Available online at www.sciencedirect.com

ScienceDirect

Procedia Economics and Finance 39 (2016) 482 – 492

Procedia Economics and Finance

www.elsevier.com/locate/procedia

3rd GLOBAL CONFERENCE on BUSINESS, ECONOMICS, MANAGEMENT and TOURISM, 26-28 October 2015, Roma, Italy

Experiments in Economics

Petr Obergruber[a*], Gabriela Hrubcova[a]

[a]*University of Economics, Departmant of Microeconomics, W. Churchill Sq. 1938/4, Prague, Czech republic*

Abstract

The experiment is one of base approach to scientific work for centuries. However, as Camerer & Loewenstein (2004) mentioned, many economists have long been pessimistic that an experimental approach could offer such vivid illustrations of cause and effect in their field. Difficulties of experimental approach are highly compensated by datasets and we would like to show how to use this experimental approach correctly. For this reason, we introduce the experimental design of our experiment and show some major problems with developing experiment, ways how to solve those problems or avoid the problem. Main theoretical focus of this essay is on paradigm about homo economicus and the ceteris paribus condition in the context of necessarily in economic research. Focus of the experiment part will be put on problematic of too complex experimental design, ways how to avoid that and through that shows also mistakes which could arise with development.

Peer-review under responsibility of the Organizing Committee of BEMTUR- 2015

Keywords: Ceteris paribus; experimental design; homo economicus; behavioral economics; reliability of results

1. Introduction

In nature sciences, there is long history of using experiments in science work and discovering. In this case it is no surprise – there is no possibility to asks molecules about their experiences through reaction or calculate trajectory of falling object by studying time lines. Nature sciences are made for experimental research simply because there is no other way how to improve the understanding of the problematic.

For a long time, economics (or economists) choose other way of science approach – more similar to mathematic. The mainstream economics research focused for a decades to formulate normative theories based on behavioral of

* Petr Obergruber, Tel.: +420 728 138 996;
E-mail address: xobep00@vse.cz

Peer-review under responsibility of the Organizing Committee of BEMTUR- 2015
doi:10.1016/S2212-5671(16)30352-5

homo economicus – perfect rational and logical being with no emotions. This approach with homo economics condition simplify many problematic part of human behavior applied in economic. With this approach we can formulate robust and internally logical structure of microeconomics and macroeconomics with relative ease.

Second important condition in whole mainstream economics is ceteris paribus condition. This one says that when we study any changes in economics, we do so with only changes we explicitly define – every other variables stays constant. This often leads to study impact of only one changed variable to several variables, which we choose. That kind of logic has major advantage, which is simple explanation of impacts and also has big pedagogical advantages.

Unfortunately, the homo economicus condition and ceteris paribus condition has big problems when they are taken too seriously. Models we can build on those condition lacks reflection of the reality and could generate systematical mistakes in our description of the situation and in our predictions. Especially in microeconomics when we are talking about homo economicus as single decision maker, we can get dramatically different conclusions from the reality, when people do not decides completely or even partly rationally.

The experimental approach is one of possibilities, how to deal with two strong conditions we have in economics. Based on experiments of Kahneman, Knetsch, & Thaler (1991, 2000, 2008) and List (Levitt & List, 2007; List, 2003, 2014) experimental economics refuse the conditions given the notable significance of the anomalies from the normative models or uses weaken or approximate type of those conditions.

There are basically two ways how to use experiment in economics: Lab experiment and Field study. Ideal lab experiments would be some decision making problem with one independent variable (I.V.) and one dependent variable (D.V.). The conclusion of this ideal experiment would be mathematical relationship of those two variables. In the same time, the lab experiments are usually designed to be consistent with ceteris paribus condition at least on some level. The homo economicus condition is abandoned.

As we obviously cannot come up with this clear dataset, we can still come up with relatively close situation when we just accept, that the relationship between I.V. and D.V. will not be perfectly related and there will be some noise in our dataset (random deviations from relationship - ε).

Pros of this experimental design is relatively easier statistical treatment and not as tricky conclusions. Cons are difficulties with preparation of experimental design – designer must be very careful with every decision possibilities. All of decision and motivations of participants must be consistent with initial $D.V. = f(I.V.)$ needs. If there is some untreated result or motivation which designer did not take in consideration (or which just does not fit as initial I.V. or D.V.) the whole experiment is useless. This approach can give us (with proper experimental design) good insight to human behavior and decision making. On the other hand, lab experiments are executed in sort of sterile environment, which could shift results in unexpected way and obviously, participants know that they are tested. This could change motivation and behavior as well. A critical assumption underlying the interpretation of data from many laboratory experiments is that the insights gained in the lab can be extrapolated to the world beyond, a principle we denote as generalizability. As Levitt & List (Levitt & List, 2007) argue, for physical laws and processes like gravity, photosynthesis, and mitosis, the evidence supports the idea that what happens in the lab is equally valid in the broader world. This is not always the case of economics processes.

With leaving ceteris paribus condition we can still execute reliable and robust experimental investigation in economics, which is shown in works of Camerer & Loewenstein (2004), List (List, 2003, 2014) or in Kahneman ‘s work (Kahneman et al., 1991, 2008; Kahneman & Tversky, 1979; Tversky & Kahneman, 1992). Leaving the ceteris paribus condition permits us to study real world situation, but also hugely increases demands to perfection of execution of this study and our statistical methods. While all our measured actions or decision are happening in permanently changing environment, on the one hand we have to take those changes into account, but on the other hand the results could not be based only on environmental context. In every case conclusions must be at least partly general.

Those studies are infeasible with lab experiments, therefore they subject to different rules how to execute this type of field studies and generally demands more participants and wider measures than lab experiments. But at the end they could provide better conclusion and understanding of the problematic because of real world situations. Also participants do not has to know that they are participating in the experiment.

The empirical goal is of course the perfection of ceteris paribus condition of lab experiment with real world environment of field study. This is obviously easier said than done. But also we cannot assume that we should execute experiments with relative freedom of field study with faster and simpler lab experiment. Both approaches has its own pros and cons and both has to be executed under some rules. In following text, we would like to show you some of the lab experiments rules and possible mistakes in experimental design.

2. Complexity in simplicity of lab experiments

As it was mentioned, lab experiments usually study very simple decisions from limited possibilities. With this, experimental designers usually comes with surprisingly simple mechanics, how and what they want to study. Then they gather data on participants of the experiment. However, under those simple and straight forward decision possibilities often lays hours of preparations, because many good ideas shows themselves as too complicated or unfeasible. One problem could be, that the simple looking decision making process could hide many possible motivations of decision maker, which could cause overgrowing experimental design in order to treat every possible way of thinking. With this come second problem which is exaggerated effort to solve too many things at once.

We were focus in following experiment on personality treats of the entrepreneurs. Since there are many researches on entrepreneurship itself and also on entrepreneurs and their behaving on the market, there are significantly less researches on their personality treats. With some modifications we were interested in relationship of the entrepreneurship attributes and overconfidence. Since we did not have proven entrepreneurs, we had decide to define entrepreneurship person under Big-five methodology developed by Costa and McCrae (Costa & McCrae, 1992) and use it as I.V. and take overconfidence as our D.V.

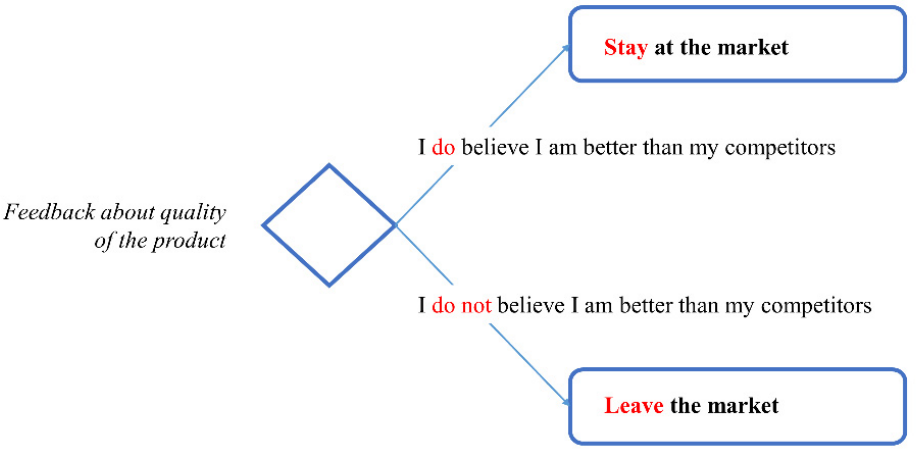
There are some verified questioners, which are quite successful with predicting better and worse potential entrepreneurs. This I.V. of entrepreneurship potential is based on Cantner, Goethner, & Silbereisen (Cantner, Goethner, & Silbereisen, 2015) 45 question questioner which measure all five dimensions of Big-five profile (openness, conscientiousness, extraversion, agreeableness, neuroticism).

As shown by Cantner et al. (Cantner et al., 2015) or earlier by Huettner, Freibauer, Haug, & Cantner (Huettner, Freibauer, Haug, & Cantner, 2010), person with entrepreneurship potential should score high at openness, conscientiousness and extraversion and score low at neuroticism and agreeableness.

2.1. Feedback and product quality

The overconfidence should have been tested on market game. The group of participants (our models worked with 5 participants per group) should have decided (after some information they got – see lower) if they want to join the market and compete with other joined participants or if they want not to join the market – in that case they save some resources they have.

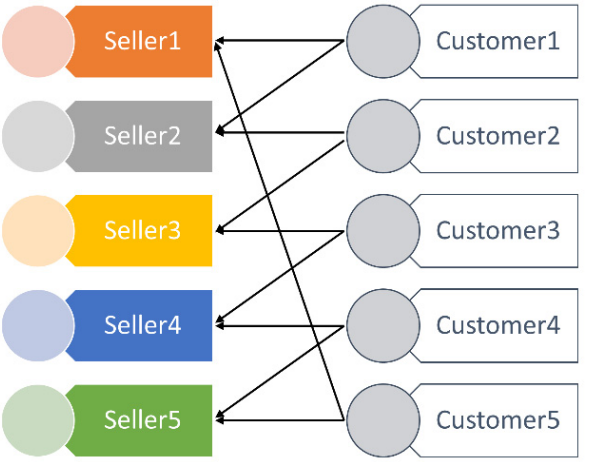
Crucial point about the decision about entering the market if mentioned information. This information is basically level of quality of the product they could sell on the market. This quality mend to be random in one group and dependent on skill in simple skill game in the other group.



Picture 1 - Decision making after feedback

2.2. Success of the sellers - payment

The sell part of the products had been designed trickier than simple better product wins. We wanted to include an element of uncertainty so we made every (virtual) customer with limited vision. Every customer has been programed to see only two sellers at the time. Between those two the customer always choose better product. Therefore not only the best product could get the payment (every customer bought one product for price 1). The amount of payment would be dependent on quality of the product and on luck combined.



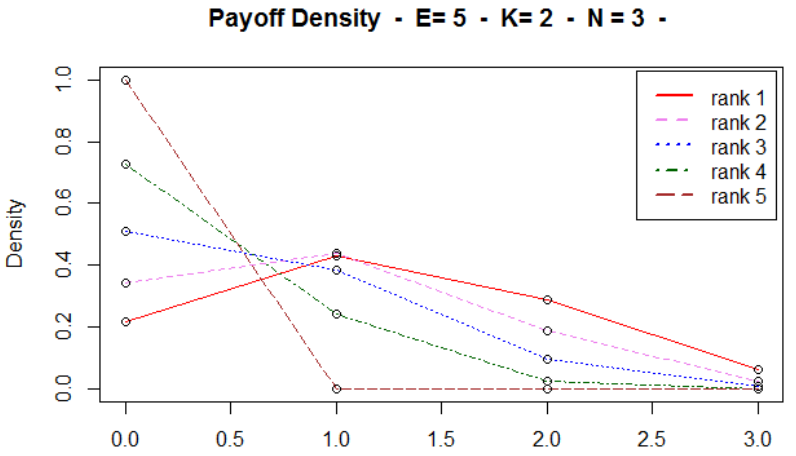
Picture 2 - Customers and limited vision

Under the rules of the customers apply on sellers in their vision, the sellers got their payment.

Table 1 - Probability of payment depending of entrants

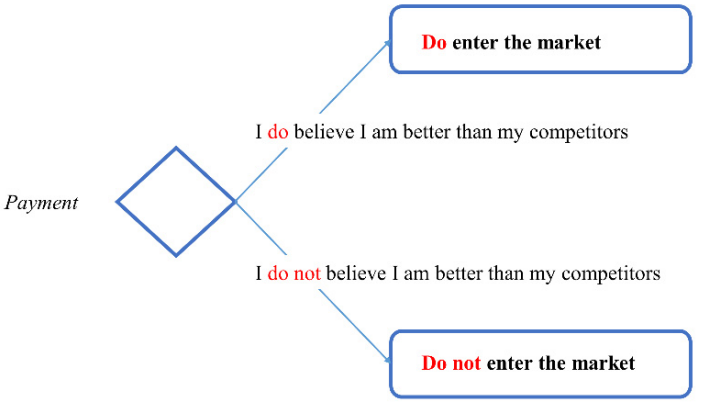
		Number of entrants				
		1	2	3	4	5
Rank of the participant	1st	100%	100%	67%	50%	40%
	2nd		0%	33%	33%	30%
	3rd			0%	17%	20%
	4th				0%	10%
	5th					0%

Moreover, there was certain probability that some of the participants get payment more than 1. Followed graph shows on horizontal axis the probability of getting payment and on vertical axis the payment. All of that with conditions that there will be 5 entrants, there are 3 consumers and every customer see exactly 2 entrants.



Picture 3 - Payoff density while defined market variables

After payment, every participant on the market should made decision if he wanted to stay at market or leave the market.



Picture 4 - Decision making after payment

On top of that we had to differ those entrants who just believed they got lucky or unlucky from those who actually were lucky or unlucky – as we will see below, this part was one of those problems which looks easy to proceed but at the end developed more problems than solve.

The intuitive way how to solve this, is simple question *"At which rank do you think your product is compare to others?"* The problem of this approach is that believes in ranks does not has to have normal distribution. That means that believes under potential answer *"I think my product is third from five"* could be mend as

- *"I think there is 10% chance I am first, 20% I am second, 40% I am third, 20% I am fourth and 10% I am fifth. I see highest chance to be third, therefore I go for third."* This would respond to normal distribution.

Or for example

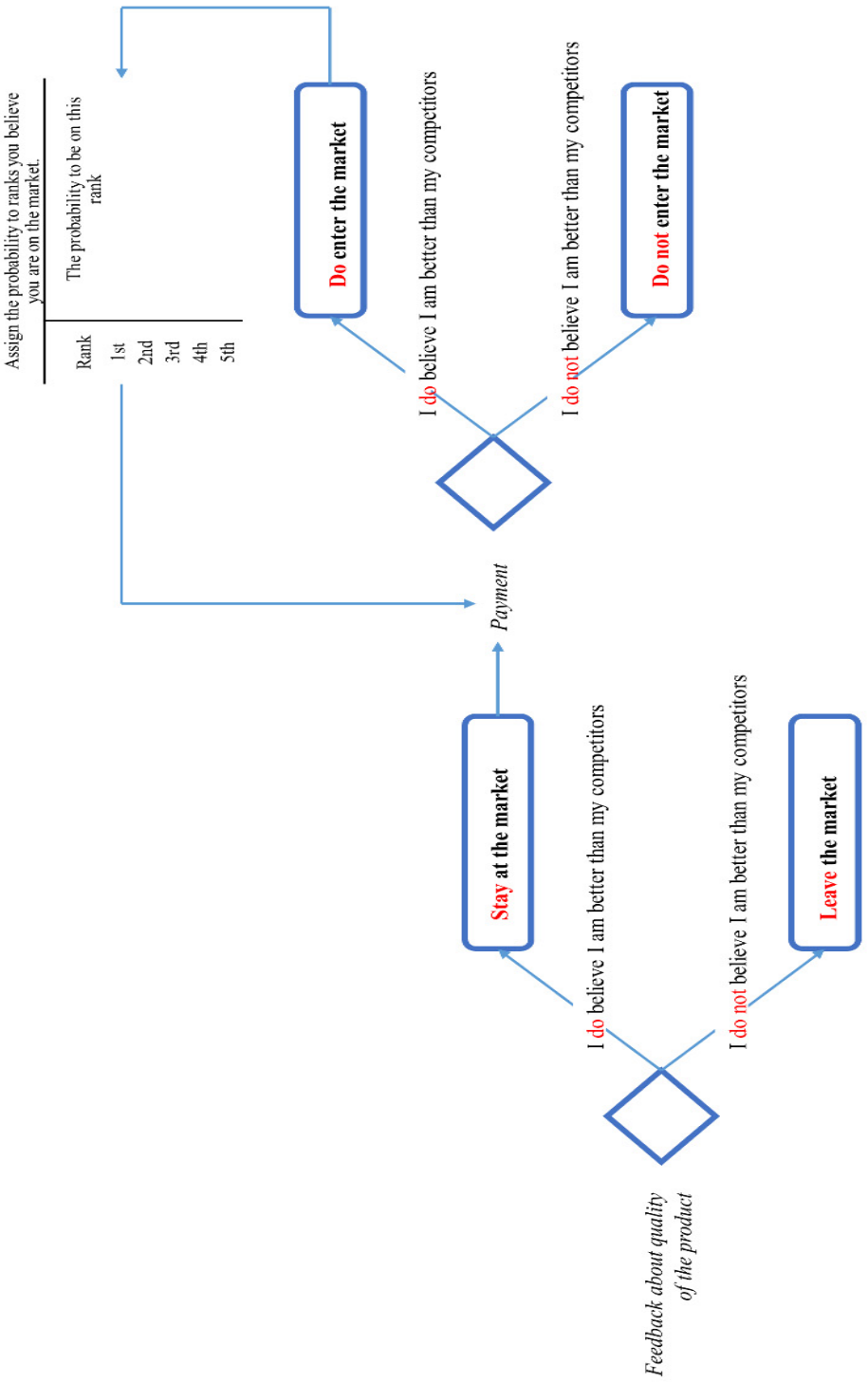
- *"I think there is 20% chance I am first, 30% I am second, 50% I am third, and there is no chance to be worse. I see highest chance to be third, therefore I go for third."*

Or any other imaginable possibility. Therefore we needed to ask to believe in distribution of possible ranks as a whole, not only most probable rank.

Table 2 - Probability assignment

Assign the probability to ranks you believe you are on the market.	
Rank	The probability to be on this rank
1st	
2nd	
3rd	
4th	
5th	

Than after whole design was finished and problem with believe in probability distribution has been solved, the whole design looks like picture 5 shows.



Picture 5 - Experimental design

2.3. Experiment as a whole and redesign

Whole process after payment has been planned to repeat 5 times and whole game (with new defining the quality of the product) has been planned to repeat 3 times. The idea of measuring the overconfidence is following: *When the participant shows more willingness to enter the market than objective information says, than he should be* (based on difference of information and decision to enter or not enter) *identify as overconfident*. Picture 5 shows process of every participant. Squares identify decision making process. As picture 5 shows, there are more than 1 decision making process which is the point where all data became highly complicated and unclear. Moreover we have to add the skill game for defining quality in one group and whole decision making process under feedback of the payment.

As whole picture 5 shows, this experiment has been designed as extremely difficult to understand and even more difficult to process potential data (moreover, the product defining part and payment part has its own specific rules). At the end this design has been (after many corrections) abandoned!

On this example we wanted to show and share some mistakes which experimental design could have. The effort to solve as many problems as possible cannot stand in the way of simplicity and comprehensibility of the experiment. In the same time, researchers has to think about data they are going to gather. With design we showed, data could be so complicated and interrelated that any statistical analysis could be beyond reach of researchers. Introduced experiment would gather data about believes of product quality, believes about luck and believes about probable rank, all of that 5x in the row.

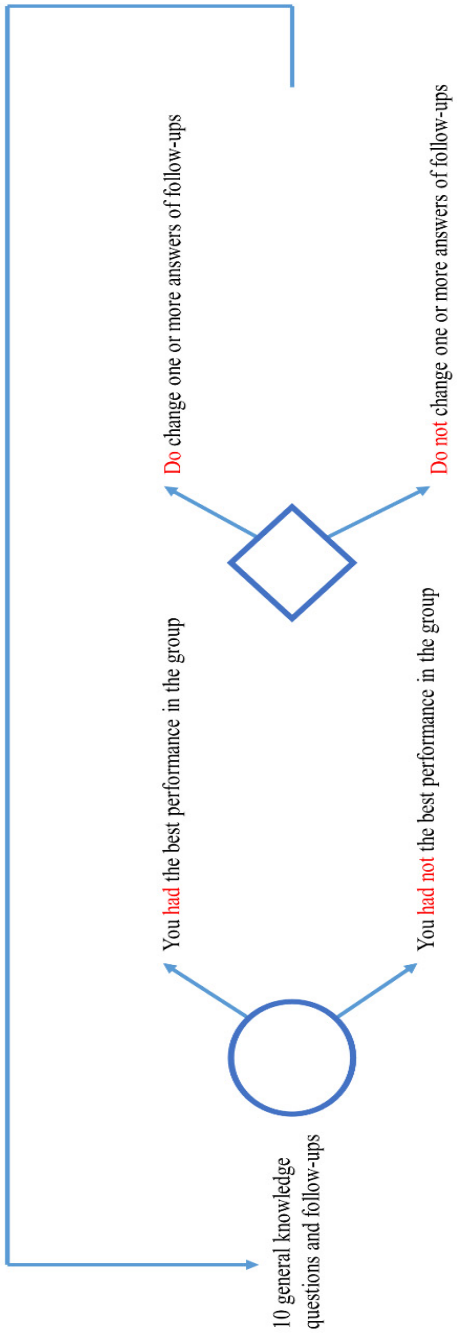
In the complicated version of the experiment we showed intention to measure the overconfidence through quite tricky way depend on understanding objective information and responding on them. Than we wanted to find relationship between those measurement and the results of Big-five personality treats.

Based on problems mentioned above, we have decided to change whole design, but we kept main idea in this redesign. We wanted to find the relationship between entrepreneur potential (through Big-five) and overconfidence.

To reach maximum simplicity, we choose one of the easiest way how to measure overconfidence. We come up with 10 general knowledge questions and asks them several times in row. The whole experiment divided participants to 4-members group. In all groups there were same questions.

Overconfidence is measured by several general knowledge questions and follow-up question. The general knowledge approach is quite usual, for example in Camerer & Lovallo (Camerer & Lovallo, 1999), so this experiment did not try to improve or replace this part. Despite of that, we wanted more indicator of overconfidence, so we add one more part which measure this variable: The follow-up question. The follow-up question which after every general knowledge question asks „How confident are you that your answer is the correct one? “. For simplicity there were just three possible levels of assurance – not at all, somewhat confident and very confident. The 10 question part has been repeated 5 times (for every participant) with same questions and same follow-ups. Than the level of overconfidence has been sum of *confident but unchanged answers* plus wrong but unchanged answers between rounds. Whole experiment supposed few patterns of behaviour which at the end should show if there is some relationship between D.V. and I.V.

Picture 6 shows decision making process of every participant.



Picture 6 - Experimental design (simple)

As it is clearly see, independently on feedback, there is only one decision making process which makes data analysis dramatically easier than in the first case. Moreover, whole experiment is highly straight forward and clear for participants.

3. Conclusion

As the mainstream economics reveals its weaknesses the experimental approach is getting more important in economics science. Even if this research method is still new for economist, the impact and influence is rising. The experiment method already showed some big faults in our understanding of decision making processes.

The dominant influence of homo economicus condition and ceteris paribus condition shaped economic as science field to the point where we almost completely abandon the simple look at human being as we know him from our daily bases. This kind of view surely bring us many important discoveries, but also made us overlook some critical points, where our models do not work at all.

Leaving or weaken those condition could bring us closer to real world condition, which rises demands to appropriate scientific methods and statistical analysis, but at the end could come up with more realistic and more specific conclusions.

As it was said above, if we would took the homo economics condition seriously, there would be no reason to execute any experiments. But as many researches and real world decisions shows, this condition is simply too strong to settle as a description of reality. The ceteris paribus condition on the other hand is not that unambiguous. Still, even with pure lab experiment, we have to assume, that this condition could not be abide absolutely.

The experimental approach as a science method has some advantages over normative theories. Whether we are talking about lab experiments of field studies, both capture the real world and both are easily comparable with existing behavioural theories.

In the same time there are disadvantages with same magnitude as advantages. With lab experiments you are dependent on precise modelling of closed and sterile environment which on the one hand could simulate ceteris paribus condition well, but in the same time could cause unsolvable problems, when experimental design is not as simple as it looked like at the beginning.

We showed you the experimental design which has this kind of problem. At the beginning and pre-designing looked very simple and feasible. But with treating of all conditions, open ends and potentially ambiguous decisions we ended up with huge decision making process which would be incomprehensible for significant amount of participants and so complicated that any statistical analysis would be on the edge of possibilities of researches.

Acknowledgement

This article was created with the help of the Internal Grant Agency of University of Economics in Prague No. 80/2014 under the title „Non-monetary Incentives on the Labor Market."

References

Camerer, C., & Loewenstein, G. (2004). *Behavioral Economics: Past, Present, Future*. Princeton: Princeton University Press.

Camerer, C., & Lovallo, D. (1999). Overconfidence and Excess Entry: An Empirical Approach. *The American Economic Review*, *89*(1), 306–318. Dostupne z http://www.researchgate.net/publication/4980840_Overconfidence_and_Excess_Entry_An_Empirical_Approach

Cantner, U., Goethner, M., & Silbereisen, R. K. (2015). Schumpeter ' s Entrepreneur Psychological , Sociological and Economic Dimensions. *Friedrich Schiller University Jena, Department of Economics*, 1–38.

Costa, P. T., & McCrae, R. R. (1992). Four ways five factors are basic. *Personality and Individual Differences*, *13*(6), 653–665. http://doi.org/10.1016/0191-8869(92)90236-I

Huettner, M., Freibauer, A., Haug, C., & Cantner, U. (2010). Regaining momentum for international climate policy beyond Copenhagen. *Carbon balance and management*, *5*(0), 2. http://doi.org/10.1186/1750-0680-5-2

Kahneman, D., Knetsch, J. L., & Thaler, R. H. (1991). Anomalies: The Endowment Effect, Loss Aversion, and Status Quo Bias. *Journal of Economic Perspectives*, *5*(1), 193–206. http://doi.org/10.1257/jep.5.1.193

Kahneman, D., Knetsch, J. L., & Thaler, R. H. (2000). *Behavioral Law and Economics*. (C. R. Sunstein, Ed.). Cambridge: Cambridge University Press. http://doi.org/10.1017/CBO9781139175197

Kahneman, D., Knetsch, J. L., & Thaler, R. H. (2008). The Endowment Effect: Evidence of Losses Valued More than Gains. In *Handbook of*

Experimental Economics Results (Roc. 1, Part 7, s. 939–948). Elsevier. Dostupne z http://ideas.repec.org/h/eee/expchp/7-100.html

Kahneman, D., & Tversky, A. (1979). Prospect Theory: An Analysis of Decision under Risk. *Econometrica*, *47*(2), 263–292. http://doi.org/10.1111/j.1536-7150.2011.00774.x

Levitt, S. D., & List, J. A. (2007). What do Laboratory Experiments Measuring Social Preferences Reveal about the Real World? *The Journal of Economic Perspectives*, *21*(2), 153–174.

List, J. A. (2003). Does market experience eliminate market anomalies? *The Quarterly Journal of Economics*, (February), 41–71. http://doi.org/10.1257/aer.101.3.313

List, J. A. (2014). Neoclassical Theory versus Prospect Theory : Evidence from the Marketplace. *Econometrica*, *72*(2), 615–625.

Tversky, A., & Kahneman, D. (1992). Advances in Prospect Theory: Cumulative Representation of Uncertainty. *Journal of Risk and Uncertainty*, *5*(4), 297–323. http://doi.org/Doi 10.1007/Bf00122574