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The Influence of Psychotropic Drugs on Investor Overconfidence

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Abstract

We study the effects of the self-reported intake of stimulants, depressants and hallucinogens on investor overconfidence. A total of 105 investors participated. We find that the frequency of drug use did not affect overconfidence. However, overconfidence was correlated with the use of psychotropic drugs in our sample; regardless of type, we find a positive correlation of 15 percent. Correlation of investor overconfidence with stimulants in particular was even stronger at 41 percent. We suggest that identifying the ways psychotropic drugs in general, and stimulants in particular, interfere with striatum activity, is key for understanding their effects on investor overconfidence.

Subject Areas

Behavioral Economics, Medicine

Keywords

Psychotropic Drugs, Investor Overconfidence, Behavioral Economics

1. Introduction

Overconfidence is a psychological bias in which the subjective confidence in one's judgement is greater than the objective accuracy of the judgement. It is well established in the literature that entrepreneurs, managers and investors are overconfident [1]-[7]. Overconfident investors overestimate the precision of their own knowledge and skills. As a result, they are often more confident than right, and wrong when they are sure they are right [8]. Whenever investor confidence overcomes investor accuracy, financial markets overtrade and under-react to information [9], becoming more volatile [10]. Things are likely to become even worse when investors make decisions under the effect of psycho-

tropic drugs [11].

Risk taking increases under the influence of alcohol [12], cannabis [13], and benzodiazepines (Valium [14]) and Alprazolam [15]. Amphetamines (such as Adderall) cause heightened focus and wakefulness, and this helps poker playing [16]. Propranolol, a beta blocker used to treat "stage fright" and other types of anxiety and impulsivity, reduces the discrimination between large and small possible losses when the probability of winning is low [17].

Perhaps one in four large investors has used some kind of mood-altering drug [18]. These also include Selective Serotonin Reuptake Inhibitors (SSRI) to treat depression: citalopram (Celexa), escitalopram (Lexapro), fluoxetine (Prozac), paroxetine (Paxil, Pexeva), sertraline (Zoloft) and vilazodone (Viibryd). Investors taking these drugs "report that they become far less cautious than they were before, worrying too little about real dangers" [18]. Citalopram decreases fear-related amygdala activations [19]. Prozac is known among executives as "teflon-medicine", because it allows them to look past perceived threats, decide quickly without ruminating and remain more optimistic during stress. Paxil does not cause euphoria for most people, but it can block fear and sadness, cause a reduction in threat perception and increase affiliative behaviors [20]. The characteristics of decreased threat perception and increased social affiliation mirror the decreased risk perception and herding of overly bullish investors [11]. Thus, SSRI are "steroids for the business Olympics" [21].

This work studies the effects of self-reported intake of stimulants, depressants and hallucinogens on investor overconfidence. Stimulants ("uppers") make one feel less tired both physically and mentally. Types of stimulants include amphetamines, methamphetamines, lisdexamfetamines, methylphenidates (Ritalin), MDMA (Ecstasy or Molly), cocaine, nicotine, caffeine and diet pills. Depressants ("downers") reduce arousal. Types include alcohol, barbiturates, benzodiazepines, cannabis, opioids, alpha and beta blockers (Propranolol), anticholinergics (Atropine), anticonvulsants (Pregabalin), antihistamines (Diphenhydramine), antipsychotics (Haloperidol), hypnotics (Zolpidem), muscle relaxants (Baclofen) and sedatives. Hallucinogens cause changes in thoughts, emotion and consciousness. Types include ayahuasca, psilocybin, mescaline and LSD. After reporting whether or not they consume any of these drugs, volunteers in our experiment indicate their frequency of use into three categories: mild (less than one time per week), moderate (two to three times per week) or heavy (daily).

The rest of this paper is organized as follows: Section 2 describes the materials and methods used; Section 3 shows the results found and Section 4 presents the conclusion.

2. Materials and Methods

We prepared a questionnaire to gauge overconfidence and another to assess the participants' consumption of drugs. We initially sent both Google Forms online to 48 consented volunteer students who had previous investment experience.

The students were from the University of Brasilia, Brazil, and were enrolled in production engineering. We asked them to resend the link to acquaintances. Data collection started on 20 April 2017 and finished on 2 June 2017. In the end, a total of 105 investors participated (62 males; 62 were ages 25 and older; 29 had a college degree).

Participants freely reported their consumption of drugs and the frequency, as described earlier. Overconfidence can be easily assessed through a questionnaire, and we opted to employ the classical one [22]. The description of this questionnaire in detail is provided elsewhere [23]. After responding to a set of 10 true-false questions, respondents indicate how confident they were in the response given, either 50, 60, 70, 80, 90 or 100 percent. A value of 50 percent means one respondent had no idea what the correct response was, because the same probability means a random guess between two choices. A value of 100 percent means the respondent was completely confident in the response. After subtracting how confident one respondent was in all the 10 questions from the correct responses given (in percentages), one gets a measure of overconfidence, in case of a resulting positive value.

3. Results

The average confidence level for all investors was 77.74 percent and their accuracy was 59.62 percent, meaning they were overconfident. Only 11 percent of the estimates of confidence coincided with the correct results. In general, the estimates of confidence were 29 percent higher than the correct responses.

Overconfidence occurs when the confidence judgments are larger than the relative frequencies of the correct responses, in which case there is poor calibration. **Figure 1** shows a calibration curve [24], derived as follows: 1) we collected

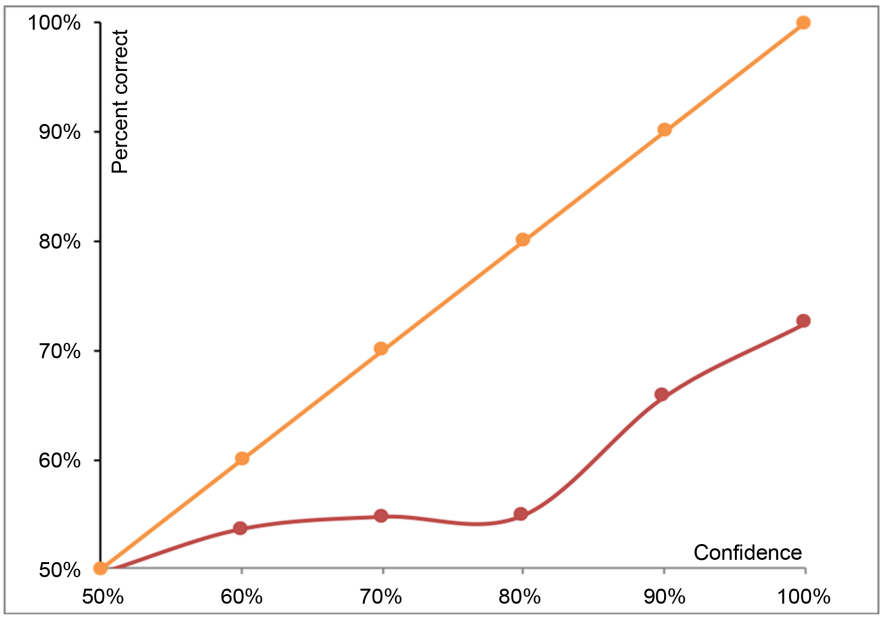

Figure 1. Calibration curve: overconfidence curve (in red) and the 45˚ identity line.

the probability assessments for each of the 10 items; 2) we grouped similar assessments within ranges (for example, all assessments between 0.60 and 0.69 were placed in the same category); 3) within each category, we computed the proportion that was correct (that is, the proportion of items for which the proposition was true or the alternative was correct); 4) for each category, we plotted the mean response (on the abscissa) against the proportion correct (on the ordinate). Perfect calibration would be shown by all points falling on the identity line. Figure 1 shows how the overconfidence effect appeared in our sample. Of note, the greatest excesses occurred for the confidence level of the 80 percent interval.

Table 1 shows the responses from the questionnaires in detail. The vast majority of the participants displayed overconfidence (88 percent). Only 12 showed underconfidence and a single one was perfectly calibrated. Only 36 participants were drug free. The majority in our sample (66 percent) used some type of drug. Hallucinogens (H) were consumed by 46 participants, stimulants (S) by 27, and depressants (D) by 22.

Five hallucinogen users displayed underconfidence, one was perfectly calibrated, and the vast majority showed a 33.5 percent average overconfidence. Five stimulant users showed underconfidence, and the majority showed a 32.3 percent average overconfidence. Two depressant users displayed underconfidence, and the majority showed a 37.4 percent average overconfidence.

As for the frequency of consumption, it was mild for 33 users, moderate for 24 and heavy for 13. Of note, whenever one participant indicated a moderate use of hallucinogens and a high consumption of stimulants, for example, her frequency of consumption was classified as heavy. For those heavy users, two showed underconfidence; the others showed a 32 percent average overconfidence. For mild users, seven displayed underconfidence; the others presented the same 32 percent average overconfidence as that of heavy users. So, the frequency of consumption did not seem to matter for overconfidence in our sample.

However, overconfidence was correlated with the consumption of drugs in our study, regardless of type (for all drugs, Pearson's coefficient = 0.152, $\chi^2(2) = 1.58$, $p < 0.05$; critical value = 1.38). Despite this low positive correlation of 15 percent, correlation with stimulants in particular was stronger. That is, 41 percent (for stimulants, Pearson's coefficient = 0.414, $\chi^2(2) = 3.31$, $p < 0.05$; critical value = 3.22). Nevertheless, correlations with the other types of drugs were non-significant in our sample: the chi-square statistics fell below the critical values (for depressants, Pearson's coefficient = 0.422, $\chi^2(2) = 4.34$, $p < 0.05$; critical value = 4.61; for hallucinogens, Pearson's coefficient = 0.119, $\chi^2(2) = .664$, $p < 0.05$; critical value = 0.713).

These results make sense from a neuroscience perspective. The more confident people are about their performance, the higher the activation in brain areas such as the striatum, which is a region often associated with reward processing [25]. However, too much confidence is associated with lower metacognitive ability [25]. When combined, such results indicate that although being confident

Table 1. Questionnaires responses.

Participant	Confidence, %	Drug type	Frequency of use
1	45	H	Mild
2	50	H	Mild
3	3	H	Moderate
4	−15	H	Moderate
5	24	H	Heavy
6	46	H, S	Heavy
7	0	H	Moderate
8	41	H, S	Moderate
9	33	H	Moderate
10	1	H, S	Heavy
11	49	H	Heavy
12	32	H	Heavy
13	45	H	Heavy
14	18	H, S	Moderate
15	66	H, S, D	Heavy
16	29	H	Heavy
17	47	S, D	Moderate
18	14	H, S, D	Moderate
19	80		Moderate
20	55	H, S, D	Moderate
21	54	H, D	Moderate
22	50	H, S	Moderate
23	44	H, D	Moderate
24	24		
25	36	H	Mild
26	30	D	Mild
27	28		
28	9		
29	23		
30	41	H, S	Mild
31	26	D	Moderate
32	38	H	Mild
33	33		
34	47		
35	31		
36	26	D	Mild
37	33	D	Mild
38	31		
39	30		

Continued

40	33		
41	13		
42	15		
43	29	D	Mild
44	19	H, S	Mild
45	14		
46	32	D	Mild
47	16		
48	25		
49	46	H, S	Mild
50	39	S	Mild
51	35	S, D	Moderate
52	38	S, D	Mild
53	39	H, S	Moderate
54	33	S	Moderate
55	24		
56	36	H, S	Moderate
57	33	D	Mild
58	53	D	Mild
59	38	D	Mild
60	53	H	Mild
61	43	H	Heavy
62	17	D	Moderate
63	20		
64	36	H, D	Mild
65	36		
66	42	H, D	Moderate
67	45		
68	25		
69	32		
70	42		
71	22		
72	14		
73	12		
74	18	H	Moderate
75	6	H	Mild
76	8		
77	38	H	Mild
78	62	H	Moderate
79	31		
80	50		

Continued

81	37	H	Mild
82	12		
83	−30	H	Mild
84	4	H	Mild
85	55		
86	−20	H	Moderate
87	18		
88	−14	D	Mild
89	−9	S	Mild
90	1		
91	32		
92	−7	D	Heavy
93	−26		
94	18	H	Mild
95	−10	H	Heavy
96	−19	H, S	Mild
97	17	S	Mild
98	−11	S	Mild
99	2	H, S	Heavy
100	16	H	Heavy
101	17	S	Moderate
102	−4	S	Mild
103	3		
104	−10	S	Mild
105	11	H, S	Mild

entails a reward-like component, it can also lead to overconfidence. Therefore, identifying the ways psychotropic drugs in general, and stimulants in particular, interfere with striatum activity is key for understanding their effects on investor overconfidence.

4. Conclusion

We study the effects of self-reported intake of stimulants, depressants and hallucinogens on investor overconfidence using a sample of 105 participants. First, we replicate the well-established overconfidence effect in our own experiment, thus finding an average level of confidence for all investors of 77.74 percent, along with an accuracy level of 59.62 percent. Then, we find a positive correlation of 15 percent between overconfidence and the use of psychotropic drugs in our sample, regardless of type. In particular, the correlation of investor overconfidence with stimulants only is even stronger at 41 percent, but correlations with the other types of drugs are non-significant. Nevertheless, we find the frequency of

drug consumption not to matter for overconfidence in our sample. We suggest that identifying the ways psychotropic drugs in general, and stimulants in particular, interfere with striatum activity, is key for understanding their effects on investor overconfidence.

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Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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