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Introduction

One of the fastest growing areas in the economic sciences is broadly defined area of finance, with particular emphasis on the financial markets, financial institutions and risk management. Real world challenges stimulate the development of new theories and methods. A large part of the theoretical research concerns the analysis of the risk of not only economic entities, but also households.

The first Wrocław Conference in Finance WROFIN was held in Wrocław between 22nd and 24th of September 2015. The participants of the conference were the leading representatives of academia, practitioners at corporate finance, financial and insurance markets. The conference is a continuation of the two long-standing conferences: INVEST (Financial Investments and Insurance) and ZAFIN (Financial Management – Theory and Practice).

The Conference constitutes a vibrant forum for presenting scientific ideas and results of new research in the areas of investment theory, financial markets, banking, corporate finance, insurance and risk management. Much emphasis is put on practical issues within the fields of finance and insurance. The conference was organized by Finance Management Institute of the Wrocław University of Economics. Scientific Committee of the conference consisted of prof. Diarmuid Bradley, prof. dr hab. Jan Czekaj, prof. dr hab. Andrzej Gospodarowicz, prof. dr hab. Krzysztof Jajuga, prof. dr hab. Adam Kopiński, prof. dr. Hermann Locarek-Junge, prof. dr hab. Monika Marcinkowska, prof. dr hab. Paweł Miłobędzki, prof. dr hab. Jan Monkiewicz, prof. dr Lucjan T. Orłowski, prof. dr hab. Stanisław Owskiak, prof. dr hab. Wanda Ronka-Chmielowiec, prof. dr hab. Jerzy Różański, prof. dr hab. Andrzej Sławiński, dr hab. Tomasz Słoński, prof. Karsten Staehr, prof. dr hab. Jerzy Węclawski, prof. dr hab. Małgorzata Zaleska and prof. dr hab. Dariusz Zarzecki. The Committee on Financial Sciences of Polish Academy of Sciences held the patronage of content and the Rector of the University of Economics in Wrocław, Prof. Andrzej Gospodarowicz, held the honorary patronage.

The conference was attended by about 120 persons representing the academic, financial and insurance sector, including several people from abroad. During the conference 45 papers on finance and insurance, all in English, were presented. There were also 26 posters.

This publication contains 27 articles. They are listed in alphabetical order. The editors of the book on behalf of the authors and themselves express their deep gratitude to the reviewers of articles – Professors: Jacek Batóg, Joanna Bruzda, Katarzyna Byrka-Kita, Jerzy Dzieża, Teresa Famulska, Piotr Fiszeder, Jerzy Gajdka, Marek Gruszczyński, Magdalena Jerzemowska, Jarosław Kubiak, Tadeusz Kufel, Jacek Li-

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SELF-CONTROL AND FINANCIAL DECISION-MAKING: A TEST OF A NOVEL DEPLETING TASK

SAMOKONTROLA A DECYZJE FINANSOWE: TEST NOWEGO NARZĘDZIA DO WYCZERPYWANIA SAMOKONTROLI

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Abstract: The aim of the study is to test the efficacy of a novel depleting task, which could be used to obtain a measure of self-control in the financial domain. In the paper we postulate that if participants receive a surprising, emotionally taxing stream of negative outcomes (i.e. they lose a majority of gambles with a positive expected value (EV)), their capacity to control their actions will be significantly reduced, and thus it will be more likely that they will make a gamble with a negative EV. Results show that participants subject to the depleting task have a lower expected final payoff from their gambles, but that this is the result of a lower level of engagement in gambles with a positive EV, and not the result of a higher level of participation in gambles with a negative EV. The lack of the latter means that our hypothesis is not supported by the evidence, although a post-experiment assessment of affect confirms that the depleting task strained the participants on an emotional level.

Keywords: self-control, decision-making, crowdsourcing.

Streszczenie: Celem badania jest przetestowanie nowego narzędzia do wyczerpywania samokontroli, które można by wykorzystać jako miernik poziomu samokontroli w zakresie decyzji finansowych. W pracy zakładamy, że ekspozycja na serię zaskakujących, obciążających emocjonalnie negatywnych wyników (tj. przegranie większości zakładów z dodatnią wartością oczekiwaną (EV)), obniży zdolność do samokontroli i zwiększy skłonność do uczestnictwa w nieracjonalnym zakładzie (zakładzie z ujemną EV). Wyniki badania pokazują, że uczestnicy poddani wspomnianemu zadaniu wybierają zakłady, które mają mniejszą skumulowaną EV, co jest jednak wynikiem zmniejszonego uczestnictwa w zakładach z dodatnią EV, a nie wynikiem zwiększonego uczestnictwa w zakładach z ujemną EV. Brak występowania

tego drugiego zjawiska oznacza, że nasza hipoteza nie znalazła potwierdzenia, pomimo że przeprowadzona po eksperymencie ocena stanów afektywnych potwierdziła, że opracowane narzędzie było dla uczestników obciążające emocjonalnie.

Słowa kluczowe: samokontrola, podejmowanie decyzji, crowdsourcing.

1. Introduction

In traditional economic models it is usually assumed that risk preferences are stable across time and domains. In other words, when someone makes choices in a risky situation, he/she is always expected to be consistently risk-averse or risk-seeking, irrespectively of the considered domain (financial, career, health and safety, ethical, recreational and social decisions e.g. Weber et al. [2002]). However, behavioral studies have shown there is no stability of risk preferences (e.g. [Kahneman, Tversky 1979; Camerer 2004; Baucells, Villasís 2010]). It was discovered that risk preferences are influenced, e.g., by aspirations [Lopes, Oden 1999], the level of wealth [Bell 1988], the framing of the problem [Kahneman, Tversky 1979], stress levels [Delaney et al. 2014], and emotions (e.g. [Loewenstein, Lerner 2003]).

Many of the previous research (for a review see e.g. Schwarz [2000], Slovic et al. [2004]) has shown that mood and affective states can influence decision making. For example, Knap and Clark [1999] have shown that decision making under emotions such as sadness or anger can impact outcomes (participants affected by those emotions achieved less profit in the resource dilemma problem than people in a happy or neutral emotional state). As Schwarz [2000] indicates, one may use his/her affective state as a reference while judging, and base their decision on the answer to the question “How do I feel about this?”. Because it is difficult to separate prior feelings from the present emotional reactions, one is likely to evaluate problems more positively when he/she is in a positive mood and more negatively when he/she is in a negative mood. Thus, the higher the ability to reduce the experience of emotions, the more robust decision making becomes [Heilman et al. 2010].

In this paper we explore self-control, but adopt an approach that is untypical in economic research. When economists discuss self-control, it is most often associated with time discounting. Economists’ favorite explanation for the self-control problems is present bias [Delaney, Lades 2015]. Conversely, for psychologists the key component of self-control is the ability to regulate emotions (next to regulating behaviors and thoughts) (e.g. [Baumeister, Tierney 2011]). In psychological research, self-control problems mark a conflict between desire (the hedonic force) and willpower (the ability to overcome desire) [Hoch, Loewenstein 1991]. In our paper we use the latter operationalization of self-control.

In their studies, Leith and Baumeister [1996] found that people who were induced to feel angry and frustrated selected the high-risk, high-payoff option more often, which had a lower expected value than the safer option. Somewhat similarly,

in our study we hypothesize that subjects exposed to a negative-mood inducing task may deplete their ability to self-control, and thus this may cause them to participate in gambles with a negative expected value. In essence, we propose a novel way of measuring self-control. Contrary to the usually-administered self-rating methods, we use an experimental design, in order to obtain what could be a more valuable way to measure self-control.

2. The depleting task

In our experiment, each participant has to decide whether they would participate in a particular gamble (overall, they have 30 decisions to make). Half of the gambles have a positive expected value (EV), with a probability of winning that exceeds 50%. For example, participants have the following type of decision to make:

*Will you participate in a gamble with a 60% probability of winning \$20
and a 40% probability of losing \$5?*

If the participant makes such a gamble, he/she is immediately provided with an outcome of the gamble. The key feature of the experiment is that the results of each of the tasks will be predetermined. We have manipulated the outcomes of the experiment so that the majority of the gambles with a positive-EV leads to a loss. The objective of this manipulation is to induce the state of emotional stress in the participants, which should generally increase the likelihood of depleting their self-control. We operationalize self-control depletion as an increased propensity to engage in gambles with an unfavorable expected outcome.

The tasks with a positive-EV are alternated with 15 tasks with a negative-EV, e.g.:

*Will you participate in a gamble with a 30% probability of winning \$20
and a 70% probability of losing \$10?*

We expect that if the participant decides to make such a gamble, it will mean that his or her ability of self-control is exhausted. Put differently, as in the case of gamblers, we expect that the person making such a gamble will not analyze the real chances of winning or its usefulness, but will act on emotions, feeling the need to win back and equalize the previous losses. More specifically, we hypothesize that participants that have been exposed to the depleting task will more often engage in gambles with a negative-EV, although a rational participant should be interested in rejecting all of these gambles.

It is worth noting that our method is only a laboratory simulation based on gambles, and is thus not directly related to real-life financial decision making. However, it seems feasible that if a series of unfortunate gambles should cause distress and change the behavior of our participants, investors (especially day-traders) subject to similar distress might also engage in aggressive, less thoughtful

trades, to their own detriment. Our novel method of estimating self-control could then serve as an instrument to estimate the vulnerability to making irrational trades.

3. Procedure

We recruited participants through a crowdsourcing service (CrowdFlower). The gambles were presented via an online survey website (Survio). Participants had to state whether they will participate in each gamble (the set of gambles used in the study is shown in Table 1). The probability and outcome of the gambles were presented on the left and right hand side, respectively).

Table 1. The gambles presented to participants and the outcome assigned in the experimental group

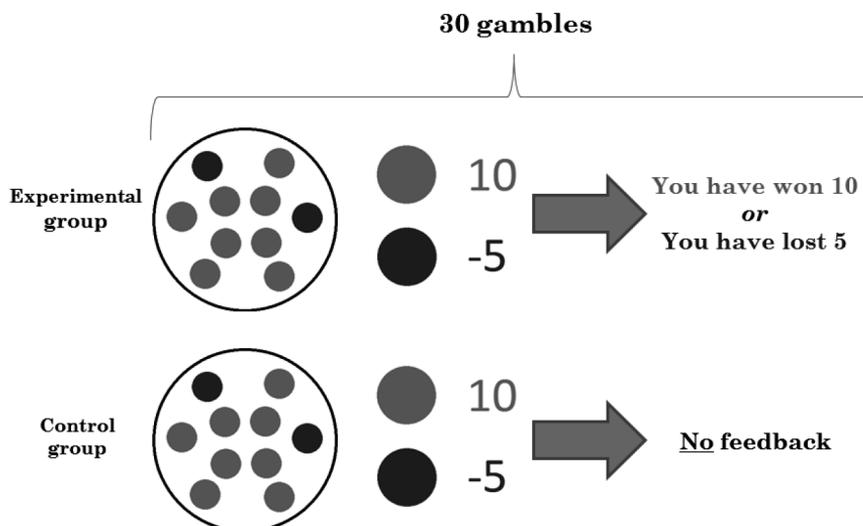
Gamble	Win		Loss		EV	Outcome	Gamble	Win		Loss		EV	Outcome
	P	V	P	V				P	V	P	V		
1	.9	20	.1	-5	17.5	20	16	.3	10	.7	-5	-5	-5
2	.7	20	.3	-5	12.5	-5	17	.7	15	.3	-5	9	-5
3	.6	20	.4	-5	10	-5	18	.7	5	.3	-15	-1	5
4	.4	10	.6	-10	-2	-10	19	.8	15	.2	-5	11	-5
5	.8	15	.2	-15	9	-15	20	.4	5	.6	-5	-1	5
6	.5	10	.5	-15	-2.5	-15	21	.7	5	.3	-5	2	5
7	.7	5	.3	-5	2	5	22	.2	15	.8	-5	-1	-5
8	.2	15	.8	-5	-1	-5	23	.5	15	.5	-20	-2.5	5
9	.8	15	.2	-5	11	-5	24	.6	20	.4	-15	6	-15
10	.6	20	.4	-15	6	-15	25	.3	20	.7	-10	-1	-10
11	.4	5	.6	-5	-1	-5	26	.1	5	.9	-5	-4	-5
12	.6	10	.4	-5	4	-5	27	.7	20	.3	-5	12.5	-5
13	.1	5	.9	-5	-4	-5	28	.8	5	.2	-5	3	5
14	.8	5	.2	-5	3	5	29	.4	10	.6	-10	-2	-10
15	.1	10	.9	-5	-3.5	-5	30	.5	10	.5	-15	-2.5	-15

Note: P denotes probability of obtaining the outcome, V denotes the value obtained in case of winning or losing.

Source: Authors' own study.

When investigating whether our depleting task leads to less self-control, it is necessary to contrast the behavior of the participants exposed to the depleting task (henceforth, the experimental group) with participants who were not subject to the same emotional stress (the control group). Our control group is administered the same set of gambles as the experimental group. The key difference between the experimental and control group is that the former receive feedback on each gamble

(i.e. whether they won or lost the gamble), and the latter do not. In Figure 1 we illustrate the basic concept of the experiment, showing one specific gamble.



Note: Green (red) circles (presented in light (dark) gray in this Figure) depict the probabilities of a win (loss) described in the specification of each gamble. The numbers presented in green (red) depict the amount won (lost). Statements "You have won 10" or "You have lost 5" present the way of communicating the feedback about the outcome of the gamble in the experimental group (this stage was omitted in the control group).

Figure 1. Overview of the experiment – a graphical presentation of the probabilities and outcomes of winning and losing

Source: Authors' own study.

To measure the feelings of participants – which is aimed at investigating whether they considered the depleting task to be emotionally taxing – after completing the survey, they were asked to select items from the Positive and Negative Affect Schedule [Watson et al. 1988].

We have taken some steps to ensure that the experiment could be considered robust. Firstly, we informed the participants that – apart from their regular crowdsourcing compensation – the three top performers will receive a payout of 6 USD, 3 USD, and 1.5 USD. The purpose of this is to ensure that participants are sufficiently engaged in the experiment. Secondly, we have included in the survey, three 'control' gambles. This was, once again, to check against the possibility that the participants answered randomly, i.e. that they weren't sufficiently engaged in the experiment. Thirdly, we asked participants to give feedback on the experiment, and to assess the fairness of the gambles and the general quality of the survey. This was done to rule out the possibility that participants considered the experiment not credible.

4. Results

Overall, 61 participants took part in the study: 30 in the experimental group, and 31 in the control group. After data collection, 4 participants from the experimental group and 6 from the control group were excluded from the analysis, as their responses suggested that they did not put sufficient effort into the survey (i.e., they did not participate in at least one ‘control’ gamble). Thus, the final sample consists of 26 participants in the experimental group, and 25 participants in the control group. A comparison of both of our samples reveals homogeneity according to each variable (Levene’s tests were not significant).

It is worth mentioning that our study was conducted on a geographically diverse sample, so comparing the samples by country of origin is not feasible. However, a rather crude analysis shows that our groups did not differ significantly according to the continent of origin. Moreover, as Horton, Rand and Zeckhauser [2011] notice, conducting experiments through crowd-sourcing platforms is as valid as laboratory and field experiments. Subjects in the experimental group rated the fairness of the gambles at 3.12 and the quality of the survey at 4.35 (both on a 5-point scale), which we interpret as evidence that they considered the survey credible.

Table 2 presents a comparison of the performance and participation rate between the subjects in the experimental and control group. The results show that participants in the experimental group took part in gambles which would have a mean total (cumulative) expected value of 95.7, which was lower than the mean expected value of the gambles for participants in the control group (106.3), the differences being statistically significant ($p < 1\%$). The rate of participation in the positive and negative-EV gambles shows why.

Participants in the experimental group decided to participate in 79% of the gambles with a positive-EV, compared to the rate of participation in the control group (89%; these rates are statistically different at the 5% level). Conversely, the rate of participation in gambles with a negative-EV was similar for both groups (15% for the experimental group and 12% for the control group; the difference is not statistically significant). Altogether, the results suggest that the depleting task has decreased the propensity to participate in gambles with a positive-EV (the subjects have become averse to such gambles to a certain extent), without affecting their participation in gambles with a negative-EV.

These findings might lead one to conclude that participants might have found the outcomes of the gambles with a positive-EV to be rigged. However, given that the assessment of the gambles’ fairness was good, and that participants did not provide negative feedback on the survey after completion, this conclusion is not supported by the evidence. More likely, this might be the result of an increased level of risk aversion resulting from initial losses [Thaler, Johnson 1990].

Table 2. Performance and participation in gambles

	Experimental group	Control group	<i>diff</i>
Cumulative expected value (EV)	95.67 (18.43)	106.28 (11.06)	**
Participation in positive-EV gambles	0.79 (0.18)	0.89 (0.13)	*
Participation in negative-EV gambles	0.15 (0.14)	0.12 (0.15)	

Note: The table presents the mean level of affect. Standard deviations are in parentheses. **, * denote significant differences at the 1, 5% level, respectively (Mann-Whitney U test).

Source: Authors' own study.

Table 3 shows the results of a comparison of how the participants felt after completing the survey (we only report feelings that correspond to the level of emotional stress). Our findings strongly support the hypothesis that the depleting task has produced negative affect in the participants. More specifically, participants in the experimental group reported being significantly more upset, irritable, nervous and jittery than participants in the control group. However, somewhat surprisingly, participants did not report being significantly more distressed, which contrasts with the results obtained for the remainder of the negative affect measures.

Table 3. Assessment of negative affect

	Experimental group	Control group	<i>diff</i>
Distressed	2.69 (1.19)	2.48 (1.39)	
Upset	2.96 (1.00)	1.68 (0.85)	**
Irritable	2.81 (1.10)	2.04 (1.14)	*
Nervous	3.19 (1.39)	2.08 (1.19)	**
Jittery	3.00 (1.10)	1.96 (0.98)	**

Note: The table presents the mean level of affect. Standard deviations are in parentheses. **, * denote significant differences at the 1, 5% level, respectively (Mann-Whitney U test).

Source: Authors' own study.

Overall, although our investigation shows that the administration of the depleting task puts emotional stress on participants, the hypothesis that such strain increases the propensity to engage in unfavorable gambles (gambles with a negative expected value) is not supported by our results.

5. Conclusion

In this study we tested a potential method of decreasing the level of self-control in participants, which could be considered a novel experimentally-derived measure

of self-control in the financial domain. As expected, the responses provided by participants suggested that being subject to the depleting task caused an increase in negative affect. However, this shift in affect did not increase participation in gambles with a negative expected value, which we operationalized as a measure of self-control depletion. Thus, our hypothesis was not supported by the evidence.

For a plausible explanation, one might look at the research carried by Leith and Baumeister [1996], which revealed that negative affect must be coupled with physiological arousal to increase risk-taking (in another study, Mano [1992] argued that the level of arousal is a more significant determinant of the willingness to gamble than the affective state). Thus, it is possible that our task (in which participants only made hypothetical decisions, i.e. they had no possibility to lose their own money) elevated the level of negative mood, but did not arouse the subjects to a level that would promote irrational risk-seeking behavior.

Our other finding – on the decline in participation in gambles with a positive expected value (after experiencing losses) – is convergent with conclusions drawn by Thaler and Johnson [1990], i.e. that people tend to be more risk-averse when they had prior losses. This confirms the notion that elicited emotional states can influence decision making and shift one's risk preferences. This may be connected with the observation that risk perception is strongly associated with affective reactions [Slovic et al. 2004]. Namely, if someone has experienced a negative outcome of a prior decision, that person could create a negative connection to the object of this decision [Damasio 1994], and hence may avoid it (in our case: avoid risky choices) in the future.

We should mention that our study, as any, has its limitations. For example, the gambles we used are only hypothetical, and we have not measured the level of physiological arousal. These shortcomings could be addressed in future studies, e.g. through a study in which participants would play with real money, which would ensure a higher level of involvement and arousal. Alternatively, the order or parameters of the gambles could be changed. For example, to induce a desperate win-back longing in the participants, after having suffered several losses participants may be given an opportunity to nullify their losses in one stroke, through a high-win and low-loss negative expected value gamble¹.

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