-week high or the day of a historical high significantly increase the monthly portfolio turnover. The effect of the number of corporate announcements on monthly portfolio turnover is also statistically significant and positive. In both specifications, the estimate for smokers remains qualitatively unaltered.

As drug addiction is also a prime example of sensation seeking, defined as search for intense experiences typically accompanied by physical or financial risks[11], the differences in trading activity might be due to this phenomenon rather than to lower self-control. Grinblatt and Keloharju (2009) analyze the impact of sensation seeking on trading activity by using speeding tickets as a proxy for sensation seeking. Since we do not find significant effects of a higher willingness to take risks while driving for smokers than for nonsmokers in the SOEP data (table II, column 4), smokers might not be strong sensation seekers. Speeding tickets may not serve as an excellent proxy in Germany because there is no speed limit on highways. Instead, we use the propensity to hold lottery stocks as a direct measure of gambling tendencies in portfolio allocation to shed light on this issue (column 5). If smokers are indeed more prone to be sensation seekers, they should have a higher propensity to hold lottery-like products. As an alternative measure of gambling, we use jackpots and lottery bets of the two largest German lotteries and analyze the impact on the trading behavior of smokers (columns 6 and 7). Gao and Lin (2015) and Dorn, Dorn, and Sengmueller (2014) argue that individual investors use lotteries as a substitute for trading in individual stocks and options, finding that trading activity decreases in these

an urban dummy in our analysis does not change the significance of our coefficient, and the interaction term between the smoking dummy and the urban dummy is not statistically significant.

[11] For a review of the sensation seeking literature, see Zuckerman (1994).

products when the jackpot is high. Hence, smoking should no longer be significant if smokers were indeed merely sensation seekers. We also find a significant and negative effect of lottery stocks on monthly turnover (Dorn, Dorn, and Sengmueller (2014)). A one-unit increase in lottery stocks decreases the monthly turnover by 0.08% (0.96% p.a.). Consequently, regarding the effects of lotteries, we find a decrease in turnover when lottery jackpots or bets increase[12]. However, the smokers' coefficient remains nearly stable and significant at 0.6%. Self-control failure is hence more than a synonym for gambling preferences.

Simultaneously controlling for all predispositions (column 8) does not affect our results or the conclusions we have drawn thus far. Self-control failure has an effect that goes beyond known and well-researched biases. The effect of smoking throughout all specifications never becomes insignificant and remains in the neighborhood of the 0.68% higher monthly turnover (8.16% p.a.) as presented in column 8.

[Insert Table VI about here]

5.4 Is self-control failure aggravating other behavioral predispositions?

Although the effect of self-control failure is not explained by the alternative measures, it is possible that the effects of the behavioral predispositions loom larger for investors who are already subject to a predisposition and simultaneously exhibit self-control failure. We test this idea by examining whether there is a larger effect on a predisposition for smokers than for nonsmokers. To do so, we interact the smoker dummy with each behavioral predisposition. This interactive effect will then directly indicate whether a predisposition looms larger for smokers. We show the results in table VII.

We find that male investors have a higher turnover when they also smoke (column 1). For clients with self-control failure, the effect of overconfidence on monthly turnover is 0.54% larger. The effect of social contagion on monthly turnover is positive and statistically significant for nonsmokers (column 2). The effect on monthly turnover doubles in size for clients with self-control failure, indicating that

[12] Using announced jackpots or lottery bets does not change the results because the correlation between both measures is very high.

smokers are more likely to be affected by their peer groups. Thus, investors with self-control failure are more likely to talk with others about financial investments and/or are less able to resist the impulse of trading when others do. The aggravating effect of self-control failure on attention triggers becomes obvious when analyzing corporate announcements and days of historical highs in the DAX, which usually receive media attention. The general impact of corporate announcements on monthly turnover is positive and statistically significant (table VI, column 3). However, the effect of corporate announcements on monthly turnover for nonsmokers is negative (table VII, column 3). Thus, the effect of attention on monthly turnover seems to be mainly driven by smokers, for whom the effect is positive and statistically significant and who are triggered by the news. We also find a statistically significant effect of days of historical highs on monthly turnover for investors with self-control failure, which is 0.59% larger (column 4). The effect of days of historical highs on monthly turnover is approximately twice the size as it is for nonsmokers. The findings on social contagion, corporate announcements, and days of historical highs indicate that self-control failures aggravate the effect of attention triggers on monthly turnover.

According to Dorn, Dorn, and Sengmueller (2014), the effects of gambling preferences on portfolio turnover are not straightforward. The turnover in lottery-like stocks decreases if jackpot amounts in the US and Germany increase. Applied to our setting, this means that the most important effect comes from the jackpot size. If jackpot sizes increase, trading in lottery stocks becomes less attractive, and investors with a gambling preference (who hold lottery stocks) would rather participate in the state lottery and refrain from gambling in the stock market. Consequently, jackpots and lottery stocks will have a negative effect on turnover. If self-control failure had an aggravating influence on sensation seeking and gambling preferences, the effects described above should become stronger. Hence, we would expect that increasing jackpots would make more investors withdraw from securities trading, whereas smaller jackpots would induce investors with self-control issues to gamble in the stock market.

To test this expectation, we interact the jackpot size, the dummy for lottery stocks, and the dummy for smoking with each other. Table VIII summarizes the results of this exercise. Column 1 uses no controls for the other predispositions, whereas column 2 controls for them. The results are not qualitatively

affected by these controls. We find that smoking aggravates the trading impact of lottery stocks if we control for the effect of jackpot sizes. The same holds for jackpot size. The negative effect of increasing jackpot sizes on turnover is larger for smokers than for nonsmokers. In fact, the negative overall effect we find seems to be driven by people with self-control failure. For those investors who own lottery stocks, there is always a complementarity between jackpot size and lottery stocks. Smoker status seems to play less of a role in this context.

[Insert Table VIII about here]

The interactive effects of self-control failure and behavioral predispositions reveal that predispositions loom larger for clients with self-control failure. Self-control failure aggravates the effects of trading on attention triggers and sensation seeking, indicating that self-control failure reduces the ability to resist salient information, causing an impulse to trade.

5.5 The effect of self-control failure on performance

To evaluate the investment performance of smokers and nonsmokers, we calculate the gross and net return for each client. To do so, we follow Bhattacharya et al. (2012) and compute daily portfolio performance, combining security holdings and transaction data with market-level data from Thomson Reuters Financial Datastream. We compute both gross and net returns. Gross returns are computed before any transaction-related costs, such as brokerage fees or front-end loads but after management fees. Net returns include all costs applicable to the transactions. Fees for holding a portfolio are generally zero. We average this portfolio performance for the 2012 to 2018 observation period.

We run three cross-sectional regressions controlling for gross return, net returns, and the difference between gross and net returns. All returns are measured on an annual basis. We use the standard set of control variables plus the standard deviation of the gross returns per client to control for different levels of risk-taking. We are only interested in the differences between the two returns. Because the difference is computed within clients, the effects of different market climates or personal investment styles and skills are removed. In contrast, using alphas would not control for those styles or market climates and might bias our results. While 4-factor alphas lead to qualitatively comparable results, we present results

for differences in returns only. We find that both the gross return and net return are lower for smokers than for nonsmokers. However, neither coefficient is statistically significant, but we note that the coefficient for smokers becomes more negative for net returns. We then compute the difference between gross and net returns per person. This difference between gross and net returns is statistically significant and larger for smokers. Thus, self-control failure is costly because smokers have a 1.76% larger gap between gross and net returns per year than nonsmokers. Since self-control failure increases trading volume, this result is in line with the findings of Barber and Odean (1998). Trading more does not coincide with an increase in gross returns; hence, the elevated trading volume only generates trading costs, which is evidenced by the significantly different gap between gross and net returns for smokers. Note that the same effect also applies to male clients, who are usually associated with overtrading.

6 Robustness

6.1 Savings plans

Regarding the connection between self-control and financial decision making, the most widely researched self-control failure is spending money that one previously assigned to savings or that one does not even possess (Gathergood (2012)). In general, higher self-control is positively correlated with savings (e.g., Romal and Kaplan (1995)). In a theoretical model of self-control and saving decisions, Laibson et al. (1998) show that hyperbolic consumers (who are associated with lower self-control) should be more responsive to savings devices. The usage of such devices is then particularly beneficial for such investors and results in larger saving and welfare effects. In contrast to being theoretically beneficial, Howlett, Kees, and Kemp (2008) show in an experimental setting that individuals are less likely to enroll in a 401(k) plan when they lack self-control.

Almost all investors in our sample have positive savings and participate in the stock market. Thus, we observe a sample of present-biased clients that have made the more long-term decision to save. However, following the theoretical models and experimental evidence, it is reasonable to assume that investors with a self-control failure in our sample should differ in their savings patterns from investors

without a self-control failure. We expect smokers to be willing to save in the same way as nonsmokers or even more but to experience difficulty in maintaining their decision.

We analyze the savings plan use of our investors to reveal the savings patterns of investors with self-control failure. Savings plans are a common instrument in Germany [13] that are usually used for long-term saving goals in which clients save a self-determined amount each month and invest it in an eligible self-selected security that might be a mutual fund, ETF, single stock, or investment certificate. Savings plan users generally chose actively managed funds or ETFs. Savings plans require a monthly saving rate of at least €25 and are completely flexible, as the client can start, change, skip, or cancel their use at any time and with no additional costs. Clients can open several savings plans at the same time on different securities, and banks usually offer special discounts for a set of ETFs and mutual funds in the savings plan context, which usually means reduced or waived initial charges. The intention of saving plans is long-term wealth accumulation while making use of a potential cost-average effect. It is therefore rational to maintain a previously opened savings plan.

We determine *savings plan usage*, *number of months with savings plans*, and *savings plan contributions*. Each transaction is labelled regarding whether a purchase has been made as part of a savings plan. Savings plan usage is a dummy variable equal to one if an investor makes one or more savings plan purchases after 1 January 2012. The number of months with savings plans is the total number of months during which an investor contributes to a savings plan and savings plan contribution is the average monthly contribution in euros made by savings plan users. We use these variables as dependent variables and run the estimation with the same set of explanatory variables as in the main analysis presented in table III. We report the results in table X.

We find that smokers exhibit a significantly higher probability of using savings plans (8.76%, column 1). Whereas 26% of all clients use savings plans, the corresponding figure for smokers is 34.76%. This is equivalent to a 33.7% increase. Smokers also have a higher contribution to savings plans of €155.95 per year (€13 per month) (column 3). This is an increase from €430.67 to €586.62 in comparison to

[13] Savings plans are comparable to 401k plans in the US. However, there is no employer sponsored component of the former, and hence, German savings plans have no tax advantages over direct investments in the respective securities.

non-smokers (equivalent to a 36.2% increase). Although the effect on trade size is economically large, it is not statistically significant. Smokers show adherence (make contributions) to a savings plan over significantly fewer months (column 2). In other words, smokers contribute 1.5 months less to savings plans than do nonsmokers, which is equivalent to a decrease from 35.71 months using savings plans to 34.21 months (equivalent to a 4.2% decrease) using savings plans over our 78-month sample period. Note that we cannot determine whether a contribution belongs to a given savings plan. Hence, smokers may terminate savings plans even earlier but then open a new plan. Consequently, our estimates are likely to underestimate the probability of savings plan termination. This provides strong evidence that clients with self-control failure are willing to save money but fail to maintain their plans when given the opportunity to opt out of them. The higher willingness to opt for saving plans might be the smokers' search for self-commitment to address their shortcomings. However, their lower ability to maintain these plans is a further indicator of self-control failure, decreasing the capability to resist the impulse to act.

[Insert Table X about here]

6.2 Alternative identification of smokers

Although misclassifications work against us, as outlined in section 3.1, we use a robustness check to test whether our results hold when we use a much more restrictive definition of smokers. Here, instead of using two transactions, we now move to a threshold of 10 cigarette purchases per year to identify smokers with above-average cigarette purchases. Conditional on being a smoker, we find that 10 cigarette purchases is the median value of purchases per year. This identification strategy has the advantage of reducing the risk of inadvertently classifying someone as a smoker.

Repeating the analysis with this alternative definition of smokers leads to qualitatively unaltered results. This finding also shows that potentially misidentified smokers would not bias our results. As effect sizes remain qualitatively unaltered, we can identify whether someone is a smoker but not necessarily whether he or she is a heavy smoker, i.e., suffers more from present bias.

[Insert Table XI about here]

6.3 Restricting to main accounts

A reasonable alternative explanation for our results might be that investors who engage in many transactions by using their credit or debit cards also tend to engage in many transactions in their portfolios because the accounts we are observing are their main accounts. Investors with a large number of credit card transactions are likely to have multiple transactions per year that would be classified as cigarette purchases, such that high-transaction individuals are more likely to be classified as smokers. Thus, there could simply be a person-level effect whereby some people who use their accounts more extensively are also more likely to engage in securities trading, simply because they do not maintain other banking arrangements.

We restrict our sample to investors using their bank account as the main account. It is reasonable to assume that individuals mainly use the cards for the accounts into which their salaries are deposited. Therefore, we classify investors as main-account users if they receive their monthly salaries in these bank accounts and repeat the analysis of trading patterns.

All coefficients are highly statistically significant for the smoker variable. Compared to our main analysis, the effects become stronger and roughly double in size. Our results are therefore robust to differences in bank usage between investors and support the idea that we are misclassifying some smokers as non-smokers.

[Insert Table XII about here]

7 Conclusion

Even among wise men and women, there is no doubt that self-control is vital and that self-control failure affects human well-being in various ways. Nevertheless, little is known about the impact of self-control on trading patterns because self-control has been a difficult-to-measure determinant in empirical settings. We clearly identify self-control failure in our empirical data set by analyzing purchases of tobacco products to identify smokers, who are the prime example of hyperbolic discounters.

We show that investors with self-control failure tend to engage in overtrading. We distinguish the effects of self-control from a set of alternative biases that includes sensation seeking, attention, social

contagion, and overconfidence. In fact, self-control failure aggravates the effects of such behavioral predispositions on overtrading. Therefore, we argue that self-control failure is an additional but previously unidentified factor driving investment and, in particular, trading behavior. This finding shows that self-control failures have effects on individuals beyond under-saving and non-participation. Future research may analyze whether and to what extent individuals failing in self-control recognize their predispositions and how they address their shortcomings (e.g., by using commitment contracts).

This paper reveals that big data analyses in one domain may be useful to help and potentially mitigate the consequences of such predispositions in another domain. Businesses could, for example, attempt to prevent people with self-control failure from costly overtrading. However, policy makers and regulators should ensure that business practices based on these insights do not exploit this informational advantage to deceive clients.

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Figures

Figure I. Cigarette purchases made in 2016 and 2017

This bar chart presents the fraction of cigarette purchases made with a debit or credit card in (1) 2016 and (2) 2017 for investors identified as smokers. A smoker is defined as a person who purchases two or more tobacco products per year during the observation period from January 2016 to June 2018. Investor data are obtained from one of the largest German discount brokerages, while cigarette prices are obtained from a German supermarket chain.

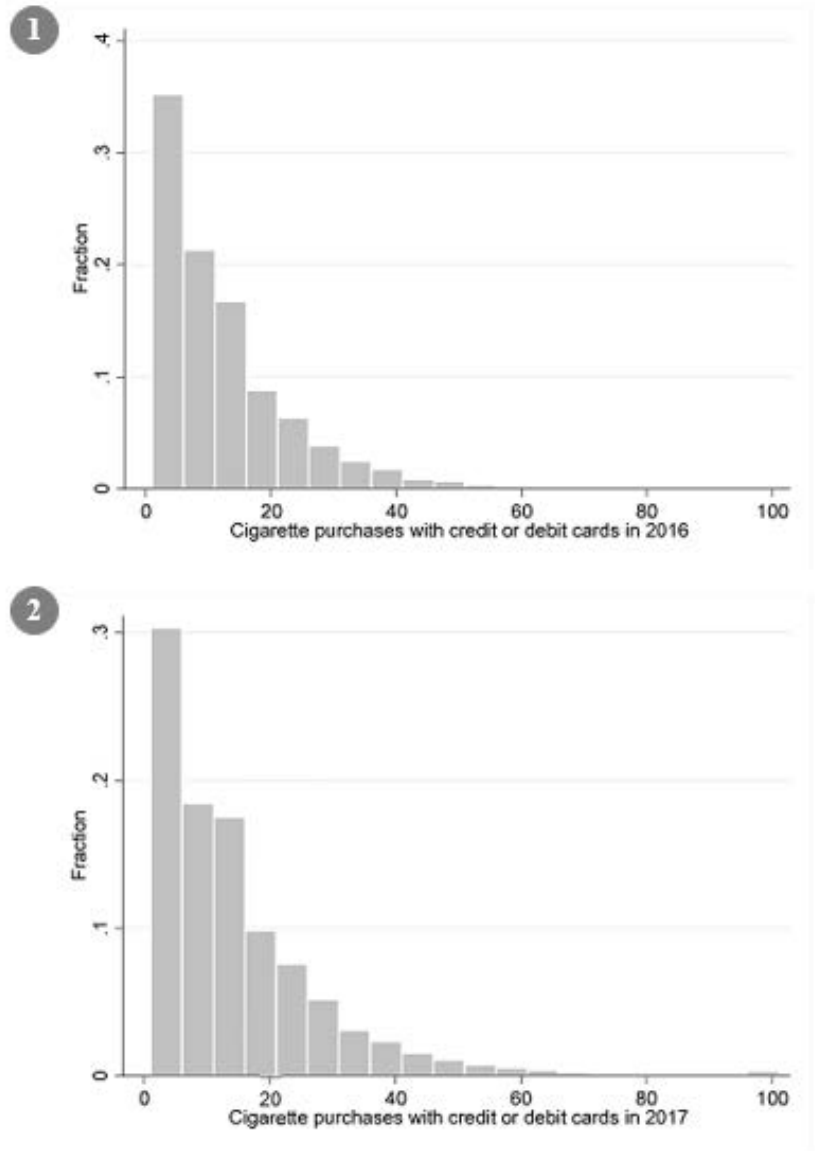


Figure II. Marginal effect on smoking

This chart presents the marginal effects on smoking for males and females in different age groups. A smoker is defined as a person who purchases two or more tobacco products per year during the observation period from January 2016 to June 2018 in the online brokerage database in chart (1) and chart (2). As control variables, we include age, gender, the average portfolio value, the length of the relationship between a bank and client, dummy variables equal to one for investors who are married, who hold a PhD, who are employees, who are self-employed or who are retired, the level of client risk aversion (high = 1 and low = 5), and the financial literacy measured by a survey in chart (2). A client is defined as smoker in columns (3) and (4) if he/she reports smoking in the SOEP survey. As control variables, we include age, wages/salary from main job, gender, dummy variables equal to one for investors who are married and who are employees, and the level of risk aversion in financial matters (high = 1 and low = 10) in chart (4). Investor data are obtained from one of the largest German discount brokerages, and survey data stem from SOEP. We obtained the cigarette prices from a German supermarket chain.

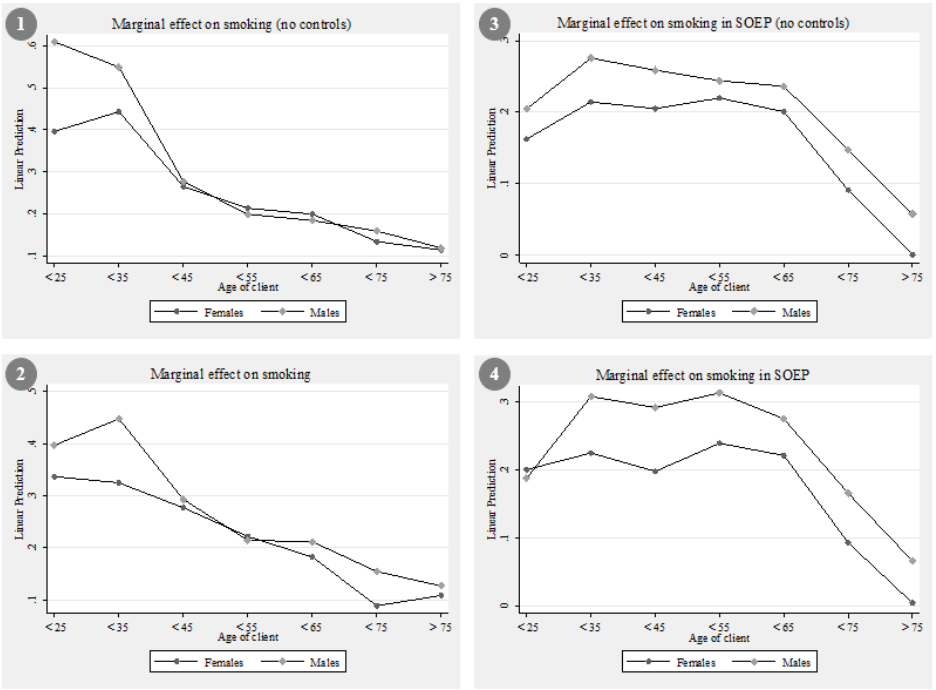
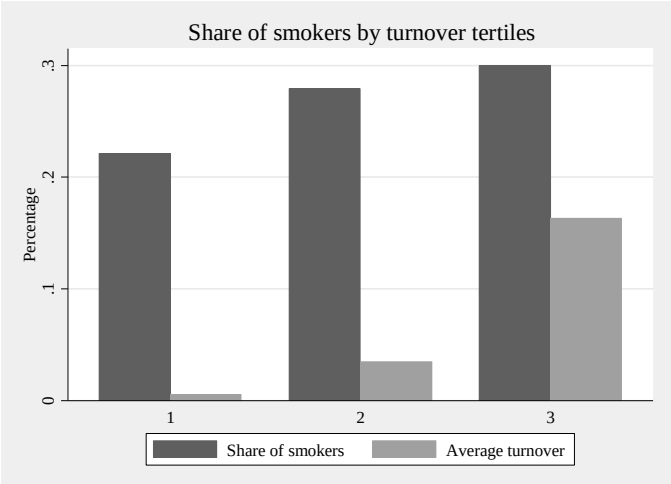


Figure III. Share of smokers by turnover tercile

This chart presents the monthly turnover and the share of smokers grouped by turnover tercile. Turnover is expressed in percentage points per month, and smokers represent the share of smokers in the respective group. A smoker is defined as a person who purchases two or more tobacco products per year during the observation period from January 2016 to June 2018 in the online brokerage database.



Tables

Table I. Investor data

This table presents summary statistics for our retail investor data as of the end of June 2018. We report socio-demographic information on the clients' smoking status (Smoker), age (Age), and marital status (Married), whether they are male (Gender), whether they hold a PhD (PhD), the length of their relationship with the bank (Length of relationship), the level of client risk aversion (high = 1 and low = 5), and whether they work as employees (Employed), are self-employed (Self-employed), or are retired (Retired). We also include information on their portfolio and trading behavior. All variables that require time-series for computation use the previous 12 months. Thus, we include the average portfolio value in euros, the number of months with trades in %, monthly turnover from the entire portfolio, the average trade size in euros, and the Herfindahl-Hirschman Index assuming a mutual fund to be equal to 100 securities. Moreover, we also report the savings plan usage, average number of months with a contribution to savings plans, and the savings plan contribution in euros. We finally show the average number of debit and credit card uses per year and per client. All data are obtained from the bank based on client ids. We include investors who make two or more ATM withdrawals or point-of-sale transactions per year and who reside in Germany. We focus on self-directed portfolios excluding delegating investors with a financial advisor or fund share above 50%.

	Mean	25th Percentile	Median	75th Percentile	Standard Deviation	Number of Observations
Socio-demographics						
Smoker (1 = smoker)	0,26	0,00	0,00	1,00	0,44	13.644
Age (in years)	49,70	40,00	49,00	59,00	13,49	13.644
Married (1 = married investor)	0,52	0,00	1,00	1,00	0,50	13.644
Gender (1 = male)	0,89	1,00	1,00	1,00	0,31	13.644
Ph.D. (1 = investor holds doctoral degree)	0,05	0,00	0,00	0,00	0,23	13.644
Income (in EUR)	51.285,55	30.000,00	50.000,00	80.000,00	24.685,15	13.644
Length of relationship between bank and client (in years)	12,52	12,00	12,00	13,00	3,93	13.644
Client risk aversion (high = 1 and low = 5)	3,87	3,00	5,00	5,00	1,52	13.644
Employed (1 = employed)	0,50	0,00	1,00	1,00	0,50	13.644
Self-employed (1 = self-employed)	0,20	0,00	0,00	0,00	0,40	13.644
Retired (1 = retired)	0,10	0,00	0,00	0,00	0,30	13.644
Portfolio, Trading & Card usage						
Portfolio value (average past 12 months, in EUR)	51.926,56	9.023,98	25.532,20	59.185,16	100.676,90	13.644
Months with trades (in %, per year)	32,11	7,14	23,90	51,28	29,09	13.644
Monthly Turnover (past 12 months, in %)	6,45	0,71	2,95	8,26	9,18	13.644
Trade size (in EUR)	3.551,03	649,29	1.863,49	4.196,46	6.575,46	12.303
Herfindahl-Hirschman Index (HHI, in %)	0,33	0,13	0,26	0,47	0,25	13.644
Savings plan usage (1 = user)	0,26	0,00	0,00	1,00	0,44	13.644
Number of month with contribution into savings plans (of 78 months)	35,71	13,00	30,00	57,00	26,11	3.601
Savings plans contribution (per year, in EUR)	430,67	95,39	175,87	372,46	2.426,04	3.601
Number of debit & credit card usages (per year)	196,76	2,00	14,00	148,00	430,76	13.644

Table II. Demographics of Smokers

This table presents results drawn from linear probability models explaining the demographics of smokers. The dependent variable is a dummy variable equal to one when an investor is classified as a smoker in the brokerage data in columns (1) and (2). A smoker is defined as a person who purchases two or more tobacco products per year during the observation period from January 2016 to June 2018 in the online brokerage database. As control variables, we include age, the average portfolio value, the Herfindahl-Hirschman Index assuming a mutual fund to be equal to 100 securities, the length of the relationship between a bank and client, gender, dummy variables equal to one for investors who are married, who hold a PhD, who are employees, who are self-employed or who are retired, the level of client risk aversion (high = 1 and low = 5), and financial literacy measured by a survey. A person is defined as smoker in columns (3) and (4) if he/she reports smoking in the SOEP survey. As control variables, we include age, salary from main job, gender, number of years of education, the level of risk aversion in financial matters (1 = high and 10 = low), dummy variables equal to one for individuals who are married, employed, have online banking, or are divorced, overall life satisfaction (1 = low and 10 = high), whether individuals report worrying about finances (1 = low and 3 = high) or health (1 = low and 3 = high), the degree of impulsiveness (1 = low and 10 = high), the willingness to take risks in general (1 = low and 10 = high), the willingness to take risks while driving (1 = low and 10 = high), the willingness to take health risks (1 = low and 10 = high), attendance of social gatherings (1 = low and 4 = high), beer consumption (1 = low and 4 = high), and body weight. The data in specifications (1) and (2) are obtained from the online bank at the client id level. We include investors who make two or more ATM withdrawals or point-of-sale transactions per year and who reside in Germany. We focus on self-directed portfolios excluding delegating investors with a financial advisor or fund share above 50%. The data in specifications (3) and (4) are obtained from the socio-economic panel survey (SOEP) in Germany. ***, **, and * indicate that the coefficient estimates are significantly different from zero at the 1%, 5%, and 10% levels, respectively.

	(1) Smoker (Online bank data)	(2) Smoker (Online bank data)	(3) Smoker (SOEP)	(4) Smoker (SOEP)
Age (in years)	-0.0083***	-0.0075**	-0.003***	-0.003***
	(0.0004)	(0.0038)	(0.000)	(0.001)
Average portfolio value (in EUR)	0.0074***	-0.0351		
	(0.0023)	(0.0295)		
Average Herfindahl-Hirschman Index (HHI)	-0.0504***	-0.1181		
	(0.0177)	(0.2015)		
Wages/ Salary from main job (in EUR)			-0.000	0.000
			(0.000)	(0.000)
Length of relationship (in years)	-0.0117***	-0.0178*		
	(0.0011)	(0.0093)		
Gender (1 = male)	0.0324***	0.2105*	0.053***	0.061***
	(0.0113)	(0.1171)	(0.012)	(0.014)
Married (1 = married investor)	0.0199**	-0.0300	-0.085***	-0.076***
	(0.0078)	(0.0794)	(0.013)	(0.013)
Ph.D. (1 = investor holds doctoral degree)	0.0032	-0.0525		
	(0.0155)	(0.1193)		
Number of Years of Education			-0.024***	-0.021***
			(0.002)	(0.002)
Financial sophistication (number of correct answers)		0.0189		
		(0.0328)		
Client risk aversion (high = 1 and low = 5)	-0.0315***	-0.0511**		
	(0.0026)	(0.0254)		
Risk aversion in financial matters (1 = high and 10 = low)			-0.002	-0.012***
			(0.003)	(0.004)
Employed (1 = employed)	0.0138	-0.0031		
	(0.0097)	(0.0948)		

Contd.

Contd.	(1) Smoker (Online bank data)	(2) Smoker (Online bank data)	(3) Smoker (SOEP)	(4) Smoker (SOEP)
Self-employed (1 = self-employed)	-0.0012	0.0913		
	(0.0114)	(0.1157)		
Retired (1 = retired)	0.1205***	-0.0382		
Employment Status of Individual (1 = employed)			0.065***	0.065***
			(0.017)	(0.017)
Online-banking (1 = has online banking)				-0.046***
				(0.013)
Overall life satisfaction (1 = low and 10 = high)				-0.013***
				(0.004)
Worried About Finances (1 = low and 3 = high)				0.013
				(0.010)
Worried About Own Health (1 = low and 3 = high)				0.011
				(0.010)
Personal Impulsivness (1 = low and 10 = high)				0.011***
				(0.003)
Peronal willingness to take risks (1 = low and 10 = high)				0.011***
				(0.003)
Willingness To Take Risks While Driving (1 = low and 10 = high)				-0.002
				(0.003)
Willingness To Take Health Risks (1 = low and 10 = high)				0.019***
				(0.003)
Attend Social Gatherings (1 = low and 4 = high)				0.014**
				(0.006)
Alcoholic Beverages: Beer (1 = low and 4 = high)				0.011*
				(0.006)
Body weight (kilograms)				-0.001***
				(0.000)
Divorced (1 = divorced)				0.126
				(0.125)
Constant	0.8323***	1.2334***	0.689***	0.597***
	(0.0318)	(0.3028)	(0.046)	(0.075)
Observations	13,644	160	5,184	5,116
R-squared	0.1001	0.2369	0.061	0.085

Robust standard errors in parentheses
**** p<0.01, ** p<0.05, * p<0.1*

Table III. The effect of low self-control on trading patterns

This table presents pooled cross-sectional regression results on months with trades, monthly turnover, and trade size. The dependent variable given in column (1) is a dummy variable for months with trades and is equal to one when an investor makes a trade in a month. The dependent variable in column (2) is the monthly portfolio turnover and is set to one (=100%) for a given month when the monthly turnover is larger than one. Trade size (3) is a variable for the absolute trade size in euros and measures the average absolute value per trade in a month with trade and treats purchases and sales equally. A smoker is defined as a person who purchases two or more tobacco products per year during the observation period from January 2016 to June 2018. As control variables, we include the client's age, the portfolio value (ln), the Herfindahl-Hirschman Index assuming a mutual fund to be equal to 100 securities, the length of the relationship between a bank and client, gender, dummy variables equal to one for investors who are married, who hold a PhD, who are employees, who are self-employed or who are retired, and the level of client risk aversion (low = 1 and high = 5). We include year fixed effects. ***, **, and * indicate that the coefficient estimates are significantly different from zero at the 1%, 5%, and 10% levels, respectively.

	(1)	(2)	(3)
	Months with trades	Monthly Turnover	Trade size
Smoker (1 = smoker)	0.0134***	0.0057***	287.4884***
	(0.0012)	(0.0004)	(28.2621)
Age (in years)	0.0017***	0.0003***	16.1583***
	(0.0001)	(0.0000)	(1.3312)
Portfolio value (ln)	0.0356***	0.0009***	1,255.6153***
	(0.0002)	(0.0001)	(13.5911)
Herfindahl-Hirschman Index (HHI)	-0.1987***	-0.0227***	5,305.3091***
	(0.0016)	(0.0005)	(73.6511)
Length of relationship (in years)	-0.0080***	-0.0019***	12.7460***
	(0.0001)	(0.0000)	(3.2077)
Gender (1 = male)	0.0473***	0.0109***	53.3416
	(0.0015)	(0.0004)	(32.6822)
Married (1 = married investor)	0.0024**	0.0012***	207.9454***
	(0.0011)	(0.0003)	(25.3334)
Ph.D. (1 = investor holds doctoral degree)	-0.0481***	-0.0141***	562.5597***
	(0.0022)	(0.0006)	(72.9654)
Client risk aversion (high = 1 and low = 5)	0.0477***	0.0097***	-131.3986***
	(0.0003)	(0.0001)	(8.7984)
Employed (1 = employed)	-0.0060***	-0.0039***	-245.3015***
	(0.0013)	(0.0004)	(34.0906)
Self-employed (1 = self-employed)	-0.0002	-0.0013***	174.6536***
	(0.0016)	(0.0005)	(44.9198)
Retired (1 = retired)	0.0237***	0.0031***	-314.3614***
	(0.0022)	(0.0007)	(48.2841)
Year fixed-effects	YES	YES	YES
Constant	-0.1668***	0.0151***	-11,828.6218***
	(0.0040)	(0.0012)	(131.5297)
Observations	803,624	803,624	347,329
R-squared	0.1225	0.0215	0.0988

Robust standard errors in parentheses
**** p<0.01, ** p<0.05, * p<0.1*

Table IV. The effect of low self-control on buy turnover and sell turnover

This table presents pooled cross-sectional regression results on buy turnover and sell turnover. The dependent variables given in columns (1) and (3) are the portfolio buy turnover. This is purchases of securities divided by end-of-month portfolio value. The dependent variable in column (2) is portfolio sell turnover. This is purchases of securities divided by beginning-of-month portfolio value. The dependent variables given in columns (4) and (6) are the discretionary buy turnover, which is calculated as the buy turnover but excludes any trades coming from saving plans or predetermined limit orders. The dependent variable given in column (5) is the discretionary sell turnover, which is calculated as the sell turnover but excludes any trades coming from saving plans or predetermined limit orders. A smoker is defined as a person who purchases two or more tobacco products per year during the observation period from January 2016 to June 2018. As control variables, we include the client's age, the portfolio value (ln), the Herfindahl-Hirschman Index assuming a mutual fund to be equal to 100 securities, the length of the relationship between a bank and client, gender, dummy variables equal to one for investors who are married, who hold a PhD, who are employees, who are self-employed or who are retired, and the level of client risk aversion (low = 1 and high = 5). We also include sell turnover in specification (3) and discretionary sell turnover in specification (6). We include year fixed effects. ***, **, and * indicate that the coefficient estimates are significantly different from zero at the 1%, 5%, and 10% levels, respectively.

	(1)	(2)	(3)	(4)	(5)	(6)
	Buy turnover	Sell turnover	Buy turnover	Buy turnover (discretionary)	Sell turnover (discretionary)	Buy turnover (discretionary)
Smoker (1 = smoker)	0.0069***	0.0045***	0.0041***	0.0044***	0.0040***	0.0018***
	(0.0004)	(0.0004)	(0.0003)	(0.0004)	(0.0004)	(0.0003)
Sell turnover			0.6347***			
			(0.0023)			
Sell turnover (discretionary)						0.6454***
						(0.0023)
Age (in years)	0.0002***	0.0004***	-0.0001***	0.0003***	0.0004***	0.0000**
	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)
Portfolio value (ln)	0.0023***	-0.0005***	0.0026***	0.0046***	0.0002***	0.0045***
	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0001)
Herfindahl-Hirschman Index (HHI)	-0.0118***	-0.0337***	0.0096***	0.0056***	-0.0276***	0.0234***
	(0.0007)	(0.0006)	(0.0006)	(0.0007)	(0.0005)	(0.0006)
Length of relationship (in years)	-0.0024***	-0.0014***	-0.0015***	-0.0021***	-0.0014***	-0.0012***
	(0.0001)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)
Gender (1 = male)	0.0129***	0.0088***	0.0073***	0.0119***	0.0084***	0.0064***
	(0.0005)	(0.0005)	(0.0004)	(0.0005)	(0.0005)	(0.0003)
Married (1 = married investor)	0.0016***	0.0008**	0.0011***	0.0007**	0.0006	0.0004
	(0.0004)	(0.0004)	(0.0003)	(0.0004)	(0.0003)	(0.0003)
Ph.D. (1 = investor holds doctoral degree)	-0.0146***	-0.0135***	-0.0060***	-0.0139***	-0.0129***	-0.0055***
	(0.0006)	(0.0006)	(0.0005)	(0.0006)	(0.0006)	(0.0005)
Client risk aversion (high = 1 and low = 5)	0.0104***	0.0090***	0.0047***	0.0103***	0.0088***	0.0046***
	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0001)
Employed (1 = employed)	-0.0039***	-0.0038***	-0.0015***	-0.0037***	-0.0036***	-0.0014***
	(0.0004)	(0.0004)	(0.0004)	(0.0004)	(0.0004)	(0.0003)
Self-employed (1 = self-employed)	-0.0017***	-0.0010*	-0.0010**	-0.0013**	-0.0006	-0.0009**
	(0.0005)	(0.0005)	(0.0004)	(0.0005)	(0.0005)	(0.0004)
Retired (1 = retired)	0.0033***	0.0029***	0.0014**	0.0027***	0.0032***	0.0007
	(0.0008)	(0.0008)	(0.0006)	(0.0008)	(0.0008)	(0.0006)
Year fixed-effects	YES	YES	YES	YES	YES	YES
Constant	0.0085***	0.0217***	-0.0053***	-0.0334***	0.0101***	-0.0399***
	(0.0014)	(0.0013)	(0.0012)	(0.0013)	(0.0013)	(0.0011)
Observations	803,624	803,624	803,624	803,624	803,624	803,624
R-squared	0.0187	0.0182	0.3955	0.0212	0.0178	0.4115

Robust standard errors in parentheses
**** p<0.01, ** p<0.05, * p<0.1*

Table V. The effect of low self-control on gender

This table presents pooled cross-sectional regression results on gender. The dependent variable is always monthly turnover. In column (1), we show the results for female investors, and in column (2) we report those for male investors. A smoker is defined as a person who purchases two or more tobacco products per year during the observation period from January 2016 to June 2018. As control variables, we include the client's age, the portfolio value (ln), the Herfindahl-Hirschman Index assuming a mutual fund to be equal to 100 securities, the length of the relationship between a bank and client, dummy variables equal to one for investors who are married, who hold a PhD, who are employees, who are self-employed or who are retired, and the level of client risk aversion (low = 1 and high = 5). We include year fixed effects. ***, **, and * indicate that the coefficient estimates are significantly different from zero at the 1%, 5%, and 10% levels, respectively.

	(1) Monthly Turnover (Female investors)	(2) Monthly Turnover (Male investors)
Smoker (1 = smoker)	0.0048***	0.0058***
	(0.0009)	(0.0004)
Age (in years)	0.0002***	0.0003***
	(0.0000)	(0.0000)
Portfolio value (ln)	0.0012***	0.0008***
	(0.0002)	(0.0001)
Herfindahl-Hirschman Index (HHI)	-0.0191***	-0.0233***
	(0.0014)	(0.0006)
Length of relationship (in years)	-0.0018***	-0.0020***
	(0.0001)	(0.0000)
Married (1 = married investor)	0.0053***	0.0005
	(0.0008)	(0.0004)
Ph.D. (1 = investor holds doctoral degree)	-0.0155***	-0.0140***
	(0.0017)	(0.0006)
Client risk aversion (high = 1 and low = 5)	0.0079***	0.0100***
	(0.0002)	(0.0001)
Employed (1 = employed)	0.0002	-0.0044***
	(0.0010)	(0.0004)
Self-employed (1 = self-employed)	0.0057***	-0.0022***
	(0.0013)	(0.0005)
Retired (1 = retired)	0.0023	0.0033***
	(0.0016)	(0.0008)
Year fixed-effects	YES	YES
Constant	0.0122***	0.0256***
	(0.0031)	(0.0012)
Observations	92,111	711,513
R-squared	0.0245	0.0202

Robust standard errors in parentheses
**** p<0.01, ** p<0.05, * p<0.1*

Table VI. The effect of alternative explanations on turnover

This table presents pooled cross-sectional regression results on turnover. The dependent variable is portfolio turnover and is set to one (=100%) for a given month when the monthly turnover is larger than one. A smoker is defined as a person who purchases two or more tobacco products per year during the observation period from January 2016 to June 2018. Specification (1) contains a male dummy equal to one when an investor is male, and specification (2) contains peer effects measured by the average monthly turnover of investors within a 50 km diameter around the investor, excluding the investor himself. To measure attention to events in specification (3), we include the number of corporate announcements (e.g., earnings releases, dividends) on a given day. To measure attention to the price level (specification (4)), we include the closeness to the 52-week high, closeness to the historical high, as well as the day of the new 52-week high and day of the new historical high. Specification (5) contains a lottery stocks dummy equal to one if an investor holds lottery stocks, defined as all stocks with above-median idiosyncratic volatility, above-median skewness, and below-median prices relative to the total portfolio value. Specification (6) includes jackpot size calculated as the sum of the Lotto jackpot and Euro jackpot per month, and specification (7) contains the betting amount calculated as the sum of all bets in the Lotto and Euro jackpots in a month. As control variables, we include the client's age, the portfolio value (ln), the Herfindahl-Hirschman Index assuming a mutual fund to be equal to 100 securities, the length of the relationship between a bank and client, gender, dummy variables equal to one for investors who are married, who hold a PhD, who are employees, who are self-employed or who are retired, and the level of client risk aversion (low = 1 and high = 5). Data on the investors are obtained from the bank. Data on the Lotto and Euro jackpots are provided by Lotto Germany. Market data are obtained from Thomson Reuters Financial Datastream. We include year fixed effects. ***, **, and * indicate that the coefficient estimates are significantly different from zero at the 1%, 5%, and 10% levels, respectively.

	(1) Monthly Turnover (Overconfidence)	(2) Monthly Turnover (Social contagion)	(3) Monthly Turnover (Attention Announcement)	(4) Monthly Turnover (Attention - Price level)	(5) Monthly Turnover (Sensation seeking)	(6) Monthly Turnover (Sensation seeking)	(7) Monthly Turnover (Sensation seeking)	(8) Monthly Turnover (All alternatives)
Smoker dummy (1 = smoker)	0.0057***	0.0057***	0.0059***	0.0059***	0.0067***	0.0057***	0.0061***	0.0068***
	(0.0004)	(0.0004)	(0.0004)	(0.0004)	(0.0005)	(0.0004)	(0.0004)	(0.0005)
Male dummy (1 = male)	0.0109***							0.0121***
	(0.0004)							(0.0006)
Peer effects (monthly turnover)		0.3635***						0.3034***
		(0.0146)						(0.0213)
Corporate announcements (/1000)			0.0021***					-0.0002
			(0.0005)					(0.0010)
Closeness to 52 week high				-0.0306***				0.0188
				(0.0102)				(0.0422)
Closeness to historical high				0.0428***				0.0382
				(0.0124)				(0.0423)
Day of new 52 week high (dummy)				0.0015**				-0.0009
				(0.0007)				(0.0015)
Day of new historical high (dummy)				0.0049***				0.0027*
				(0.0006)				(0.0014)
Lottery stocks dummy (1 = holds lottery stocks)					-0.0008*			-0.0017***
					(0.0004)			(0.0005)
Jackpot size (Million Euro)						-0.0673***		-0.1180***
						(0.0110)		(0.0271)
Betting amount (Million Euro)							-0.1120***	
							(0.0178)	

Contd.	(1) Monthly Turnover (Overconfidence)	(2) Monthly Turnover (Social contagion)	(3) Monthly Turnover (Attention Announcement)	(4) Monthly Turnover (Attention - Price level)	(5) Monthly Turnover (Sensation seeking)	(6) Monthly Turnover (Sensation seeking)	(7) Monthly Turnover (Sensation seeking)	(8) Monthly Turnover (All alternatives)
Age (in years)	0.0003***	0.0002***	0.0003***	0.0003***	0.0002***	0.0002***	0.0002***	0.0002***
	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)
Portfolio value (ln)	0.0009***	0.0009***	0.0008***	0.0008***	0.0008***	0.0009***	0.0009***	0.0009***
	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0001)
Herfindahl-Hirschman Index (HHI)	-0.0227***	-0.0226***	-0.0227***	-0.0228***	-0.0234***	-0.0240***	-0.0240***	-0.0260***
	(0.0005)	(0.0005)	(0.0005)	(0.0005)	(0.0007)	(0.0006)	(0.0006)	(0.0008)
Length of relationship (in years)	-0.0019***	-0.0019***	-0.0019***	-0.0019***	-0.0022***	-0.0019***	-0.0019***	-0.0024***
	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0001)	(0.0000)	(0.0000)	(0.0001)
Married (1 = married investor)	0.0012***	0.0012***	0.0014***	0.0014***	0.0011***	0.0015***	0.0015***	0.0008
	(0.0003)	(0.0003)	(0.0003)	(0.0003)	(0.0004)	(0.0004)	(0.0004)	(0.0005)
Ph.D. (1 = investor holds doctoral degree)	-0.0141***	-0.0132***	-0.0135***	-0.0135***	-0.0126***	-0.0139***	-0.0139***	-0.0134***
	(0.0006)	(0.0006)	(0.0006)	(0.0006)	(0.0008)	(0.0006)	(0.0006)	(0.0009)
Client risk aversion (high = 1 and low = 5)	0.0097***	0.0100***	0.0100***	0.0100***	0.0107***	0.0099***	0.0099***	0.0105***
	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0001)
Employed (1 = employed)	-0.0039***	-0.0036***	-0.0037***	-0.0037***	-0.0039***	-0.0038***	-0.0038***	-0.0043***
	(0.0004)	(0.0004)	(0.0004)	(0.0004)	(0.0005)	(0.0004)	(0.0004)	(0.0006)
Self-employed (1 = self-employed)	-0.0013***	-0.0008	-0.0009*	-0.0009*	-0.0012*	-0.0010*	-0.0010*	-0.0018**
	(0.0005)	(0.0005)	(0.0005)	(0.0005)	(0.0006)	(0.0005)	(0.0005)	(0.0008)
Retired (1 = retired)	0.0031***	0.0036***	0.0035***	0.0035***	0.0068***	0.0032***	0.0032***	0.0073***
	(0.0007)	(0.0007)	(0.0007)	(0.0007)	(0.0009)	(0.0008)	(0.0008)	(0.0011)
Year fixed-effects	YES	YES	YES	YES	YES	YES	YES	YES
Constant	0.0151***	0.0111***	0.0236***	0.0156***	0.0270***	0.0355***	0.0401***	-0.0378***
	(0.0012)	(0.0012)	(0.0011)	(0.0041)	(0.0015)	(0.0012)	(0.0016)	(0.0086)
Observations	803,624	803,624	803,624	803,624	490,595	683,447	683,447	370,418
R-squared	0.0215	0.0216	0.0209	0.0213	0.0218	0.0212	0.0212	0.0244

Robust standard errors in parentheses
**** p<0.01, ** p<0.05, * p<0.1*

Table VII. The effect of self-control failure on alternative explanations (I)

This table presents pooled cross-sectional regression results on turnover. The dependent variable is portfolio turnover and is set to one (=100%) for a given month when the monthly turnover is larger than one. A smoker is defined as a person who purchases two or more tobacco products per year during the observation period from January 2016 to June 2018. Specification (1) contains an interaction term of the smoker dummy with the male dummy, whereas specification (2) includes an interaction term between the smoker dummy and peer effects. Specification (3) has an interaction term between the smoker dummy and the number of corporate announcements, and specification (4) contains an interaction term between the smoker dummy and the day of new historical highs. Each specification contains all alternative explanations (overconfidence, social contagion, and attention measured by corporate announcements, new historical highs, the lottery stock dummy and jackpot size) as control variables. These control variables are a male dummy equal to one when an investor is male, peer effects measured by the average monthly turnover of investors within a 50 km diameter around the investor, the number of corporate announcements (e.g., earnings releases, dividends) on a given day, the day of the new historical high, a lottery stocks dummy equal to one if an investor holds lottery stocks defined as all stocks with above-median idiosyncratic volatility, above-median skewness, and below-median prices relative to the total portfolio value, and jackpot size calculated as the sum of the Lotto jackpot and Euro jackpot per month. Data on the investors are obtained from the bank. Data on the Lotto and Euro jackpots are provided by Lotto Germany. Market data are obtained from Thomson Reuters Financial Datastream. We include year fixed effects and control variables at the investor level, which are the client's age, the portfolio value (ln), the Herfindahl-Hirschman Index assuming a mutual fund to be equal to 100 securities, the length of the relationship between a bank and client, gender, dummy variables equal to one for investors who are married, who hold a PhD, who are employees, who are self-employed or who are retired, and the level of client risk aversion (low = 1 and high = 5). ***, **, and * indicate that the coefficient estimates are significantly different from zero at the 1%, 5%, and 10% levels, respectively.

	(1) Monthly Turnover (Overconfidence)	(2) Monthly Turnover (Social contagion)	(3) Monthly Turnover (Attention Announcement)	(4) Monthly Turnover (Attention - Price level)
Male dummy (1 = male)	0.0101***	0.0112***	0.0113***	0.0114***
	(0.0005)	(0.0005)	(0.0005)	(0.0005)
Male dummy x Smoker dummy	0.0054***			
	(0.0004)			
Peer effects (monthly turnover)	0.3136***	0.1327***	0.3159***	0.3163***
	(0.0161)	(0.0091)	(0.0161)	(0.0161)
Peer effects x Smoker dummy		0.1327***		
		(0.0091)		
Corporate announcements (/1000)	0.0010*	0.0010*	-0.0013**	0.0009
	(0.0006)	(0.0006)	(0.0006)	(0.0006)
Corporate announcements x Smoker dummy			0.0090***	
			(0.0008)	
Day of new historical high (dummy)	0.0054***	0.0054***	0.0054***	0.0039***
	(0.0004)	(0.0004)	(0.0004)	(0.0004)
Day of new historical high x Smoker dummy				0.0059***
				(0.0006)
Lottery stocks dummy (1 = holds lottery stocks)	-0.0023***	-0.0022***	-0.0023***	-0.0024***
	(0.0003)	(0.0003)	(0.0003)	(0.0003)
Jackpot size (Million Euros)	-0.0751***	-0.0748***	-0.0748***	-0.0757***
	(0.0111)	(0.0111)	(0.0111)	(0.0111)
Control variables (investor level)	YES	YES	YES	YES
Year fixed-effects	YES	YES	YES	YES
Constant	0.0110***	0.0106***	0.0119***	0.0125***
	(0.0015)	(0.0015)	(0.0015)	(0.0014)
Observations	683,447	683,447	683,447	683,447
R-squared	0.0231	0.0231	0.0230	0.0230

Robust standard errors in parentheses
**** p<0.01, ** p<0.05, * p<0.1*

Table VIII. The effect of self-control failure on alternative explanations (II)

This table presents pooled cross-sectional regression results on turnover. The dependent variable is portfolio turnover and is set to one (=100%) for a given month when the monthly turnover is larger than one. A smoker is defined as a person who purchases two or more tobacco products per year during the observation period from January 2016 to June 2018. Both specifications include interaction terms of the smoker dummy with the lottery stocks dummy, interactions terms of the smoker dummy with the jackpot size dummy, and interaction terms of the smoker dummy, lottery stock dummy, and jackpot size dummy. Specification (1) contains no control variables for alternative explanations, whereas specification (2) includes all alternative explanations (overconfidence, social contagion, and attention measured by corporate announcements and new historical highs) as control variables. These variables are a male dummy equal to one when an investor is male, peer effects measured by the average monthly turnover of investors within a 50 km diameter around the investor, the number of corporate announcements (e.g., earnings releases, dividends) on a given day, the day of the new historical high, a lottery stocks dummy equal to one if an investor holds lottery stocks defined as all stocks with above-median idiosyncratic volatility, above-median skewness, and below-median prices relative to the total portfolio value, and jackpot size calculated as the sum of the Lotto jackpot and Euro jackpot per month. Data on the investors are obtained from the bank. Data on the Lotto and Euro jackpots are provided by Lotto Germany. Market data are obtained from Thomson Reuters Financial Datastream. We include year fixed effects and control variables at the investor level, which are the client's age, the portfolio value (ln), the Herfindahl-Hirschman Index assuming a mutual fund to be equal to 100 securities, the length of the relationship between a bank and client, gender, dummy variables equal to one for investors who are married, who hold a PhD, who are employees, who are self-employed or who are retired, and the level of client risk aversion (low = 1 and high = 5). ***, **, and * indicate that the coefficient estimates are significantly different from zero at the 1%, 5%, and 10% levels, respectively.

	(1) Monthly Turnover (Sensation seeking)	(2) Monthly Turnover (Sensation seeking)
Smoker dummy x Lottery stocks dummy		
Nonsmoker x Lottery stocks	0.0010	0.0004
	(0.0010)	(0.0010)
Smoker x No lottery stocks	0.0083***	0.0080***
	(0.0013)	(0.0013)
Smoker x Lottery stocks	0.0079***	0.0069***
	(0.0013)	(0.0013)
Smoker dummy x Jackpot size		
Nonsmoker x Jackpot size	0.0018	-0.0080
	(0.0194)	(0.0194)
Smoker x Jackpot size	-0.0957***	-0.1096***
	(0.0242)	(0.0242)
Smoker dummy x Lottery stocks dummy x Jackpot size		
Nonsmoker x Lottery stocks x Jackpot size	-0.0921***	-0.0879***
	(0.0225)	(0.0225)
Smoker x Lottery stocks x Jackpot size	0.0085	0.0162
	(0.0352)	(0.0352)
Control variables (investor level)	YES	YES
Year fixed-effects	YES	YES
Control variables for alternative explanations	NO	YES
Constant	0.0339***	0.0077***
	(0.0014)	(0.0016)
Observations	683,447	683,447
R-squared	0.0213	0.0232

Robust standard errors in parentheses
**** p<0.01, ** p<0.05, * p<0.1*

Table IX. The effect of self-control failure on performance

This table presents cross-sectional regression results on gross returns, net returns and the difference between gross and net returns. The dependent variable given in column (1) is measured as the average daily portfolio performance for 2012 to 2018. Net returns shown in column (2) are measured as the average daily portfolio performance after incurred costs (e.g., brokerage fees or front-end loads). The dependent variable given in column (3) is the difference in return per year calculated as the difference between gross and net return. We include control variables at the investor level, which are the client's age, the average portfolio value (ln), the length of the relationship between a bank and client, gender, dummy variables equal to one for investors who are married, who hold a PhD, who are employees, who are self-employed or who are retired, the level of client risk aversion (low = 1 and high = 5) and the annualized standard deviation of gross returns. A smoker is defined as a person who purchases two or more tobacco products per year during the observation period from January 2016 to June 2018. Market data are obtained from Thomson Reuters Financial Datastream. ***, **, and * indicate that the coefficient estimates are significantly different from zero at the 1%, 5%, and 10% levels, respectively.

	(1)	(2)	(3)
	Return per year	Net return per year	Diff. Returns per year
Smoker dummy (1 = smoker)	-0.0081	-0.0257	0.0176***
	(0.0139)	(0.0167)	(0.0063)
Age (in years)	-0.0006	-0.0004	-0.0002
	(0.0006)	(0.0008)	(0.0003)
Average portfolio value (in EUR)	0.0127**	0.0323***	-0.0196***
	(0.0059)	(0.0076)	(0.0036)
Length of relationship between bank and client	0.0063***	0.0114***	-0.0051***
	(0.0017)	(0.0021)	(0.0008)
Gender (1 = male)	-0.0283*	-0.0460**	0.0177**
	(0.0170)	(0.0206)	(0.0071)
Married (1 = married investor)	0.0232*	0.0305*	-0.0073
	(0.0132)	(0.0158)	(0.0057)
Ph.D. (1 = investor holds doctoral degree)	0.0071	0.0060	0.0011
	(0.0272)	(0.0317)	(0.0105)
Client risk aversion (low = 1 and high = 5)	-0.0160***	-0.0209***	0.0049***
	(0.0035)	(0.0044)	(0.0018)
Employed (1 = employed)	-0.0131	0.0023	-0.0154*
	(0.0152)	(0.0184)	(0.0079)
Self-employed (1 = self-employed)	-0.0173	-0.0029	-0.0144
	(0.0192)	(0.0229)	(0.0094)
Retired (1 = retired)	0.0678***	0.0750**	-0.0072
	(0.0257)	(0.0305)	(0.0105)
Annualized standard deviation	-0.6868***	-0.8576***	0.1709***
	(0.0245)	(0.0290)	(0.0082)
Constant	0.1262**	-0.1044	0.2306***
	(0.0593)	(0.0772)	(0.0388)
Observations	12,855	12,855	12,855
R-squared	0.4313	0.4574	0.2105

Robust standard errors in parentheses

**** p<0.01, ** p<0.05, * p<0.1*

Table X. Robustness: The effect of low self-control on saving plans

This table presents cross-sectional regression results on saving plans. The dependent variable given in column (1) is a dummy variable for saving plan purchases and is equal to one when an investor makes one or more saving plan purchases after 1 January 2012. Column (2) uses the number of months in which customers make contributions to a savings plan. The dependent variable for savings plan contribution used in column (3) is defined as the absolute value of saving plan contributions in euros. A smoker is defined as a person who purchases two or more tobacco products per year during the observation period from January 2016 to June 2018. As control variables, we include the client's age, the average portfolio value, the Herfindahl-Hirschman Index assuming a mutual fund to be equal to 100 securities, the length of the relationship between a bank and client, gender, dummy variables equal to one for investors who are married, who hold a PhD, who are employees, who are self-employed or who are retired, and the level of client risk aversion (low = 1 and high = 5). ***, **, and * indicate that the coefficient estimates are significantly different from zero at the 1%, 5%, and 10% levels, respectively.

	(1) Savings plans usage	(2) Number of month with savings plans	(3) Savings plans contribution
Smoker (1 = smoker)	0.0876***	-1.5025*	155.9523
	(0.0088)	(0.9060)	(110.0378)
Age (in years)	-0.0065***	-0.0022	4.1536
	(0.0004)	(0.0492)	(4.7703)
Average portfolio value (ln)	-0.0395***	1.0103***	157.5520***
	(0.0021)	(0.2905)	(51.5801)
Average Herfindahl-Hirschman Index (HHI)	-0.6935***	-31.4630***	660.0914
	(0.0148)	(2.2858)	(630.3539)
Length of relationship (in years)	-0.0007	0.4914***	-5.3306
	(0.0010)	(0.1104)	(11.3165)
Gender (1 = male)	0.0300***	-0.5083	218.1234***
	(0.0107)	(1.5371)	(66.9080)
Married (1 = married investor)	0.0363***	0.8378	114.5887**
	(0.0076)	(0.9663)	(47.9991)
Ph.D. (1 = investor holds doctoral degree)	-0.0318**	-1.0851	1,000.7580
	(0.0146)	(2.2284)	(708.2013)
Client risk aversion (high = 1 and low = 5)	0.0096***	0.6859**	-55.7417
	(0.0023)	(0.2816)	(48.4384)
Employed (1 = employed)	0.0316***	0.0834	97.7107*
	(0.0094)	(1.0388)	(56.1538)
Self-employed (1 = self-employed)	-0.0109	-0.7423	177.0703
	(0.0109)	(1.4675)	(108.2874)
Retired (1 = retired)	0.0226	-4.2953*	7.5872
	(0.0145)	(2.4104)	(241.4499)
Constant	1.0756***	25.2207***	-1,526.5822**
	(0.0303)	(3.4127)	(693.6848)
Observations	13,616	3,601	3,601
R-squared	0.1642	0.0845	0.0223

Robust standard errors in parentheses
**** p<0.01, ** p<0.05, * p<0.1*

Table XI. Robustness: Alternative identification of smokers

This table presents pooled cross-sectional regression results on months with trades, monthly turnover and trade size. The dependent variable given in column (1) is a dummy variable for months with trades and is equal to one when an investor makes a trade in a month. The dependent variable shown in column (2) is the monthly portfolio turnover and is set to one (=100%) for a given month when the monthly turnover is larger than one. Trade size (3) is a variable for the absolute trade size in euros and measures the average absolute value per trade in a month with trade and treats purchases and sales equally. A smoker is defined as a person who purchases two or more tobacco products per year during the observation period from January 2016 to June 2018. All investors making more than two but fewer than 10 purchases of tobacco products are excluded from our analysis. As control variables, we include the client's age, the portfolio value (ln), the Herfindahl-Hirschman Index assuming a mutual fund to be equal to 100 securities, the length of the relationship between a bank and client, gender, dummy variables equal to one for investors who are married, who hold a PhD, who are employees, who are self-employed or who are retired, and the level of client risk aversion (low = 1 and high = 5). We include year fixed effects. ***, **, and * indicate that the coefficient estimates are significantly different from zero at the 1%, 5%, and 10% levels, respectively.

	(1)	(2)	(3)
	Months with trades	Monthly Turnover	Trade size
Smoker (1 = smoker)	0.0117***	0.0051***	67.3452**
	(0.0016)	(0.0005)	(32.4695)
Age (in years)	0.0018***	0.0003***	9.9256***
	(0.0001)	(0.0000)	(1.4367)
Portfolio value (ln)	0.0346***	0.0010***	1,245.1810***
	(0.0002)	(0.0001)	(14.5001)
Herfindahl-Hirschman Index (HHI)	-0.2069***	-0.0226***	5,319.4554***
	(0.0017)	(0.0006)	(77.9573)
Length of relationship (in years)	-0.0076***	-0.0018***	10.8751***
	(0.0002)	(0.0000)	(3.2002)
Gender (1 = male)	0.0450***	0.0107***	100.5879***
	(0.0016)	(0.0004)	(33.0707)
Married (1 = married investor)	0.0025**	0.0011***	234.5913***
	(0.0012)	(0.0003)	(27.0707)
Ph.D. (1 = investor holds doctoral degree)	-0.0480***	-0.0134***	548.4746***
	(0.0023)	(0.0006)	(75.6505)
Client risk aversion (high = 1 and low = 5)	0.0482***	0.0098***	-142.9074***
	(0.0004)	(0.0001)	(9.8763)
Employed (1 = employed)	-0.0003	-0.0021***	-203.8157***
	(0.0014)	(0.0004)	(36.7254)
Self-employed (1 = self-employed)	0.0074***	0.0007	301.0493***
	(0.0017)	(0.0005)	(46.8438)
Retired (1 = retired)	0.0280***	0.0042***	-110.9362**
	(0.0024)	(0.0007)	(48.8917)
Year fixed-effects	YES	YES	YES
Constant	-0.1652***	0.0111***	-11,455.4068***
	(0.0043)	(0.0013)	(136.9508)
Observations	703,354	703,354	301,135
R-squared	0.1241	0.0213	0.0965

Robust standard errors in parentheses
**** p<0.01, ** p<0.05, * p<0.1*

Table XII. Robustness: The effect of low self-control on trading patterns for main account users

This table presents pooled cross-sectional regression results on months with trades, monthly turnover and trade size for main account users. Main account users are defined as clients receiving a monthly salary in their bank accounts. The dependent variable given in column (1) is a dummy variable for months with trades and is equal to one when an investor makes a trade in a month. The dependent variable in column (2) is the monthly portfolio turnover and is set to one (=100%) for a given month when the monthly turnover is larger than one. Trade size (3) is a variable for the absolute trade size in euros and measures the average absolute value per trade in a month with trade and treats purchases and sales equally. A smoker is defined as a person who purchases two or more tobacco products per year during the observation period from January 2016 to June 2018. As control variables, we include the client's age, the portfolio value (ln), the Herfindahl-Hirschman Index assuming a mutual fund to be equal to 100 securities, the length of the relationship between a bank and client, gender, dummy variables equal to one for investors who are married, who hold a PhD, who are employees, who are self-employed or who are retired, and the level of client risk aversion (low = 1 and high = 5). We include year fixed effects. ***, **, and * indicate that the coefficient estimates are significantly different from zero at the 1%, 5%, and 10% levels, respectively.

	(1)	(2)	(3)
	Months with trades	Monthly Turnover	Trade size
Smoker (1 = smoker)	0.0322***	0.0142***	744.3740***
	(0.0068)	(0.0020)	(122.3902)
Age (in years)	0.0004	0.0005***	44.4257***
	(0.0003)	(0.0001)	(4.0531)
Portfolio value (ln)	0.0373***	0.0011***	1,364.1713***
	(0.0012)	(0.0003)	(57.0732)
Herfindahl-Hirschman Index (HHI)	-0.2318***	-0.0253***	5,737.3867***
	(0.0094)	(0.0028)	(335.7289)
Length of relationship (in years)	-0.0027***	-0.0009***	11.4012
	(0.0009)	(0.0003)	(16.0029)
Gender (1 = male)	0.0689***	0.0086***	333.8545*
	(0.0089)	(0.0028)	(180.4646)
Married (1 = married investor)	0.0423***	0.0124***	610.0248***
	(0.0060)	(0.0017)	(113.9073)
Ph.D. (1 = investor holds doctoral degree)	0.0548***	0.0401***	-1,287.2786***
	(0.0143)	(0.0058)	(132.3801)
Client risk aversion (high = 1 and low = 5)	0.0580***	0.0101***	-45.3512
	(0.0021)	(0.0005)	(43.6420)
Employed (1 = employed)	-0.0511***	-0.0132***	-570.7985***
	(0.0072)	(0.0021)	(134.2919)
Self-employed (1 = self-employed)	0.0001	-0.0087***	-592.5409***
	(0.0086)	(0.0026)	(164.7381)
Retired (1 = retired)	0.0208*	0.0007	-668.1411***
	(0.0120)	(0.0040)	(188.2341)
Year fixed-effects	YES	YES	YES
Constant	-0.2497***	-0.0208***	-15,300.6927***
	(0.0235)	(0.0064)	(685.4002)
Observations	27,047	27,047	12,104
R-squared	0.1370	0.0384	0.1439

Robust standard errors in parentheses
**** p<0.01, ** p<0.05, * p<0.1*

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