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A Comparison of Professional Traders and Psychopaths in a Simulated Non-Zero Sum Game

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Abstract

In a prior study psychopathic individuals showed a diminished level of cooperativeness but realized higher individual rewards in a prisoner's dilemma game, compared with community controls. The present study replicated this finding with professional bank traders, who exhibited less cooperative behavior than both of the aforementioned groups (community controls and psychopathic patients). While the bank traders did not obtain a higher gain than the psychopathic individuals at an absolute level, they maximized the discrepancy between their own profit and the yield of their anonymous computerized gaming partner. The bank traders were more prone than psychopathic patients to rely on strategies that considerably harmed the profit of their gaming partners without necessarily optimizing their own total profit. The community controls achieved the same overall gain as traders and psychopaths. Unlike traders and psychopathic patients, the normal controls balanced overall gains of themselves and their game opponent, which led to the highest overall profit, whereas the traders achieved the lowest overall profit.

Introduction

The crash of the financial market in 2008 caused considerable damage to the reputation of bankers and traders among large parts of the society. Traders are perceived as being selfish, greedy, overconfident and willing to ignore risks (Barber & Odean, 1999; Carr, 2009; Daniel et al., 1998, 2001; Levy, 2010; Lo et al., 2005). According to Mortreuil (2010), the personal behavior of traders is said to be more to blame for the economic crisis than the financial system or specific instruments. This supposed lack of cooperative behavior is based on the notion that "market participants pursue their respective individual advantage[s] regardless of others" (Snyder Belousek, cited in Jackson, 2010, p. 768). A scientifically sound method to assess cooperativeness and competition of individuals in social situations is the Prisoner's Dilemma Game (Oskamp & Perlman, 1965).

The Prisoner's Dilemma Game

The Prisoner's Dilemma Game (PDG (Luce & Raiffa, 1957)) is a non-zero-sum game in which gains and losses of the players follow a graded pattern of rewards, depending on the choices of the participants. Zero-sum games, in contrast, are based on winning and losing. In the PDG, the individuals engage in pairwise interactions with two behavioral options: cooperation or defection. The decisions are made simultaneously. The specific constellation of their decisions determines their payoffs (Hauert & Stenull, 2002).

The classic example of the PDG is presented as follows (Lave, 1962; Luce & Raiffa, 1957): Two offenders (A and B) are arrested for a crime they committed together, and they are interrogated separately. They are both informed that if neither A or B confess to the crime, they will both receive one year in jail. If A does not confess and B confesses, A will receive five years in prison while B goes free. On the other hand, if A confesses and B does not, A will be released while B goes to prison for five years. If A confesses and B also confesses, they will both go to prison for four years. A and B are informed that they would not be told about the decision of the other to reveal or withhold information until the end of the investigation.

The PDG mirrors many situations that occur in social life. The PDG always contains the same components: A *reward* (R) if the players both cooperate, a *punishment* (P) if they both defect, and a *temptation* (T) that consists of increasing one's gain by defecting if the other player cooperates. In the latter scenario, the cooperating agent receives the so-called sucker's *payoff* (S) only. According to Scodel, Minas, Ratoosh, and Lipetz (1959) the graded pattern of outcomes must fulfil two criteria: First, the payoffs are ordered as $T > R > P > S$. Second, the average of temptation and sucker's payoff must be smaller than the reward: $(T + S)/2 < R$. Otherwise, alternating cooperation/defection would be more rewarding than mutual cooperation.

Psychopaths in a PDG

The behavior of individuals with psychopathic and antisocial personality traits is generally estimated to be less cooperative than average (Babiak & Hare, 2006; Harris & Rice, 2006). This notion led a team of researchers to empirically assess the behavior of criminal psychopaths from high-security psychiatric hospitals in a computer simulation of a prisoner's dilemma situation (Mokros et al., 2008). Few prior studies addressed the issue of cooperativeness of psychopathic or antisocial individuals - antisociality being an integral part of the psychopathy construct (Hare & Neumann, 2010) - in controlled experiments, and to our knowledge only three of them applied the PDG paradigm (Montañés Rada et al., 2003; Rilling et al., 2007; Widom, 1976). In her study, Widom concluded that psychopaths acted just as cooperatively in the PDG setup as the controls, whereas Montañés Rada et al. (2003) and Rilling et al. (2007) found a significant correlation between psychopathic traits or antisocial personality disorder and non-cooperativeness.

In view of these heterogeneous findings, Mokros et al. (2008) compared the behavior of 24 patients diagnosed as psychopaths from two German forensic psychiatric hospitals with that of 24 men from the general population in a PDG situation. The results demonstrated that the psychopaths defected significantly more often than the controls. This tendency was related to three subscales of the *Psychopathic Personality Inventory-Revised* (PPI-R (Lilienfeld & Widows, 2005)): *rebellious nonconformity*, *Machiavellian egocentricity*, and the *total score*). Furthermore, psychopaths were found to earn significantly higher relative rewards than did the community control group. The psychopaths disproportionately increased their relative profit at the expense of the simulated game partner. The authors concluded that the selfishness of psychopaths leads to higher short-term rewards than prosocial behavior and may thus constantly be positively reinforced.

Why observe traders in a PDG?

Egocentricity, callousness and manipulative behavior are said to be overrepresented in the professional trader community (Barber & Odean, 1999; Lo et al., 2005). Thus, the question arises whether traders would act as uncooperatively as psychopaths in a PDG.

The aim of the present study was therefore to replicate the methodology of the study conducted by Mokros et al. (2008), introducing professional bank traders as a new sample group for comparison. The unique data set allows the evaluation of cooperativeness among professional traders under controlled conditions. Experiments on economic behavior are usually conducted with easily available undergraduate students. Obviously, student's behavior is not necessarily representative of behavior in naturally occurring environments – e.g. traders are possibly characterized by unusually egoistic behavior (Fehr & List, 2008; Johnson & Mislin, 2011). Our hypothesis was that traders would act similarly to psychopaths in the PDG – defecting significantly more often than the community controls and thus maximizing relative gain at the expense of the anonymous computerized game partner.

Method

In order to allow direct comparison of the results, this replication study was conducted with the identical design and psychometric instruments as the original study by Mokros et al. (2008). The two studies differed only in the samples of participants that took part (bank traders vs. psychopaths and community controls).

Participants

The subjects of this study were one female and 27 male German-speaking individuals. This distribution was unintentional, but it reflects the fact that the

trading business is notoriously male-dominated. All of the participants were professional bank traders (working in equities, commodities etc.). Thirteen of the 28 study participants were working for large international banks. Twelve were working for medium-size banks. Two participants were commodity-traders and one participant was working for a hedge fund-company. All of the traders we asked agreed to participate. The participants were recruited by phone and then tested during an individual meeting. All of the subjects participated in the study voluntarily, in complete orientation of the objective of the study - including the results of the previous study by Mokros et al. (2008) - and without any incentives. Total anonymity was guaranteed. Informed consent was obtained from all participants. The authors sought approval by the Ethics Committee of the Canton of Zurich. The Ethics Committee assured that a formal evaluation of the research proposal was not necessary due to the ethically unobjectionable content of the study.

Design and Procedures

Apparatus

In accordance with the original study, we opted for a computerized opponent in the PDG. In their paper, Mokros et al. (2008) point out the advantages of such an approach: The behavior of the opponent can be controlled more systematically than if the opponent were another generic player. If the experimenter represents the opponent, on the other hand, the course of the game can be controlled, but his mere presence might interfere with the decision making of the player, e.g. by enhancing his cooperative moves because of their higher social acceptance. A weakness of the computerized opponent approach, on the other hand, is the possibility of the subject figuring out the algorithm, on which the behavior of the computerized opponent is based.

The dummy strategy of the computer was set to decide cooperatively unless the participant defected twice in a row (i.e., a *tit-for-two-tats* strategy)¹. The computer switched back to cooperation as soon as the player ceased to defect. In order to conduct the present replication as true to the original as possible, the computerized JAVA script of the PDG and the entire procedure of the original study were adopted.

The PDG scenario that the subjects were asked to react to was based on a story of their home state suffering from serious water shortage after a local catastrophe. Every day for a period of 40 days, the player could collect his ration of water from the municipality (cooperation). By picking up the neighbor's share as well, the player could augment his own ration (defection), leaving the neighbor without any water. If the (computer simulated) neighbor also chose to

¹The dummy strategy of the computer was set to *tit-for-two-tats*. That is, the computer opponent would cooperate until the player defected twice in a row at which time the computer would shift to defection as well. As soon as the player cooperated once again, the computer would resort to cooperation, too. The order of gains is: 8 liters (i.e., the temptation of successful defection) > 5 liters (the reward for mutual cooperation) > 1 liter (the punishment for joint defection) > 0 liters (the loss incurred through being duped).

cheat - which the program only did after having been cheated twice in a row by the player - both parties were punished by the municipality with a considerable reduction of their share. More specifically, the values of the payoffs were set to $T = 8$, $R = 5$, $P = 1$, $S = 0$ liters of water. Table 1 gives an overview of the pay-off matrix for the PDG in the present study.²

Table 1. Pay-Off Matrix in the Prisoner’s Dilemma Game

Player’s Choice	Computer Opponent’s Response			
	<i>Cooperation</i>		<i>Defection</i>	
<i>Cooperation</i>	5	5	0	8
<i>Defection</i>	8	0	1	1
Outcome:	Player’s Gain	CPU Gain	Player’s Gain	CPU Gain

Consequently, cooperating throughout all 40 trials would yield an absolute gain of 200 liters for the player. The absolute gain for the computer opponent would be equal. Thus, the relative gain (i.e., the difference between the absolute gain of the participant and the computer opponent) would be zero. In the light of the pre-selected computer strategy, choosing an optimum strategy on behalf of the player (i.e., alternating between defection and co-operation, with two defective trials at the end of the sequence) would afford a maximum possible absolute gain of 263 liters of water and a maximum relative gain of 168 liters.

Each subject was called on at his (or her) job and tested individually. The rules of the PDG were explained and every participant was personally assisted during the game in order to answer possible technical questions. At the end of each of the 40 runs, the preliminary results were presented to the player.

Psychometric Measures

Psychopathic Personality Inventory-Revised (PPI-R). The Psychopathic Personality Inventory (PPI (Lilienfeld & Andrews, 1996)) is a reliable and valid (Lilienfeld & Fowler, 2006) self-report questionnaire developed in non-clinical samples (e.g. university students) to assess psychopathic personality traits in non-criminal populations. In its revised edition, the PPI-R (Lilienfeld & Widows, 2005), 154 items are used to analyze eight traits of psychopathy: blame externalization, rebellious nonconformity, stress immunity, social potency, cold-heartedness, Machiavellian egocentricity, carefree non-planfulness, and fearlessness. In addition to these psychopathic characteristics, the test measures the subject’s tendency toward untruthful answering in the dimension: “invalid answering”. In our study, we used the German version of the PPI-R (Alpers & Eisenbarth, 2008), where the two validity scales of the PPI-R are combined into one. Other than that, the German version closely follows the subscale structure of the English original and is a reliable instrument (Eisenbarth & Alpers, 2007).

²The combination of the computer answering cooperation on behalf of the player with defection is not part of the tit-for-two-tats strategy and only included here for the sake of completeness.

Multiple-Choice Vocabulary Test. The Mehrfachwahl-Wortschatz-Intelligenztest-B (MWT-B) was developed by Lehrl (1999) to appraise verbal intelligence of German-speaking subjects (Lehrl et al., 1995). The MWT-B correlates well with other IQ tests (Satzger et al., 2002).

Results

The data for the groups of psychopathic forensic patients and the community controls were taken from the study by Mokros et al. (2008). With a mean age of $M = 37.11$ years ($SD = 5.68$), the traders from the current study did not differ significantly from any of the other groups: $F(2, 75) = 0.54$, $p = .59$. The mean age of the psychopathic patients was $M = 39.13$ ($SD = 9.08$), the mean age of the community controls was $M = 39.50$ ($SD = 11.78$). The average verbal IQ, as estimated with the MWT-B test, was $M = 104.21$ ($SD = 12.31$) among the traders, compared with $M = 102.21$ ($SD = 12.71$) for the psychopathic patients and $M = 102.50$ ($SD = 18.90$) for the community controls. The three groups of participants did not differ significantly in terms of verbal IQ: $F(2, 75) = 0.14$, $p = .87$. Consequently, the three groups of traders, psychopathic patients, and community controls seem comparable in terms of age and verbal intelligence.

According to a MANOVA, the three groups of participants (bank traders, psychopathic patients, community controls) were clearly distinct on the subscales of the German version of the *Psychopathic Personality Inventory-Revised* (PPI-R (Alpers & Eisenbarth, 2008; Lilienfeld & Widows, 2005)): $F(20, 128) = 51.02$, $p = .000$.³ As post hoc tests with Bonferroni adjustment indicated at a type I error rate of $p = .05$, four sub-scales of the PPI-R significantly distinguished the bank traders from community controls and from the psychopathic patients. Specifically, the bank traders had a significantly higher mean score than the community controls in terms of *rebellious nonconformity* and *social potency*. Furthermore, the bank traders had significantly higher scores than both the men from the community and the psychopathic patients in terms of *Machiavellian egocentricity* and *invalid answering*. Finally, the bank traders had significantly lower mean scores than psychopathic patients with regard to *blame externalization*, *coldheartedness*, *carefree non-planfulness*, and the *total score*. Table 2 gives the descriptive statistics (means, standard deviations) of the three groups on the subscales of the PPI-R.⁴

³The similarity of individual profiles on the ten PPI-R (sub-)scales was assessed per participant group by calculating the average Mahalanobis distances (MD) within and between groups. Based on this analysis, the within-group similarities are highest, affording the smallest mean Mahalanobis distances (4.23 for traders, 4.01 for community controls, and 4.03 for psychopathic patients). When comparing participant groups with each other, the traders appeared more distinct from the group of community controls ($MD = 4.16$) and from the psychopathic patients ($MD = 4.63$) than community controls appeared from psychopathic patients ($MD = 4.24$).

⁴PPI-R = Psychopathic Personality Inventory-Revised (Eisenbarth & Alpers, 2008; Lilienfeld & Widows, 2005). Data for psychopathic patients and community controls are from Mokros et al. (2008).

Table 2. Means (SDs) of Bank Traders, Psychopathic Patients, and Community Controls on the Subscales of the PPI-R.

Scale	Bank Traders	Psychopathic Patients	Community Controls
Total Score	304.04 (27.05)	334.86 (25.44)	308.78 (22.58)
Rebellious Nonconformity	61.82 (13.74)	60.29 (11.77)	45.15 (8.06)
Blame Externalization	25.79 (6.69)	41.08 (7.99)	30.09 (7.10)
Machiavellian Egocentricity	38.61 (5.27)	33.33 (5.26)	29.61 (3.85)
Social Potency	48.79 (8.77)	46.71 (5.38)	42.89 (6.98)
Coldheartedness	33.64 (6.03)	38.04 (7.45)	34.79 (5.50)
Stress Immunity	47.64 (6.11)	48.22 (8.50)	49.94 (7.44)
Fearlessness	19.46 (4.50)	19.00 (5.93)	17.58 (5.20)
Invalid Answering	39.82 (5.46)	25.41 (5.59)	26.63 (4.81)
Carefree non-planfulness	27.93 (4.68)	32.77 (9.05)	32.08 (7.11)
n	28	24	24

Table 3 lists the descriptive statistics for the occurrence of defective trials as well as for total and relative gain achieved by participants from the three groups on average. In the prisoner’s dilemma game (PDG), the bank traders on average defected more often than psychopathic patients and community controls. According to a Kruskal-Wallis H test, the difference between groups in terms of the *number of defective trials* was statistically significant: $\chi^2 = 28.39$, $p < .001$. A post hoc test (Critchlow & Fligner, 1991; Dwass, 1960; Steel, 1960) indicated that all pairwise comparisons were significant.⁵

The pairwise comparisons between bank traders₁, psychopathic patients₂, and community controls₃ yielded test statistics of $W_{12} = 7.10$, $W_{13} = 10.18$, $W_{23} = 3.87$ (all $p < .05$). Furthermore, it was nearly twice as common among the bank traders to defect *at least once* (78.6% of participants) than among the psychopathic patients (41.7% of participants). The community controls defected most rarely (8.3% of participants). The relative rate of defecting at least once differed significantly between the three groups: $\chi^2 = 25.92$, $p < .001$.

⁵The asymptotic critical value w_α was calculated exactly through the method put forward by Neuhäuser and Bretz (2001). At a level of $\alpha = 5\%$, this corresponds to a value of $w_\alpha = 3.3159$. Consequently, the null hypothesis of equal group medians is rejected at a type I error rate of 5% if the standardized maximum absolute value of the Wilcoxon statistic $W_{ij}(\sqrt{2})$ between two groups $i, j = 1 \dots, 3$ exceeds the value of $w_\alpha = 3.3159$.

Table 3. Defection Statistics, Total Gain, and Relative Gain for Three Groups of Participants

	Bank Traders	Psychopathic Patients	Community Controls
Defected at Least Once	78.6%	41.7%	8.3%
	22 / 28	10 / 24	2 / 24
Frequency of Defection:			
Mean	12.29	4.38	0.21
SD	(10.59)	(7.62)	(0.83)
Median	13.00	0.00	0.00
Min. - Max.	0 - 35	0 - 24	0 - 4
Total Player Gain (L):			
Mean	201.93	204.88	200.21
SD	(32.12)	(10.23)	(0.72)
Median	203.50	200.00	200.00
Min. - Max.	105 - 247	187 - 232	200 - 203
Relative Player Gain (L):			
Mean	53.71	23.67	1.00
SD	(43.70)	(38.58)	(3.59)
Median	48.00	0.00	0.00
Range	0 - 136	0 - 112	0 - 16

In terms of total player gain in the PDG (see Table 3), the bank traders held an intermediate position, with psychopathic patients on average obtaining a somewhat higher gain and community controls obtaining the lowest outcome. In a Kruskal-Wallis H test, the difference between the groups in terms of average total gain did not reach statistical significance, however: $\chi^2 = 5.94$, $p = .051$.

According to a Kruskal-Wallis H test the groups differed significantly from each other with regard to average *relative gain*: $\chi^2 = 27.29$, $p < .001$. The average relative (or competitive) gain was clearly higher among the bank traders than among the other groups (see Table 3). A post hoc test (Critchlow & Fligner, 1991; Dwass, 1960; Steel, 1960) revealed that all pairwise comparisons were significant, with test statistics of $W_{12} = 6.65$, $W_{13} = 10.22$, $W_{23} = 3.91$ (all $p < .05$), respectively (see footnote 5 for details). As a group, bank traders achieved a mean relative gain 53.71 liters compared to 23.67 liters (psychopathic patients) and 1.00 liter (community controls).

Whereas the bank traders on average achieved 76.8% of the maximum possible total gain, they realized 32.0% of the potential relative gain for themselves (compared to values of 77.9% [total gain] and 14.1% [relative gain] for the psychopathic patients and 76.1% [total gain] and 0.6% [relative gain] for the community controls). Expressing the group differences of total and relative gain between the bank traders and the two other groups in terms of standard deviation units through Cohen's d coefficient, the d values with regard to the *total gain* were $d = -0.12$ (compared with psychopathic patients) and $d = 0.07$ (compared with community controls). The d coefficient for the *relative gain*

with regard to psychopathic patients was $d = 0.74$ and $d = 1.67$ compared with the community controls.

Correlating the number of non-cooperative trials with the sum scores of the ten subscales of the PPI-R for the group of bank traders, the only Spearman rank-order correlation coefficient that reached significance after controlling for multiple testing ($\alpha^* = \alpha/10 = .005$) was the subscale *cold-heartedness*: $r_s = 0.54$ (see Table 2 for the list of the PPI-R subscales). The second- and third-highest correlations concerned the PPI-R subscales of *fearlessness* and *invalid answering*, with a coefficient of $r_s = 0.35$ each. Neither of these correlation coefficients reached the level of statistical significance after Bonferroni adjustment. None of the three subscales that correlated with the number of non-cooperative trials in the previous study by Mokros et al. (2008) had a significant coefficient in the current findings: *Rebellious nonconformity* ($r_s = 0.00$), *Machiavellian egocentricity* ($r_s = 0.05$), and the *total score* ($r_s = 0.13$).

Discussion

The purpose of the present research was to assess the behavior and performance of professional bank traders as compared to psychopaths and a group of community controls in a prisoner’s dilemma game (PDG). To our knowledge, this is the first empirical PDG study conducted with a sample of professional traders. Empirical research on egoism and cooperativeness in the business world, and especially in banks, is limited and mostly confined to self-report measures. This is mainly due to the difficulty of obtaining the active cooperation of business organizations and their personnel for research purposes (Babiak et al., 2010).

In a PDG setup identical to the one used in the present study, Mokros et al. (2008) found psychopaths to be significantly more egoistic in their decision making than the community controls. Among the psychopathic participants, the number of cooperative decisions was significantly smaller and the relative profits they generated were significantly larger.

In the present study, our expectation that the traders would act as uncooperatively as the sample of psychopaths was even exceeded. The number of uncooperative decisions among the traders was higher than within the psychopathic group, followed by the group of controls. More specifically, it was only the *relative* gain of the traders (i.e., the total amount of the traders’ gain minus the total amount of their computerized opponent’s gain) that exceeded the profit of the psychopaths by a medium to large effect size. The *total* gain was similar. In other words: Without gaining an advantage in regard to the absolute profit, the traders used an even more uncooperative strategy than the psychopaths, maximizing their relative gain only by harming the game partner. This result seems to corroborate the popular notion of ruthlessness on behalf of the traders, but is surprising in view of the fact that traders are supposed to maximize the total gain for their businesses. By jeopardizing their total gain only to improve the relative gain, the traders seem to be motivated more by competition than by lucrative pragmatism. This irrational relative thinking is also observed in other

areas of economic psychology such as consumer behavior (Azar, 2011; Thaler, 1980; Tversky & Kahnemann, 1981).

In the psychopathic patients and the community controls, the PPI-R subscales of *rebellious nonconformity*, *Machiavellian egocentricity*, and the *total score* were significantly correlated with the total number of non-cooperative trials in the PDG. Given that the traders had significantly higher values on the *invalid answering* scale than either of the other two groups it remains unclear whether there were other traits motivating the traders to act selfishly than was the case for the psychopathic patients and the community controls in the original study (Mokros et al., 2008).

A possible weakness of our study is the choice of a computerized-opponent approach. If a subject figured out the pattern of the computerized reactions, the circumstances would not be comparable to a real-life situation any more. Overall, there was only one subject in our sample who possibly succeeded in figuring out the pattern towards the end of the cycle. Our analyses showed that our main results remained unaltered even after exclusion of the subject in question: The nonparametric ANOVA (H test) for relative gain remained significant at $p < .001$ ($\chi^2 = 26.04$).

Our findings of the destructive behavior of traders in a PDG seem disconcerting for the traders' employers. Traders are in a position to cause damage to others by acting uncooperatively and trying to outplay the opponent at all cost - without any monetary profit for their employers. Obviously, the present results are not meant to equate traders with criminal psychopaths. In fact, the personality profiles of the community controls appeared more similar to the psychopathic group than the personality profiles of the traders (see footnote 3). Rather, the outcome of the present study may help to illustrate that a focus of selfishness (as in psychopathic individuals) or on competitiveness (as in professional traders) may jeopardize the benefit of others without even maximizing the overall gain of the acting individuals (or of the companies they represent). Nevertheless the question arises whether traders also act comparably in other situations. This topic touches on forensic issues and should be the object of further studies.

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