
Individual Differences in Susceptibility to Investment Fraud

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Overview

Despite the devastating and lasting personal consequences of financial fraud, little is known about whether some people are more susceptible to fraud than others, and if so, why. Existing knowledge comes largely from survey studies, which rely exclusively on self-report and have focused on whether demographic factors (e.g., age, gender, socioeconomic status) promote susceptibility to different types of fraud (for example, lottery versus investment fraud; e.g., Consumer Fraud Research Group, 2006; Deevy et al., 2012). To begin to address these gaps in knowledge, we combined historical, psychological, and brain imaging methods to analyze individual differences in susceptibility to investment fraud. Building from previous research, the aim of this project was to innovate and extend scientific tools that could identify and characterize individuals who are susceptible to investment fraud. A long-term research goal is to provide recommendations for mitigating susceptibility as a first step towards helping people to reduce their exposure to investment fraud.

Study Design and Results

In a previous study funded by the FINRA Investor Education Foundation, we discovered links between individual differences and significant life financial outcomes. We specifically found that: (1) individual differences in ability to learn from financial gains was correlated with greater assets, (2) individual differences in the ability to learn from financial losses was correlated with less debt; and (3) aging was associated with increased financial risk-seeking errors. In contrast, commonly assessed individual difference measures of cognitive ability and demographics (e.g., sex, ethnicity, socioeconomic status) did not significantly correlate with life financial outcomes (Knutson et al., 2011; Samanez-Larkin et al., 2010).

These findings implicate affect as well as cognition in financial choice, and are consistent with an “anticipatory affect model” (Knutson and Greer, 2008), in which one brain circuit that generates anticipatory positive arousal promotes gain acquisition (i.e., the nucleus

accumbens or NAcc — implicated in positive aroused feelings like excitement), while a second brain circuit that generates anticipatory negative arousal promotes loss avoidance (i.e., the anterior insula — implicated in negative aroused feelings like anxiety). Together, the continuing activity of these circuits may contribute to individual differences in financial risk seeking or aversion, respectively. In this research, we hoped to extend our previous research to a specific group of individuals who make biased or suboptimal financial decisions – victims of investment fraud.

We acquired multilevel data on victims of investment fraud as well as a similar sample of non-victims in order to test three distinct but complementary hypotheses (while controlling for potential alternative explanations related to demographics and age):

1. Investment fraud victims exhibit more cognitive limitations than non-victims.
2. Investment fraud victims prefer more financial risk than non-victims.
3. Investment fraud victims have less behavioral control in high-stakes scenarios than non-victims.

Methods

To initially test these predictions, we collected psychological (i.e., questionnaire), neural (i.e., fMRI scanning), and behavioral (i.e., task performance) data from 15 victims of investment fraud and 21 non-victims ranging in age from 18 to 85. Victims were recruited from a combination of registry information about people who had been defrauded in investment scams in the past, as well as self-reported exposure to fraud in our community sample. Victims reported having been defrauded from 1-20 times and losing from \$500–\$1,000,000, and ranged in age from 45–85. Non-victims were recruited from an age-matched community sample and did not report having been defrauded in the past. Some recruited volunteers were excluded from further analyses based on problems during the brain scanning session (e.g., due to excessive head motion or claustrophobia). Thus, final analyzed samples included 10 victims and 18 age-matched non-victims.

Subjects visited our laboratory at Stanford University for two testing sessions. In the first session, we collected measures of demographics, emotions, personality, cognitive ability (e.g., numeracy, working memory), and financial spending and saving. In the second session, we collected measures of functional brain activity (using fMRI; described below) as subjects completed financial decision-making tasks, as well as measures of structural brain integrity (using DTI; not further detailed here). These measures were designed to tap not only self-reported sensitivity to gains and losses and cognitive abilities, but also associated brain activity and behavior, since self-report and behavioral measures sometimes diverge — particularly in high-stakes scenarios (Ariely & Loewenstein, 2006).

To elicit behavioral and neural responses under high stakes, we developed two new tasks. The first task assessed individuals' risk preferences in general, and specifically their preferences for low probability but high magnitude (or "skewed") risks in particular (i.e., the gambling task; see Wu et al., 2012). The second task assessed individuals' ability to control their behavioral impulses in the face of compelling incentives (i.e., the Monetary Incentive Delay Inhibition or "MIDI" Task). Subjects completed the gambling and MIDI tasks as they were scanned with functional magnetic resonance imaging (or fMRI). Consistent with the greater risk preference hypothesis, we predicted that fraud victims might show increased preferences for risky gambles (along with increased NAcc activity or decreased insula activity). Consistent with the reduced control hypothesis, we also predicted that fraud victims might show reduced behavioral control specifically in the face of large incentives (along with decreased ventrolateral prefrontal cortical activity).

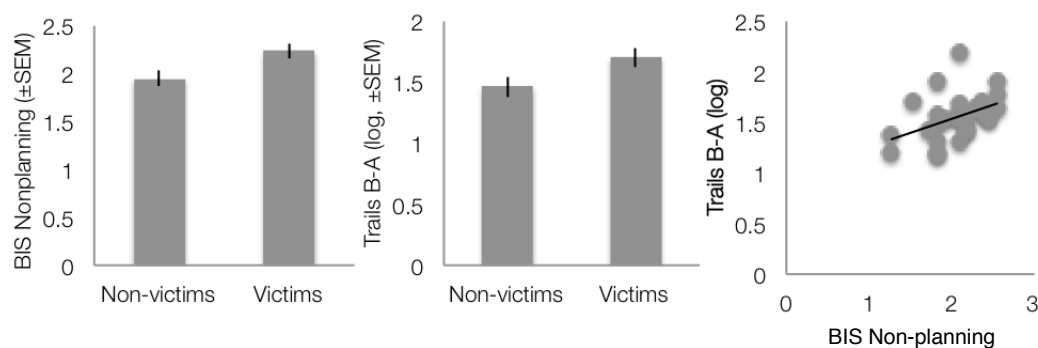
Results

In terms of cognitive abilities, victims and non-victims generally appeared similar — with one exception. Specifically, victims and non-victims did not differ on measures of emotional tendencies (e.g., affect, personality, subjective well-being, future orientation) or cognitive abilities (e.g., working memory, numeracy, verbal ability). Victims and non-victims

also did not significantly differ in their risk preferences (e.g., percentage of a windfall allocated to stocks versus cash) or discounting of future rewards. Victims did, however, report higher impulsiveness (particularly with respect to not planning; Patton et al., 1995), and demonstrated less cognitive flexibility (in shifting between different instruction sets; Reitan, 1958) (see Figure 1, first and second panels). These two findings were associated, implicating a single underlying factor (Figure 1, third panel), possibly related to perseveration, or the ability to flexibly change behavior in response to shifting demands.

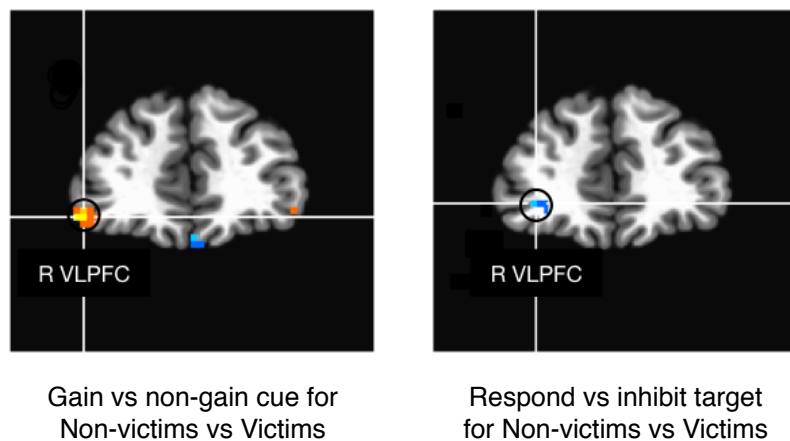
While these findings do not support the first “cognitive deficit” hypothesis in which victims suffer from limited general cognitive abilities, they do point towards a specific vulnerability factor linked to impulsive perseveration. The absence of cognitive differences, while somewhat counterintuitive, coheres with the observation that many investment fraud schemes target educated white males rather than traditionally disadvantaged groups (Consumer Research Fraud Group, 2006; Deevy et al, 2012). The discovery of higher impulsive perseveration in victims encouraged us to further focus on this difference in our analyses of neural activity.

Figure 1. Fraud victims scored higher than non-victims in non-planning (i.e., self-reported tendency not to plan; $p < .005$; left panel), and took longer to switch cognitive sets (i.e., the time required to connect dots in a task that requires reversal versus one that does not; $p < .05$; middle panel), and these two deficits were correlated ($r(28) = .43$, $p < .05$; right panel).



Behavioral and neural assessments were collected during scanning and targeted financial risk-taking (the gambling task) and inhibition of impulses (the MIDI task). In the gambling task, victims behaviorally showed similar acceptance of all types of gambles regardless of type, whereas non-victims accepted fewer negative skewed gambles (e.g., low probability of a large loss) than positive skewed (e.g., low probability of a high gain) gambles ($p < .05$). Neurally, victims showed reduced right ventrolateral prefrontal cortical activity when considering negative skewed gambles, which may have fostered greater acceptance of the small probability of a large loss. In the MIDI task, victims behaviorally showed a marginally greater decrease in impulse inhibition (i.e., failed to inhibit their responses), particularly after seeing large gain (i.e., +\$5.00) versus no gain cues (i.e., +\$0.00; $p < .10$). Neurally, victims showed less ventrolateral prefrontal cortical activity when anticipating large gains, as well as when signaled to inhibit their responses to large gain targets (Figure 2) – consistent with reduced behavioral inhibition when faced with the potential for large gains.

Figure 2. Non-victims show greater right ventrolateral prefrontal (R VLPFC) cortical activity than fraud victims when anticipating that they may have to inhibit their impulse to respond for large gains (TC: 48, 39, -6; $Z = 4.15$; $p < .001$, cluster = 4, uncorrected; **left panel**). Victims show less R



VLPFC activity than non-victims when inhibiting their impulses in order to obtain large gains (TC: 35, 39, 0; $Z = -3.48$; $p < .001$, cluster = 4, uncorrected; **right panel**). R VLPFC activity has been associated with inhibiting impulses in previous studies (warm colors = non-victims > victims while cool colors = victims > non-victims; right = left).

Behavioral and neural findings thus did not strongly support the second “risk preferences” hypothesis, since victims did not report preferring more risk than non-victims, and only preferred more risk in the negative skew gambling condition. The findings did, however, support the third “impulse control” hypothesis, since victims showed diminished ability to inhibit their responses after seeing large gain cues, and also showed less ventrolateral prefrontal cortical activity under these circumstances, consistent with reduced impulse control.

Limitations

Because this study investigates individual characteristics of fraud victims at multiple levels of measurement (self-report, brain, behavior), it allowed us to dig deeper than self-report and to probe different potential underlying mechanisms. These extensive measures required a laboratory visit with two sessions, which necessarily reduced the number of subjects who could be recruited and run. Additionally, known fraud victims proved more difficult to recruit than general community members. For these reasons, the sample size was small (but many repeated measures were acquired from each subject), and the present results should be regarded as preliminary, although they provide promising new leads for larger future studies.

While the majority of investment fraud victims were recruited from lists of individuals who were listed on victim registries, our classification of subjects as victims ultimately depended upon their self-report that they had been defrauded once or more in the past. Because a sizable proportion of victims either do not know or are unwilling to report that they have been defrauded (Deevy et al., 2012), we may have underestimated the incidence of fraud in our non-victim sample. Future studies may provide additional validation for self-report and other measures of fraud.

The design of this initial inquiry was cross-sectional, which can support correlational but not causal inference. Indeed, some of the observed differences may have resulted from

fraud itself rather than susceptibility to fraud. For instance, fraud victims tended to report that they would be less susceptible to fraud in the future, which likely is a consequence rather than a cause of experiencing fraud. On the other hand, it seems likely that behavioral impulsivity confers vulnerability to fraud rather than results from fraudulent encounters. Future longitudinal studies might establish whether our causal inferences in fact can predict future behavior (e.g., of high versus low vulnerability individuals who have not yet been exposed to fraud but which include a follow-up fraudulent probe).

Finally, this study focused only on investment fraud — many other types of fraud can seriously harm the long-term financial standing of individuals and deserve study. These other types of fraud, however, may have different antecedents than investment fraud.

Summary and Implications

Together, these findings provide a first deep glimpse into factors that may confer vulnerability to investment fraud. Interestingly, cognitive abilities were not significantly impaired overall in fraud victims. Neither did fraud victims uniformly prefer to take more risk than non-victims. Fraud victims did, however, show reduced impulse control, and this was particularly apparent in the face of large potential gains. We interpret these findings to suggest that an inability to control one's impulses under high stakes may confer vulnerability to investment fraud (and that behavioral assessments might be necessary to detect such a predisposition).

Identification of vulnerability factors does not necessarily imply causes (either inborn or due to experience), but might nonetheless highlight promising targets for intervention. For instance, our findings suggest that the best way to test one's susceptibility to investment fraud might involve completing the non-planning scale of the Barratt Impulsivity Scale (Patten et al., 1995) and/or the Trail Making Task (Reitan, 1958).

These findings also suggest that, in the heat of the moment, cognitive and affective interventions may not have the strongest impact. Interventions designed to support impulse control, on the other hand, may prove more effective. These could take the form of a plan or

script to refer to when considering financial offers. Constant impulse control can prove energetically costly though, since the occurrence of impulses is difficult to predict — almost by definition (Ariely & Loewenstein, 2006). Other solutions might involve invoking a rule that requires removing one’s self from potentially risky situations for a specified length of time before making a decision. An additional rule might require consulting with a trusted family member, friend, or advisor who is not connected to the offer in the interim.

Mostly, these preliminary findings make a strong case for further exploration. Ideally, longitudinal studies that assess community samples before fraud occurs might causally test whether the factors we have identified predict susceptibility. Studies that extend to broader samples (e.g., over the internet) could also establish the strength and generalizability of the findings. Measures developed specifically for these studies to probe investment fraud susceptibility would also be interesting to extend to other situations involving impaired impulse control (including psychiatric disorders like attention deficit/hyperactivity disorder).

Recommendations

Since these preliminary findings implicate impulse control in fraud susceptibility, screening for impulsivity and implementing plans for avoiding impulsive choice under high stakes scenarios may reduce vulnerability to investment fraud, particularly in repeated victims. The findings also highlight the need for continued research that can determine causality as well as the extent and generality of the observed effects.

Contact

This research was conducted at Stanford University and was supported by funding from the FINRA Investor Education Foundation. All results, interpretations and conclusions expressed are those of the research team alone, and do not necessarily represent the views of the FINRA Investor Education Foundation or any of its affiliated companies. The researchers, Brian Knutson and Gregory Samanez-Larkin, may be contacted at knutson@psych.stanford.edu and g.samanezlarkin@yale.edu

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