Kumulative Dissertation zum Themengebiet:

On Rational and Non-Rational Choice Behavior in Dynamic and Static Situations under Risk: Experimental Evidence of the Domains Ethics, Health and Shadow Economy.

vorgelegt von

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CONTENTS

1 Acknowledgements

I clearly remember the day my designated supervisor Professor René Fahr called me on the phone (yes on a conventional phone) to offer me a job position as a PhD candidate at the new established chair of Corporate Governance at the University of Paderborn. At that time I was about to write my diploma thesis in information systems (Wirtschaftsinformatik) at the University of Cologne and I already had a job offer to work as a programmer in a software company, which was like a dream coming true. Still, I did not need much time to decide in favor of academia. And most importantly, I am very happy to have made that decision!

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I am deeply indebted to my PhD supervisor, Professor René Fahr, for supporting me during all these years. René is not only one of the smartest people I know but also my role model for meticulous academic work. He has given me the freedom to pursue various projects without objection and was always (even after midnight) available for insightful discussions and suggestions. During and beyond all the research projects we have done together it has been a real pleasure to learn so much from his expertise. René, your advice on my career have been priceless.

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2 Introduction and Synopsis

The current doctoral thesis investigates human (non-)rational choice behavior in static and dynamic situations under risk. The research in this thesis comprises a literature review about dynamic decision-making on low probability events with high negative consequences and five experimental studies about individual choice behavior in the domains of ethics, health and shadow economy. Insights from the field of behavioral economics are used to conceptualize the economic world with more realistic psychological foundations, while the predictions of the proposed behavioral models are empirically validated by the methods of experimental economics.

Traditional models of choice under uncertainty which rely on solid axiomatic systems and rationality principles have often been challenged on several grounds from both within and outside economics.[1] With regard to modern economic theory as a descriptive enterprise, there is a great deal of evidence which suggests that a variety of behavioral factors appear to be highly consequential for economic outcomes, yet dismissed by classical theory, implicitly or explicitly, as unimportant details (Shafir, 2007). Moreover, explored mainly by psychological research and summarized under the term bounded rationality (Selten, 1998; Simon, 1972), systematic biases manifested in the beliefs people have and choices they make run profoundly counter to what, in the formal world, is envisaged as rational agents.[2] These two components seem to be especially entailed in economic situations considered in this thesis. For example, the traditional framework by Allingham and Sandmo (1972) which models tax evasion as individual choice under risk and uncertainty predicts only poorly how people actually decide about paying taxes (Kirchler et al., 2007). Factors going beyond parameters like income, tax rate, detection probability and sanctions seem to matter for the tax payer. In dynamic situations with repeated decisions, decision-makers tend to misperceive the cumulative nature of risk (Slovic, 2000), ignore low-probability events (Kunreuther et al., 2001) or violate the principles of dynamic rational choice (Machina, 1989). So far, there is no economic model based on rational choice which might explain why patients stop taking their medicine at some point in the medical treatment, leave alone predicting patient behavior given costs, benefits and risks of (non-)complying with medication (Elliot et al., 2008).

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[1]For surveys, theoretical developments and empirical findings see for example Camerer, 1995; Chew and MacCrimmon, 1979; Chew et al., 1991; Fishburn, 1988; Hey, 1984; Kahneman and Tversky, 1979; MacCrimmon and Larsson, 1979; Machina, 1987; Quiggin, 1982; Starmer, 2000; Sugden 1986; Tversky and Kahneman, 1992; Weber and Camerer, 1987.

[2]Some illustrative examples of biases in judgments include overconfidence, optimism, anchoring, status quo and extrapolation (Kahneman et al., 1982; Kahneman and Tversky, 2000).

The central aim of the thesis is therefore to propose and empirically validate alternative models of individual choice based on principles of behavioral economics. At the core of behavioral economics is the conviction that standard economic frameworks enriched with psychological foundation will make the models more accurate and increase the understanding of the field of economics on its own terms (Camerer and Loewenstein, 2003; Diamond and Vartiainen, 2007). Accordingly, practicing behavioral economics requires the modification of only few assumptions of the standard theory in the direction of greater psychological realism without abandoning the key methodological principles of modern economics.

The following lines provide some background and briefly introduce the six papers of the doctoral thesis.

The first paper, *Djawadi, B. M. (2016)*, reviews the literature about risk perception and choice behavior in dynamic situations with repeated decisions of low-probability, high-consequence events. This kind of situation often occurs in daily life, i.e. making many car trips during a year, smoking cigarettes over a long period of time or frequently investing in stocks with low risks of a total loss. All the described situations under risk and uncertainty potentially generate an anomaly: while the single probability of an event with high negative consequences may be small, being exposed to the same situation repeatedly over time however makes the one-time occurrence of this event highly probable. As the negative consequences in form of an accident or a medical hazard are either lethal or, in form of severe financial damages, crucial for future life, the impact of judgment and choices about these low-probability, high-consequence events deserves special attention. Evidence is presented which demonstrates that people violate the principles of rationality and make their decisions in isolation instead of integrating all future consequences. Moreover, errors in belief formation lead to judgments which do not coincide with those obtained by probability theory and Bayesian updating. The basic proposition of this literature review is that policy-makers can benefit from an integrated view of psychological factors and economic (non-)rational choice behavior so that a better understanding of how people think and make decisions about cumulative risk of extreme events conceivably leads to effective policies and risk management strategies.

The second paper, *Djawadi, B.M. and Fahr, R. (2013)*, studies the impact of risk perception and risk attitudes on corrupt behavior. Petty corruption describes the situation in which the public official frequently engages in illegal actions where small amounts of bribes are involved and the detection rate is rather low. In this respect, this situation is an application of the aforementioned dynamic situations with repeated decisions of low-probability, high-consequence events. The probability of being detected when taking bribes may be very small in each case. However, since getting caught terminates the career of a public official, what matters is the

overall probability of getting caught once, which is much higher if the public official habitually engages in corruption. To abstract from confounding effects of reciprocal behavior, we design an experiment where a public official decides upon accepting a bribe that leads to a higher present period income while facing the risk of being audited and being left with a considerable lower income in all subsequent periods. Because risk attitudes might differ when putting earned versus endowed income at risk, treatments are compared in which participants either receive an endowment beforehand, or earn their income by conducting a real effort task in every period. Independent of the treatments, high rates of corruption can already be found in very early periods which suggest a systematic underestimation of the overall probability of being audited. Risk attitudes measured with a subsequent lottery-choice experiment do not correlate with the behavior observed in the corruption experiment. These findings have important political implications because the underestimation of the total risk involved in engaging in corrupt behavior might nullify measures to fight petty corruption by increased governmental auditing.

The third paper, *Djawadi, B.M. and Fahr, R. (2014)*, investigates how firstly tax knowledge about public expenditures and secondly taxpayers' influence on budget spending affects tax compliance. Embedded in two hypothetical tax systems with high and low power of authorities respectively, we investigate in which specific tax system transparency and taxpayers' control over the use of the taxes are of major relevance. To clearly disentangle any effect from factors that are known to influence tax compliance from previous studies, we control for tax commitment, risk attitude, income and effort exerted on the task in the experiment. Tax compliance is higher in tax systems with low power of authorities when providing complete transparency about public expenditures and when taxpayers are given the possibility to decide on the use of their taxes. With a powerful tax authority in place which is reflected in high audit rates, this tax knowledge and the influence on budget spending do not affect compliance rates. We find that tax commitment, income and real effort are not related to tax compliance and thus do not explain our results. However, we find evidence that compliance increases with the degree of risk aversion. These results have important policy implications as obviously the mere hypothetical possibility of expressing preferences concerning budget spending influences tax compliance. Tax authorities can provide taxpayers with information along with the annual tax declaration about the different tax items, the volume of the federal budget and a feedback mechanism to express preferences about the allocation of their tax dollars.

The fourth paper, *Djawadi, B.M. and Fahr, R. (2015)*, generates evidence with a field experiment on the pervasiveness of cheating in professional contexts. Over the last decade ethical issues in business received more and more attention. Rather than adopting a prescriptive or normative approach which uses insights from philosophy to describe how people should behave

in ethical dilemma situations, the field of behavioral ethics describes the actual behavior of people, the influence of social and situational factors on ethical decision-making and studies how decisions can be nudged towards a more ethical direction with simple interventions (Bazerman and Gino, 2012). Given the huge economic damage that unethical behavior causes by evading taxes or insurance fraud, it is not surprising that economists are also interested in the overall distribution and the determinants of lying and cheating in professional contexts. We argue that lying in professional contexts share three characterizing features: 1) the gain from the dishonest behavior is uncertain, 2) the harm that lying may cause to the other party is only indirect and 3) lies are more indirect lies by action or written statements. Conducted as a field experiment with a heterogenous group of participants during a University "Open House Day", our "gumball-machine-experiment" provides evidence that more than 32% of the population cheats for their own gain. Regarding highest educational level and professional status we find that students cheat significantly more than non-students, i.e. pupils and fully-employed subjects. This finding warrants a careful interpretation of generalizing laboratory findings with student subjects about the prevalence of cheating in the population. Apparently, field experiments serve as an important empirical source to replicate behavioral cheating patterns found in laboratory studies. In addition to that, experiments conducted in a more natural environment or with a heterogeneous subject sample increases scientific knowledge about human conduct which might be especially important in the domain of lying and cheating. Thus, complementing laboratory research with field experiments offers a promising approach to gain further insights about lying preferences and strengthens the accurateness of possible policy implications.

The fifth paper, *Djawadi, B.M., Fahr, R. and Turk, F. (2014)*, develops a conceptual framework which augments standard economic choice theory with psychological concepts of behavioral economics to understand how patients' preferences for discontinuing with therapy arise over the course of the medical treatment. The reasons why comprehensive research in health care on the causes of non-compliance and non-persistence from a economics perspective is scarce and seldom part of the different intervention strategies, are manifold and apparent: 1) The few attempts to economically explain medical non-compliance and non-persistence only consider rational choice behavior and ignore promising approaches from behavioral economics which augment standard economic theory along with greater psychological realism (Camerer and Loewenstein, 2003). 2) There is no theoretical framework which captures the dynamic nature of compliance behavior and links the individual decision to the observed outcome over time. 3) The empirical research based on observational data or clinical studies lacks the ability to identify the general drivers of the patient's decision-making process to discontinue with therapy. Instead, existing clinical meta-analyses and retrospective studies identify determinants which

imply correlations rather than causal relationships with observed outcomes (Mihalko et al., 2004). Our conceptual framework models the patient as active economic agent who evaluates the benefits and costs for continuing with therapy. We argue that a combination of loss aversion (Kahneman and Tversky, 1979) and mental accounting operations (Thaler, 1985; 1999) explain why patients discontinue with therapy at a specific point in time. To isolate the economic drivers of the underlying decision-making process, we abstract from any medical context and transfer the key components of a conventional medical treatment into an equivalent economic investment setting. The decision environment in the investment setting differs from the medication intake only in the fact that individuals are confronted with economic goods rather than medication products. Framed as a simple investment game over discrete time, we design a laboratory experiment in which participating student subjects make repeated decisions on two investment options with different risk profiles and outcome probabilities. The two investment options represent the economic equivalent of either continuing or discontinuing with therapy. Consistent with the predictions of our conceptual framework, subjects continue with therapy as long as experienced utility losses have to be compensated. As soon as prior losses are evened out, subjects perceive the marginal benefit of compliance lower than in the beginning of the treatment. Consequently, subjects start to discontinue with therapy. It is evident from observed behavior and revealed preferences in the laboratory that subjects' choices are not aligned with rational choice theory. Instead, loss aversion and the diminishing sensitivity of future gains account for the increasing tendency of subjects during the course of a treatment to discontinue with therapy at a specific point in time. Incorporated in our conceptual framework, concepts of bounded rationality and behavioral economics seem to capture the dynamic nature of medical non-persistence much better than standard economic models and generate more accurate predictions about how patients behave under circumstances characterized by risk and uncertainty. The sixth paper, *Djawadi, B.M., Fahr, R. and Turk, F. (2016)*, uses the procedure of behavioral economic engineering to develop and test three different financial incentive schemes aimed at improving compliance behavior in therapeutic treatments. Unlike field experiments where the researcher is interested whether the effect found in the laboratory prevails in a more natural environment, behavioral economic engineering pursues the other direction: real-world institutions are brought into the laboratory, and mechanisms are tested that align individual incentives and behavior with the underlying goals (Bolton and Ockenfels, 2014). Drawing on theories from behavioral economics and the conceptual framework of medical non-compliance, loss aversion and the evaluation of future utility gains relative to a reference point are decisive for the individual decision to non-comply. Based on this knowledge, three financial incentive schemes grounded in concepts of mental accounting (Thaler, 1985; 1999), prospect theory

(Kahneman and Tversky, 1979) and choice bracketing (Read et al., 1999) are elaborated. Subsequently, their effectiveness on compliant behavior is investigated under the same controlled experimental conditions, allowing for clear causal inferences on observed behavior. We design a randomized laboratory experiment in which participants decide in analogy to an investment plan between compliance and non-compliance. The economic consequences as trade-off between benefits and costs for compliant behavior and the entailed risks of suffering a medical relapse are modeled as monetary lotteries which participants are asked to choose between in each period. We find that a financial incentive scheme based on prospect theory significantly increases compliance behavior. By lowering the costs of compliance in situations in which losses have been compensated, the economic gain of being compliant remains attractive and leads subjects to significantly comply more compared to the baseline experiment with no incentives at all. Referring to medical treatments, this finding implies that an incentive program of lowering copayments of the medicine prescribed to the patients during the course of the treatment is an effective way in improving compliant behavior. In contrast to these results, we do not find any change in compliance when we use a deposit contract to increase loss aversion in the beginning of a treatment or through the use of a bonus system aimed at enhancing rational choice behavior.

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Synopsis

Publication	**Djawadi, B. M. (2014):** Dynamic Decision Making and the Perception of Risk for Low Probability Events: A Literature Review. Working Paper, University of Paderborn.
Contribution of joint work with co-authors	This work is single-authored.
Conferences/ Workshops	-
Scientific Dissemination	The work on this literature review started in December 2013 and reached the status of a working paper in March 2014. Submission is planned in 2016 to the Journal of Risk and Uncertainty or Risk Analysis.

Publication	**Djawadi, B.M. and Fahr, R. (2013):** The Impact of Risk Perception and Risk Attitudes on Corrupt Behavior: Evidence from a Petty Corruption Experiment. IZA Discussion Paper No. 7383, Bonn, Germany.
Contribution of joint work with co-authors	-Co-authorship with Prof. Dr. René Fahr (50% B.M. Djawadi; 50% R. Fahr) -Idea and experimental design were jointly developed -Programming of experiment in z-tree and experimental procedure by B.M. Djawadi -Non-parametric analysis jointly conducted -Maximum likelihood analysis to derive risk preferences by B.M. Djawadi -Write-up of paper jointly.
Conferences/ Workshops	The paper was presented by B.M.Djawadi on the following conferences and workshops: **01/2016:** Conference **"**Gaidar Forum 2016 'Russia and the World: Looking to the Future'", Moscow, Russia **10/2012:** Conference "7th Alhambra Experimental Workshop", Granada, Spain **10/2012:** Workshop "The Economics of Corruption 2012: The Behavioral Limits of Dishonesty", University of Passau, Germany **09/2011:** Conference "European Meeting of the Economic Science Association (ESA)", University of Luxembourg, Luxembourg.
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Publication	**Djawadi, B.M. and Fahr, R. (2014):** The Impact of Tax Knowledge and Budget Spending Influence on Tax Compliance. Working Paper, University of Paderborn.
Contribution of joint work with co-authors	-Co-authorship with Prof. Dr. René Fahr (50% B.M. Djawadi; 50% R. Fahr) -Idea and experimental design were jointly developed -Programming of experiment in z-tree and experimental procedure by B.M. Djawadi -Non-parametric and multivariate analysis jointly conducted -Maximum likelihood analysis to derive risk preferences by B.M. Djawadi -Write-up of paper jointly.
Conferences/ Workshops	The paper was presented by B.M. Djawadi on the following conferences and workshops: **10/2013:** Workshop " Experiments in Tax Research", University of Paderborn, Germany **09/2012:** Conference "European Meeting of the Economic Science Association (ESA)", University of Cologne, Germany **06/2012:** Conference "11th edition of the Journées Louis-André Gérard-Varet", Institut d'Economie Publique (IDEP) Marseille, France **07/2011:** Conference "The Shadow Economy, Tax Evasion and Money Laundering", University of Munster, Germany.
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Publication	**Djawadi, B.M. and Fahr, R. (2015):** "…and they are really lying": Clean Evidence on the Pervasiveness of Cheating in Professional Contexts from a Field Experiment. In: Journal of Economic Psychology, Vol. 48(1): 48-59.
Contribution of joint work with co-authors	-Co-authorship with Prof. Dr. René Fahr (50% B.M. Djawadi; 50% R. Fahr) -Idea of gumball-machine and feature to measure exact levels of cheating by B.M. Djawadi -Experimental design jointly developed -Experiment jointly conducted -Non-parametric and multivariate analysis by B.M. Djawadi -Write-up of paper jointly.
Conferences/ Workshops	The paper was presented by B.M. Djawadi on the following conferences and workshops: **07/2013:** Conference: "2013 SABE/IAREP/ICABEEP conference", Clayton State University, Atlanta, USA **07/2013:** Conference: "World Meeting of the Economic Science Association (ESA)", University of Zurich, Schwitzerland **04/2013:** Conference "9th International Meeting on Experimental and Behavioral Economics (IMEBE)", Universidad Carlos III Madrid, Spain.
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Publication	**Djawadi, B.M., Fahr, R. and Turk, F. (2014):** Conceptual Model and Economic Experiments to Explain Non-persistence and Enable Mechanism Designs Fostering Behavioral Change. In: Value in Health, Vol. 17(8): 814-822.
Contribution of joint work with co-authors	-Co-authorship with Prof. Dr. René Fahr and Dr. Florian Turk (50% B.M. Djawadi; 30% R. Fahr; 20% F. Turk)-Brainstorming jointly with R. Fahr and F. Turk -Experimental design by B.M. Djawadi and R. Fahr -Programming of experiment in z-tree and experimental procedure by B.M. Djawadi -Non-parametric and survival analysis by B.M. Djawadi -Write-up of paper by B.M. Djawadi. Feedback, comments and corrections by R. Fahr. Minor corrections by F. Turk.
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Contribution of joint work with co-authors	-Co-authorship with Prof. Dr. René Fahr and Prof. Dr. Florian Turk (45% B.M. Djawadi; 45% R. Fahr; 10% F. Turk)-Experimental design jointly developed -Programming of experiment in z-tree and experimental procedure by B.M. Djawadi -Non-parametric and survival analysis by B.M. Djawadi -Maximum likelihood analysis to derive risk preferences by B.M. Djawadi -Write-up of paper by B.M. Djawadi. Feedback, comments and corrections by R. Fahr and F. Turk.
Conferences/ Workshops	The paper was presented by B.M.Djawadi on the following conferences and workshops: **06/2013:** Conference "12th edition of the Journées Louis-André Gérard-Varet", Faculté d'Économie et de Gestion, Aix-en-Provence, France **03/2013:** Conference "6th Annual NYU-CESS Experimental Political Science Conference", New York University, USA **06/2012:** Conference "International Society for Pharmacoeconomics and Outcomes Research (ISPOR)", Washington D.C., USA.
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Note:

All co-authors Prof. Dr. René Fahr (rene.fahr@upb.de) and Prof. Dr. Florian Turk (florian.x.turk@gsk.com) hold already a PhD title. Therefore, none of the parts of the current thesis have been used in other pending dissertations.