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BACHELOR THESIS

Does the probability to herd decrease when decisions are of higher importance? Experimental Approach

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Declaration of Authorship

The author hereby declares that he compiled this thesis independently, using only the listed resources and literature.

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Abstract

In this thesis I study the effect of decision importance on propensity to engage in herding behaviour and what is bounded rational, optimal, utility maximizing strategy for agents. In the beginning, prior literature on herding behaviour and decision importance is reviewed. The only research connecting these two issues was done in psychology. Therefore a comparison and critique of psychological research versus experimental economics is provided in the methodological part. The main part of this thesis is designing an experiment aimed at differentiation of the propensity to engage in herding behaviour with respect to the importance of the decisions being made. People decide in a cascade among two option according to signals obtained. Eight different treatments are run, each with different size of monetary reward as a motivation. Everyone gets two signals, one private and one public. In situations when these signals are contradictory and of the same informativeness, decisions are measured and compared among treatments. Main hypothesis is that people are less likely to be influenced by other people´s decisions as the task importance rises. Also data analysis is outlined.

JEL Classification	C92
Keywords	Herding behaviour, informational cascades, importance, experimental economics

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Abstrakt

Ve své práci studuji efekt důležitosti rozhodnutí na sklon ke stádovému chování a co je v takové situaci omezeně racionální (bounded rational) a optimální strategie maximalizující užitek. Existující literatura o stádovém chování a důležitosti rozhodnutí je každá zvlášť shrnuta v jedné z částí. Jediný dosud provedený výzkum propojující důležitost rozhodnutí a stádové chování byl proveden v psychologii. Z toho důvodu je zahrnuto srovnání metodologie experimentální ekonomie a psychologických výzkumů společně s kritikou některých přístupů. Hlavní částí této práce je návrh experimentu, který se zaměřuje na rozlišení sklonu ke stádovému chování s ohledem na důležitost rozhodnutí. Lidé se rozhodují v kaskádě mezi dvěma možnostmi podle signálů, které dostanou, při osmi různých úrovních odměn, které je motivují ke správnému rozhodnutí, čím vyšší odměna, tím vyšší motivace. Každý dostane dva signály, jeden soukromý a jeden veřejný. V případech kdy jsou signály protichůdné a zároveň stejně informativní, jsou rozhodnutí sledována a porovnávána s ohledem na odlišné výše odměn. Hlavní hypotézou je, že lidé budou méně ovlivněni rozhodnutími ostatních s rostoucí důležitostí rozhodnutí. Je také navržena ekonometrická analýza dat.

Klasifikace	C92
Klíčová slova	Stádové chování, informační kaskády, důležitost, experimentální ekonomie

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Bachelor Thesis Proposal

As globalization becomes wider and information easier to access, the rationality assumption of finding all relevant information and then deciding becomes more complicated and time consuming. People are overwhelmed by information and their abilities and time to search and analyze relevance are limited. Therefore it becomes rational for utility-maximizing people to follow information about other people´s decisions or their advice - to herd.

This form of behaviour called herding is widely studied not only in connection with financial markets and its impact on financial crisis but also in cognitive psychology.

In my Bachelor thesis I will sketch an experiment where I will focus on the factor of herding behaviour and its impact on important personal financial/investment decisions. The research hypothesis is that people will tend to think longer about more important decisions and tend not to be affected by revealed decisions of other people. The null hypotheses will be that people are aware of the long term consequences of their decision, therefore they use all accessible information concerning their specific conditions which can significantly differ from other´s. Searching for those information and processing them takes some time but the opportunity cost of this time should be compensated by higher certainty of the right decision. The alternative hypotheses will be that the degree of importance plays no role in decision making and herding behaviour is still present.

The second hypothesis is that people follow only people who revealed the same personal opinions and incentives. The null hypotheses will be that people who share their lifestyle, incentives and opinions to some extent will impersonate with each other and gain confidences of correctness of decision made by person of similar type. Therefore they will tend to put on those decisions more weight. The alternative is that revealed similarities among people does not affect decision making.

Structure:
Introduction
- Importance of experiments
Literature review
- Herding in personal decisions
- Herding in financial markets
Methodology
- Experimental design
Conclusion

Introduction

Understanding how people respond to incentives when they make decisions is the key topic of psychology, sociology, and also economics. All these fields try to understand people´s decision making processes by finding proper generalization which will form a meaningful and descriptive theory. One of these theories in economics is the perfect rationality which was further developed in the concept of bounded rationality (Simon 1972). In this paper I study the effect of decision importance on propensity to engage in herding behaviour and what is bounded rational, optimal, utility maximizing strategy for agents.

It is generally believed that the impact of environment, society and information available on decision making process is large. On the other hand economists argue that perfect rationality theory is sufficient to capture all such effects. When addressing information available for decisions it can be rational for a decision-maker either to use only her private information, or follow the information contained in decisions of others and completely copy it, or use it only as an additional signal in the decision-making process. The second possibility is called herding. Herding behaviour is a classical and significant aspect of people´s behaviour not only in such disciplines as economics or finance (Raafat et al. 2009).

There are many examples of herding behaviour in everyday life. Some may be positive, such as buy a bestselled book and be excited about reading it, but other can have substantially harmful effects. Consider following three examples of adverse effects of herding behaviour with their consequences.

A person wants to take a consumer loan but is not hundred percent sure of being able to repay the loan according to tight monthly budget, but knows that it is no shame to borrow money as one her friends did and repaid in time. Moreover, the loan provider makes no obstacles in signing the contract and the loan is approved. Copying of behavior of others may lead to ignoring important personally relevant information and this person may not assess the probability of repaying the debt correctly. In the worst scenario this may lead to a personal bankruptcy.

There exists anecdotic evidence that herding behavior in the financial markets is present (Martínek 2013). In this case, analysts predicted that value of gold would rise, but unfortunately completely the opposite happened. This situation is an example of the reputational herding of financial market as first described by Bikhchandani et al (1992). Investors following these recommendations are then not able to differentiate, by how much are these expert predictions influenced by a proper analysis and by how much by reputation concerns.

The adverse effects of herding behaviour can rise also in medicine, as captured in Steven Soderbergh´s last film Side Effects. A psychiatrist consent to try new, highly advertised pill which is recommended to him by a colleague doctor, without reading all supplementary information about side effects before prescribing it to a patient. In the end, the side effects lead to the death of patient's husband. Such an important decision, what medication to prescribe, is in this case done similarly to buying a piece of chocolate: it is heavily influenced by the advertisement and friend´s piece of advice.

Of course not all herd decisions lead to tragic consequences; loans can be paid, predictions fulfilled, illnesses treated. There is no problem if we arrive at the right solution by listening to friend´s advice or by approving public opinion to be correct. We save time and effort that would otherwise be spent on the decision-making process.

The contribution of this thesis is in designing an experiment aimed at differentiation of the propensity to engage in herding behaviour with respect to the importance of the decisions being made. The only academic research considering links between impact of task importance and social influence was done by Baron et al. (1996) who stated two hypotheses how task importance is affected by social influence. The optimistic hypothesis suggests that rising importance moderates conformity whereas the contrasting hypothesis supports the opinion that social influence and task importance are positively correlated. In this thesis I revisit these hypotheses and apply them to the basic model of information cascades firstly introduced by Anderson & Holt (1997). Informational cascades are a special application of rational herding well established in the literature.

Prior academic contributions on herding and information cascades (Anderson & Holt, 1997; Bikhchandani, Hirshleifer, & Welch, 1992; Devenow & Welch, 1996; Scharfstein & Stein, 1990, more in Chapter 1) focused mainly on the motivation for herding behaviour, its frequency, distinguishing whether it is rational or not and also on confirming the presence of herding behaviour in particular areas, e.g. financial decisions such as writing down assets, paying dividends, investment in research and development, recommending stock as well as personal decisions such as fertility decisions, voting, release of information by media or academic research (Devenow & Ivo Welch 1996; Bikhchandani et al. 1992).

The thesis is organized as follows: in Chapter 1 I review literature on herding behaviour together with papers focused on task importance and money at stake. Chapter 2 summarizes experimental methodology and its differences from psychological research. Chapter 3 introduces the model and hypotheses used, together with experimental design and data analysis. In the last part I conclude.

1. Literature review

1.1. Non-economic origins and approaches to herding

Prior contribution to academic research in the field of herding in economics can be found either in cognitive psychology literature when dealing with individuals and groups, or in the area of economics and finance. Description of behaviour later defined as herding was mentioned already in works of Niccolo Machiavelli or the famous economists Adam Smith and John Maynard Keynes (Smith 1880; Keynes 1936; Machiavelli 1910).

Herding in general can be defined as "the alignment of the thoughts or behaviours in a group (herd) through local interaction and without centralized coordination" (Raafat et al., 2009, p. 420). Raafat, Chater and Frith (2009) look at herding from the individual level, characteristic for cognitive psychology. They divide herding into two groups. The first group focuses on the transmissions of ideas among agents, the so called pattern-based approach, which is explained by mathematic models of interaction. The individual approach is highlighted here. This approach includes rational herding or for example mass hysteria. The second group observes patterns of connections among agents, for instance queue models or virus models. Attention is paid to groups, not individuals. Here, in transmission-based approach emotions, rationality and inner states of agents are taken into consideration.

Mimicking and copying others can be found in many other species of animals than humans (e.g. mammals, fish, birds), in situations such as selecting a partner, area to live in or ways how to escape from predators (David Hirshleifer & Hong Teoh 2003).

Sociology uses the term social influence or crowd actions for describing behaviour similar to herding. Social influence is anything where the impact of other people on behaviour, opinions or even only emotions is detected. Many types of social influence have been defined in the field of social psychology. Psychologist Herbert Kelman (1958) subdivided the positive responses to opinions of others into three groups - compliance, identification and internalization. Compliance involves the acceptance of someone´s influence in order to gain rewards despite having opposite opinion. Identification is present if a person wants to improve a relationship with someone and therefore she adopts opinions and behaviour of this person. The last group, in which a person adopts the influence without doubts and continues in behaving that way is called internalization. Kelman (1958) suggests that

the character of attitude shown by a person can vary according to one´s underlying motivation and environment.

Another social influence phenomenon is conformity. "Conformity refers to the act of changing one´s behaviour to match the responses of others" (Cialdini & Goldstein 2004). Conformity is present in a group of people with similar attributes such as age, education, religion or culture. A single individual is surrounded by a majority who press her towards an action, she is then exposed to the risk of social rejection. The level of conformity is being studied by psychologists using similar methods to experimental economics (for discussion see Chapter 2). Scherif (1935) asked subjects to determine by how much has a light in a dark room moved – the movement was only an optical illusion. After four days of repetition a non-zero estimate was agreed upon within a group. The experiment of Asch (1951) involved a subject in a group of eight people where majority was instructed to answer wrong to an easy task - determining relative length of two lines on a picture. He confirmed that people are prone to the influence of the majority in on average one third of situations.

Certain levels of conformity can be explained by the presence of hormones, as proved by Stallen et al. (2012) who gave their subjects either placebo or oxytocin hormone. This neuropeptide is associated with social behaviour. Group of six subjects was divided into two random, anonymous teams. Their task was to evaluate pictures on the scale from 1 to 11 whereas table of all six decisions of the group was shown (with a number if already replied, otherwise blank). The table was divided in a way corresponding to the team division. Subjects under oxytocin treatment showed statistically significant preferences to mimic the decisions made by their team mates.

1.2. Human rationality in economics

Terms "Economic Man" or "homo economicus" refer to a fully rational person, profit and utility maximizing in every second of her life. Such a person is self-oriented, able to evaluate all possible information and employ the right decision given all natural and institutional constraints ending up reaching her goal at the lowest cost. Economic Man was introduced in connection with John Stuart Mill´s essays on political economy in late 19th century where such behaviour was described (Persky 1995). Term homo economicus follows the Economic Man, sources of the very first use differ.

The criticism of homo economicus includes ethical and psychological reasons as well as the economic ones. It is very strong assumption that person can proceed all possible information, moreover rather impossible to obtain such an absolute

knowledge. Simon (1972) introduced the theory of bounded rationality summarizing three main forces leading to bounded rationality. Firstly adding uncertainty and risk into a demand or cost function, secondly assuming incomplete information about alternatives of an agent. Third possibility how rationality can be bounded is limited computational ability which leads to approximations.

Another theory expanding Simon´s second alternative is the rational inattention. Rational inattention theory is based on the idea that people´s abilities to collect and evaluate all available information are limited. People´s attention is one of scare resources and its allocation requires optimization, assuming that thinking and information processing is costly. Sims (2003) and Wiederholt (2010) modelled this theory by introducing entropy as a measure of uncertainty information verity. An information flow is bounded by limited amount of attention attributed to each piece of information with respect to the marginal cost of attention. Rational inattention theory was so far introduced in relation to price setting, consumption, portfolio choices and wage setting (Wiederholt 2010).

Models of rational herding and informational cascades suggest a different approach to rationality. This concept suggests that it might be completely rational for an agent to abandon her private information when the public information is more valuable and informative. Çelen & Kariv (2003) provide an explanation on differences between herding and informational cascades. "An informational cascade is said to occur when an infinite sequence of individuals ignore their private information when making a decision, whereas herd behaviour occurs when an infinite sequence of individuals make an identical decision, not necessarily ignoring their private information." (Çelen & Kariv, 2003, p.2)

1.3. Informational cascades

1.3.1. Basic models of informational cascades

There are three basic models later tested in laboratory experiments of informational cascades as ways to explain herding behaviour.

A very simple model of herd behaviour was introduced by Banerjee (1992) who analysed a sequential decision model. Firstly he uses an everyday example about which restaurant out of A and B to choose for illustration. Even though a person has a signal that one restaurant is better, two people making opposite decision are enough to copy their decision. One bad signal and one random choice where the probabilities are both 1/2 can lead to formation of a herd. Secondly Banerjee introduces a general model where agents can invest into an asset from a set [0, 1] but return is positive only for one unique asset. Agents either do not get any

signal or they receive a signal which might not be true. Decision making is sequential with no delays. Agents can observe the decisions made by previous ones. Three assumptions are stated to reduce a chance to herd. Firstly, choosing option *0* if agent has no signal and no other option was chosen. Secondly, to follow her own signal when being indifferent between this one and something else. Thirdly, choose the highest value if indifferent among more options previously chosen. Considering these assumptions the run of the game is determined by the order of agents and their signals and we can observe the decision tree. Despite all these assumptions the model results in extensive herding. The herd starts with the third person in a row in the case that two predecessors have agreed on value chosen. The probability that two people get the same wrong signal is very low. Agents choose rather to decide like others than to follow their private signals. They cannot be sure that the group has made right decision. Banerjee points out that herding can reduce social welfare. Latter decision makers are influenced by the group which lowers the probability to discover the asset with positive return.

The model of Banerjee was tested by Allsopp & Hey (2000) in two experiments. They used the model Banerjee introduced, but excluded two assumptions which presumed indifference among options which is unobservable and not known for individuals in experimental environment. They also wanted to observe the effect of the first assumption (choosing given option if no signal was received), therefore they run one experiment with the assumption and the second without it. Allsop & Hey find less frequent herding than Banerjee suggested and significant effect of probabilities of observing a signal and its accuracy under treatment with the first assumption of Banerjee. On the other hand in the treatment without assumption herding occurred more often with not following Banerjee strategy.

The original work of Bikhchandani et al (1992) defines the informational cascades trying to explain fragility of mass behaviour and localized conformity by this approach. The subjects can see all actions of predecessors as well as their own private signal and they decide whether to accept or reject an offer. They suppose that a subject facing two contradictory signals, decides with probability 1/2. In their model, a private signal accuracy, denoted as *p*, determines the probability of a cascade and its correctness. The higher value of *p*, the earlier cascades begin. First experiment based on this theory was done by Anderson & Holt (1997) who use two treatments, symmetric one with accuracy of a signal equal to 2/3 and asymmetric one with accuracy 6/7 or 5/7 known only ex post. In my experimental design I will use the first symmetric treatment as I will be able to compare my results with a number of other researches where this treatment was already studied from different point of view.

The third seminal model was introduced by Welch (1992) who modeled a situation where a security is issued. The after-market value is not known, only can be estimated according to signals investors obtain. The probability that the offering is of certain value is given by the proportion of binary signals. The certain value is stated relatively to high boundary and low boundary given by capital-unconstrained market. In one treatment he suggests perfect communication among investors leading in no successful offerings to be overpriced. Such a situation is unrealistic, therefore in the second treatment a cascade model is proposed. In a cascade, each investor makes a decision according to prior decisions made and at a certain point it becomes rational to abandon private information and follow the others.

1.3.2. Fragility of cascades

Fragility is an issue broadly discussed in association with informational cascades. By a fragile cascade we mean that by appearance of additional contradictory information a cascade will be reversed into an opposite one. Bikhchandani et al (1992) suggest that cascades can be fragile in the case that people with more accurate signals are latter in the sequence. Those put more weight on their own signal and can change the outcome by adding more information for people even more lately in the sequence. On the other hand, if the first mover has a more accurate signal, the latter agents copy her decision as her signal is more informative than theirs and therefore a cascade forms earlier and risk of a reverse one exists.

Such theory was experimentally studied in the work of Sasaki (2005) who used two treatments, seniority with descending order of signal accuracy and anti-seniority with ascending order. There were six subjects in a sequence with signal accuracy from interval (0.55; 0.8) deciding on which state of world is true. Monetary rewards were given to people if their guess was correct. According to their findings, in the seniority treatment abandoning private, less accurate information is more frequent and together with that the probability of reverse cascade increases.

On the contrary, findings of Ziegelmeyer, Koessler, Bracht, & Winter (2002) are that informational cascades are not fragile. They studied two treatments, different in accuracy of signals where all subjects in one treatment had the same accuracy. Probability of breaking a cascade by a sequence of right contradictory signals was less than 15%. Moreover, the more identical guesses in a row are observed, the lower the probability of a cascade to be broken, resulting in less fragile cascades.

To supplement the discussion on fragility, Bikhchandani et al (1992) also consider situation where a third party (government) announces new public information (such as warnings against smoking). In the case when information is released before the start of decision making and is of good quality, without noise, is

therefore highly informative and all agents can end up better off. Such a high quality information announced later in the sequence can also have the power to change the direction of a cascade.

1.3.3. Variations

After the publication of the seminal works by Banerjee and Bikchanandi et al, herding behaviour and informational cascades became a popular topic in experimental economics, therefore many variations of the first experiment of Anderson and Holt (1997) exist. Experimenters tried to find the explanations for herding as well as include and control for extra variables. Baddeley, Burke, Schultz, & Tobler (2010) tested how personal traits can influence propensity to herd. They find that there is a significant effect of age, gender and personality traits. In particular, a younger female who scored high in the dimensions of impulsivity and venturesomeness is more likely to engage in herding behavior.

To assure that first mover has a correct signal, it might be optimal to postpone a decision in the absence of signal. This hypotheses was confirmed by Sgroi (2003) despite a penalty for later decision making. On the contrary, Jones (2012) points out the problem of capacity constraints, meaning that for example for a company a delay of introduction of a new product may be costly in terms of already saturated demand after such product.

In other variations the cost of private signal was introduced. In such case, only the first person should buy a signal for non-zero cost while others copy her decision and a cascade appears with certainty, in equilibrium (Kübler & G Weizsäcker 2004). But experimental data do not confirm this theory. Both Kraemer, Nöth, & Weber (2000) and Kübler & Weizsäcker (2004) observed subjects to buy too many signals than predicted. In addition, the value of additional signal was overestimated in about half of times. Subjects were unable to rationally compare the price of a signal to the expected value of information contained in the signal. This observation that people trust too much their private information than is appropriate makes Weizsäcker (2008) in his meta-analysis covering experiments based on Anderson & Holt (1997) design.

One of issues examined is also the role of a small group, whether individuals decide differently from small groups and how it affects an informational cascade. Fahr & Irlenbusch (2011) found out that groups are more rational than individuals as they stick with Bayesian updating. Slezak & Khanna (2000) compare motivational effect of individual versus group bonus within a team and its application on ideal hierarchy system. In case of individual bonuses a cascade forms and additional private information is ignored whereas group bonuses force everyone to involve her

private information and therefore finding the right decision later, after all information is reported.

Çelen & Kariv (2005) highlight the difference between perfect and imperfect information by running an experiment on observational learning where subjects observe one direct predecessor only. They conclude that with imperfect information herding is significantly less frequent. Goeree & Yariv (2007) asked subjects in their experiments to choose the nature of information to be shown to them. One option was statistically informative private information as used in previous examples, the second option was statistically uninformative history of three first players who decided randomly without a proper signal. Despite the uninformativeness of the second option, one third of subjects let themselves be confused and chose this signal.

1.3.4. Informational cascades on field data

Experimental data can be also obtained from a field if we are able to find suitable environment. Good conditions for the presence of informational cascades are on the Internet if we focus on software adoption as the Internet is glutted by IT products. Such a study was presented by Duan, Gu, & Whinston (2009) who observed positive effects of download ranking and information about product popularity on implementation on the formation of the information cascades. They conclude that acquiring additional product information available from users (representing private information) is omitted by most downloaded products. On the other hand product information is taken into account in connection with less downloaded software. Their findings confirm theory on informational cascades.

Another field data analysis brings Zhang (2010) when observing US kidney market. If a kidney is available for transplantation, patients are approached according to a waiting list sequentially until one of them agrees to undergo the transplantation. Patient gets recommendation from her practitioner and she can see the number of refusals by people above in the waiting list. With precise time set for the decision, such environment meets assumptions of creation of an informational cascade. Zhang concludes that early refusals decrease the probability of accepting a kidney by someone later on a list, which decreases utility of all patients as everyone keeps waiting.

1.4. Herding in financial markets

One of environments where herding behaviour can occur are financial markets where market bubbles and crashes can be results. Such events affect not only traders and investors involved but potentially also the economy of a country or

the world. For those reasons, herding behaviour is studied and discussed together with certain markets.

Welch (1992) focused on initial public offerings, where in equilibrium underpriced security experience a success, while overpriced one fails on the market. But in reality it can be vice versa because information of the offering on its way to potential investors might be delayed through distribution channels. Such an investor, observing less or more purchases than expected, changes her mind leading in biased demand and ignorance of private information.

Also opinions on the true aggregation of prices differ, Avery & Zemsky (1998) claim that market prices reflects the real value and herd behaviour can affect it only in a short term. On the other hand, Cipriani & Guarino (2008) support a theory that financial markets are not efficient enough to combine and involve all private information, moreover informational cascades are able to expand from one market to another.

Scharfstein and Stein (1990) tried to distinguish in their model between "smart" and "dumb" managers who make financial decisions. For managers taking into consideration their authority and prestige in the financial sector herding behaviour can be individually rational. On the other hand, Alevy et al. (2007) arranged an experiment comparing decision making of financial market professionals to student control group. Their conclusions are very interesting as they showed that market professionals have more experienced decision process leading to decreased amount of right as well as of reverse cascades. They rely on private information when it is optimal and the more experienced they are, the better they handle Bayesian strategy.

1.5. Money at stake in experimental economics

The most suitable measure of task importance in experimental environment is to use the concept money at stake which I will stick to. The larger the amount a person trying to gain is, the more significant consequences the situation has. Another option how to implement task importance into experiment is to provide the subjects with a suitable cover story about experimental purpose. Such an approach is usually used in psychology research and does not fit experimental economics methodology because of deception and biased understanding of emotional words (for discussion on these issues see Chapter 2).

Differences in task importance have never been applied on herding behaviour, although in other areas of experimental economics, particularly bargaining games, this approach is common and repeated. Bargaining games are such games which are

solving a distributional problem, among these belongs the ultimatum game together with dictator game and trust games.

In the ultimatum game two players are involved, a proposer and a responder. In the first stage, the proposer is given a certain amount of money to divide between her and the responder. In the second and last stage, the responder either accepts the division or rejects and therefore all get zero. The dictator game implements only the first stage of ultimatum game, terminology for players is different. An allocator divides certain amount of money between her and a recipient, who cannot influence the game and the division is made. In trust game, players are called sender and receiver, while sender is given certain amount of money to be divided. The amount sent is than tripled before the sender is asked to redistribute it again and send something back. What all these games have in common is an equilibrium - for all first players, proposer, allocator, and sender it is optimal not to send anything and maximize their wealth.

The ultimatum game was firstly analyzed by Stahl (1972) theoretically and the first experiment to test this theory was conducted by Güth, Schmittberger, & Schwarze (1982) with conclusions not confirming the equilibrium. Experiments on the other games arrive at the same results. All these deviations are explained by factors like social preferences such as altruism in the dictator game or reciprocity in the trust game or strategic motived such as the risk aversion to the possibility of rejecting in the ultimatum game.

Testing for bargaining games became quite popular in experimental economics with variation of money at stake as one of the main issues. For example Forsythe et al. (1994) tested both ultimatum and dictator game with either no pay treatment or 5 and 10 dollars for fairness. Their offers were mostly non-zero, significantly lower in the pay treatment but insignificant between 5 and 10 dollars. On the other hand Andersen et al. (2011) replicated the ultimatum game with much higher stakes, ranging from about $0,4 to $410, in Northeast India. Such high rewards derived general decrease in proportions offered, moreover the higher the stakes, the lower the proportion. Even if the proportion of amount offered decreased, the absolute amount offered increased. The willingness to accept a proportionally same offer significantly rises together with the total amount divided.

It is confirmed, that stakes generally matter. But it seem very important how large the stakes are. Only a significantly higher amount motivates people to behave differently, in order not to lose such an opportunity.

2. Methodology

2.1. Importance of experimental economics

Economic theory is often being criticized because it is abstract, relies on mathematical models which are too complicated for non-economists. Moreover these theories may seem that they do not hold in real world since they are based on too simplistic assumptions. Experimental economics is a tool how to test for validity of economic theories and a way how to improve it. For example, such theories like bounded rationality or social preferences were inspired by findings from laboratory experiments (R. A. Weber & Camerer 2006).

Despite the fact how experimental economic is important, it is quite a young field. The very first experiment was done by Bernoulli in 1738 on St. Petersburg paradox, but we can talk about experimental economics from about 1930´s (Roth 1993). The value and merits of experimental economics were appreciated by the 2002 Nobel Prize for economics divided equally to Daniel Kahneman (for psychological research and behavioral economics) and Vernon Smith (for establishing economic experiments as an analytical tool).

Economic experiments are generally divided to two groups: field and laboratory ones. Both of them have their strengths as well as weaknesses. The laboratory experiments form an artificial environment where the required conditions and assumptions hold. Together with that, specific variables and situations can be controlled for. This allows the experimenter to observe the key variable and distinguish causality from correlation. The field experiments work with more realistic conditions and variables are less tightly controlled. They bring data which can be generalized to the world. On the other hand such experiments are difficult to replicate and control for the environment in the same way in order to assure of correctness of conclusions in the future. Field experiments also increase the variability in the data and therefore require more observations.

This paper focuses on laboratory experiments as one is being designed.

2.2. Experimental economics versus psychological research

Economic experiment can be an unknown term for many normal people, usually non-economists. On the other hand, almost everybody has filled in an online questionnaire, for instance an IQ test, and also can imagine how a psychological experiment is carried out. I discuss here the most important issues and assumptions

to be addressed before running an experiment in accordance with the rules of experimental economics. I also explain the main differences between economic and psychological experiment, according to theoretical work of Rachel Crosson (2005). In accordance with the discussed theory I assess the work of Baron et al. (1996) Impact of task importance on Social Influence.

A laboratory experiment works with a group of people, who are given resources, information and have unique personal preferences, each one playing a given role, e.g. buyer, seller, voter. These people, in experiment called agents or subjects, interact among themselves through institutions artificially made in the laboratory. Such an institution can be a market or a voting rule.

Two main issues are being controlled for to hold, that is internal and external validity. Internal validity assures that in any future replication of an experiment, we will arrive at the same laboratory results. That means that the effect cannot be explained by any other cause than imposed by the researcher as well as that the effect always follows the cause in time and all theoretical assumptions are taken into consideration in the design. The external validity focuses on the representativeness of the conclusions, meaning that our data are valid generally for worldwide reality.

Key thing in experimental economics is a reward given to a subject. Induced value theory suggests main conditions to be fulfilled when talking about the right reward: monotocity (sometimes called non-satiation), salience and dominance. Monotocity means that for zero additional cost, more is always better, e.g. money or utility. Second condition, salience, implies that all subjects understand the nature of reward and is interesting enough to motivate them to make a decision considered as the right one. Dominance means that subjects are interested in their rewards only, meaning that they do not intentionally respond in a way experimenter desires. When implementing dominance we want to protect the subject from biasing our data. There are several situations how it can happen: if the subject knows the experimenter´s goal or how exactly her action affects other´s rewards, the subject can put towards what she thinks is fair, moral or preferred by the experimenter.

Two other things are being discussed considering experimental methodology, subject pools and deception. First we have to realize that in order to give our subjects motivating reward, we have to either find “cheap” subjects or acquire a very large fund. The first option is usually the more common one, and even if we have a large fund, we could afford more repetitions or control for an extra variable when having cheaper subjects. Experimenters search for subjects with low opportunity cost whose average hourly wage does not exceed certain level. This condition is fulfilled either by students or in less developed countries, e.g. in Africa or India. Second condition is

a steep learning curve which enables subjects to process the instructions fast. For this condition students are more suitable, together with the fact that most experiments are being done in academic environment where students are present. On the other hand, Croson (2005) argues that there are systematic differences in volunteers who come to an experiment as they are interested in it and between "pseudo" volunteers, such as students who take part in an experiment as one of course requirements or for extra points - these subjects are less motivated and can lead in a biased data set. In addition, students of the field which is tested can already have some knowledge concerning the nature of experiment and desired outcomes.

Second most discussed issue is deception. First of all, lying to subjects is not moral, secondly if a subject suspects any indication of not being honest with her, she might lose motivation for reliable actions as well as the experimenter loses salience and dominance discussed above. Last but not least, distrust in economic experiments can significantly affect future research as subjects are not willing to come to an experiment again or they expect to be deceived. Therefore a research including deception is not accepted by journals or obtains bad references.

There are several differences between economical and psychological research. Hertwig & Ortmann (2001) draw attention on the problem that different methodology may lead to different outcomes in the experiments, they focus on several essential asymmetries between economic and psychological methodology as well as Croson (2005) does. Both highlight deception as a problem for reasons stated above. They also point out the difference among incentives. In psychology, there are either no incentives or flat payments, not taking in account the actual performance of a subject, seldom are these incentives in cash, but in kind. In economics monetary incentives play significant role, cash is used because everybody values it. The final amount usually consists of two parts: show-up fee and performance related additional surplus. The show-up fee is a flat payment for participation, which should satisfy time and so called thinking cost. Additional surplus is being given according to subject´s performance which motivates her to act deliberately and rationally, the rewards are paid privately right after the experiment. Hertwig & Ortmann (2001) also suggest using written and detailed instructions, where roles, rules of interactions, and payoffs are stated clearly. Reading those aloud then ensures the subjects that all other players are familiar with the setup and obtains the same information. In economic experiments tasks are sometimes repeated more than once to avoid biases from wrong understanding. Such an approach is not common among psychologists.

The attitude of an experimenter toward the subjects cannot be omitted. When differentiating among tested and control group, experimenter chooses usually

between single blind and double blind approach. In the single blind approach, the experimenter is aware of the group a subject is in and can involuntarily reveal some extra information or motivate subjects differently. In the double blind approach the experimenter is not aware of the treatment being imposed and therefore treats everyone in the same way, unfortunately in some cases this approach is not feasible.

Croson (2005) discusses one more issue leading to biases in experimental data, how to name actions in the instructions, in literature addressed as framing. Personal preferences towards a meaning of a word can end up in misleading effects, for example some people may think that action "going to court" is a good (or bad) thing, no matter what this action means in the game. For this reason it is recommended to use for example "action A" rather than emotional words.

In Baron et al. (1996) several issues typical for psychological research can be found. First of all, in their short literature review on conformity research which manipulated task importance they found contradictory conclusions. In my opinion the reason is that each of these studies is testing something slightly different and the manipulation and motivations are also not equal. The methodology is built on the research done by Asch (1951) and both of these experiments contain deception. The session is framed as a research on eyewitness accuracy while the correct intention is to distinguish whether task importance has an effect on social influence. In addition each group consisted of three subjects where two gave incorrect answers saying aloud. 5 participants out of total 95 were excluded because of suspicion that they detected the true intention of the experiment. Another methodological issues take subjects and incentives into account. Subjects were students of psychology who had to take part in the study in order to meet the course requirements, this is one of the criticized issued which may lead to biased data. Considering incentives, half of the subjects were motivated to obtain a flat amount of cash in the case they place themselves in the top 12 per cent while the other half has not been told about any incentives and in the end 12 per cent of the subjects received reward, according to lottery. Overall the methodology is rather psychological than economical. Together with the fact that such an experiment has not been done in economics yet, this issue deserves attention. As I will be testing for similar phenomenon, the key hypothesis is not much different.

3. Experimental design

3.1. Rules of the game

For our experimental purpose we use a modification of the model used by Anderson and Holt (1997). The original model is as follows: We have two urns of balls, denoted by B (blue) and Y (yellow) where B urn contains 2 blue balls and 1 yellow ball, Y urn contains 2 yellow balls and 1 blue ball. In the beginning of each round, one of these urns is randomly picked for the play, each with probability 1/2. Subjects are asked to determine which urn U ϵ {$\boldsymbol{B}$;$\boldsymbol{Y}$} was selected based on signals received. Payoff for a guess corresponding with the true urn is E = 25x. Otherwise the subjects earn zero.

The decision is, generally, dependent on the values of signals received and individual preferences which signal is more valuable for a person. The signals can be of either private or public nature.

Under receiving private signal we mean that one ball randomly drawn from the selected urn is shown to the subject, $s_{pr} \epsilon \{b; y\}$. Ex ante, each ball is equally likely to be drawn. But conditional probability of B urn being selected when blue ball is drawn is 2/3 while conditional probability of Y urn being selected when blue ball is drawn is 1/3.

As a public signal we provide a sequence of previous decisions in a group of the played round. That means that player 1 does not receive any public signal, only the private one. Player 2 can observe decision made by player 1, etc.

In order to reveal the relative importance of the signals, we are interested in cases when the signals are of opposite direction and equal informativeness. Then we can compare the weights under different payment level to find out the desired effect of decision importance. Mathematically in the case that both signals public and private are equally informative, we can rewrite this relationship as equation (1).

$$d = \alpha * s_{pr} + \beta * s_{pu} \qquad (1)$$

Where d is decision made, $d \epsilon$ {B;Y}; s_{pr} is private signal; s_{pu} is public signal; α and β are individual weights for each signal; $\beta > \alpha$ confirms herding behaviour.

For distinguishing the task importance we use concept of money at stake – the higher amount of money invested, the larger importance for subjects. Here the discount factor x in the values of winning price is decisive. We will range x from 1 to 128 in 8 different treatments each twice as large as previous one, in order to observe how different incentives motivate people to decide. Within-subject method

is used here rather than between-subject method. In the first one, subjects undergo all treatments while the second method tests different treatment on two or more groups. Using within-subject method we get more data from the same number of people and people are also sensitive to changes among treatments what is welcomed in this particular experiment.

Eight different treatments will help us to find even a potential non-linear relationship of the values of α and β among differently incentivized sessions. In the case that $\beta > \alpha$ we observe herding behavior where people prefer public information to private information. To confirm the main hypothesis herding is expected at treatments with lower x, with x rising preferences to signal should switch to $\beta < \alpha$.

3.2. Bayesian updating model

For rational agents as well as for computing expected amount of useful observations, we assume the following:

(i) When no public information is available, a subject decides according to her private signal.

Without loss of generality, we can assume, that first private signal is "b", meaning that a blue ball was drawn (similarly in all equations). According to Bayes rule, probability that decision "B" is correct is 2/3, shown in equation (2), probability that decision "Y" is correct is 1/3, shown in equation (3).

$$P(\boldsymbol{B}|b) = \frac{P(\boldsymbol{B})P(b|\boldsymbol{B})}{P(\boldsymbol{B})P(b|\boldsymbol{B}) + P(\boldsymbol{Y})P(b|\boldsymbol{Y})} = \frac{2}{3} \qquad (2)^*$$

$$P(\boldsymbol{Y}|b) = \frac{P(\boldsymbol{Y})P(b|\boldsymbol{Y})}{P(\boldsymbol{B})P(b|\boldsymbol{B}) + P(\boldsymbol{Y})P(b|\boldsymbol{Y})} = \frac{1}{3} \qquad (3)$$

(ii) When subject has two contradictory signals, public and private, she randomizes with probability 1/2.

As shown in equations (4) and (5), probability of $\boldsymbol{B}$ or $\boldsymbol{Y}$ urn to be selected given public signal "B" and private signal "y" (or vice versa) is the same, equal 1/2.

$$P(\boldsymbol{B}|B,y) = \frac{P(\boldsymbol{B})P(B,y|\boldsymbol{B})}{P(\boldsymbol{B})P(B,y|\boldsymbol{B}) + P(\boldsymbol{Y})P(B,y|\boldsymbol{Y})} = \frac{1}{2} \qquad (4)$$

$$P(\boldsymbol{Y}|B,y) = 1 - P(\boldsymbol{B}|B,y) = \frac{1}{2} \qquad (5)$$

* **B** and **Y** stand for the true urn, B and Y for private sinals, b and y for private signals

where $$P(B,y|\boldsymbol{B}) = P(B,y|\boldsymbol{Y}) = \frac{P(B,y,\boldsymbol{B})}{P(\boldsymbol{B})} = \frac{2}{9} \qquad (6)$$

(iii) If a private signal and a public signal are both in favor of one decision, it is rational to follow these signals.

Probability that such a decision is correct is 4/5, as shown in equation (7).

$$P(\boldsymbol{B}|B,b) = \frac{P(\boldsymbol{B})P(B,b|\boldsymbol{B})}{P(\boldsymbol{B})P(B,b|\boldsymbol{B}) + P(\boldsymbol{Y})P(B,b|\boldsymbol{Y})} = \frac{4}{5} \qquad (7)$$

(iv) A subject ignores her private information if there are at least two decision in favor of contradictory option and no decision in favor of option which her private signal suggests.

As shown in equations (8) and (9), probability that two first decisions are correct exceeds probability of alternative.

$$P(\boldsymbol{B}|B,B,b) = \frac{P(\boldsymbol{B})P(B,B,b|\boldsymbol{B})}{P(\boldsymbol{B})P(B,B,b|\boldsymbol{B}) + P(\boldsymbol{Y})P(B,B,b|\boldsymbol{Y})} = \frac{5}{6} \qquad (8)$$

and $$P(\boldsymbol{B}|B,B,y) = \frac{P(\boldsymbol{B})P(B,B,y|\boldsymbol{B})}{P(\boldsymbol{B})P(B,B,y|\boldsymbol{B}) + P(\boldsymbol{Y})P(B,B,y|\boldsymbol{Y})} = \frac{5}{9} \qquad (9)$$

(v) Each two contradictory decisions in the public signal sequence cancel out and do not affect decision of the next subject. The next subject therefore always decides according to (i), (ii), (iii) or (iv).

Equations (10) and (11) show that for case of three observed signals, probability of correct decision is the same as in equations (2) and (3).

$$P(\boldsymbol{B}|B,Y,b) = \frac{P(\boldsymbol{B})P(B,Y,b|\boldsymbol{B})}{P(\boldsymbol{B})P(B,Y,b|\boldsymbol{B}) + P(\boldsymbol{Y})P(B,B,b|\boldsymbol{Y})} = \frac{2}{3} \qquad (10)$$

and $$P(\boldsymbol{B}|B,Y,y) = \frac{P(\boldsymbol{B})P(B,B,y|\boldsymbol{B})}{P(\boldsymbol{B})P(B,B,y|\boldsymbol{B}) + P(\boldsymbol{Y})P(B,B,y|\boldsymbol{Y})} = \frac{1}{3} \qquad (11)$$

This theoretical model is expected not succeed with all decisions made in reality as proved by previously done experiments. Not everyone is able to be fully rational in Bayesian updating as well as can use a simplistic heuristic. I use it also to be able to calculate how often a desired tested observation is present.

3.3. Main hypothesis

Higher value of x in reward will lead to higher value of weight α, therefore less herding behaviour.

This is a key hypothesis which would confirm that people are less likely to be influenced by other people´s decisions as the task importance rises. People will be

more resistant to the impact of randomly chosen people whose motivation together with information processed is not revealed. This approach has been introduced by Baron et al. (1996) who call it “optimistic view” stating that higher rewards should be a motivation for group pressure resistance, forcing subjects to establish their own opinions.

3.4. Experimental procedure

For each session of the experiment a group of 30 people will be invited and divided into groups of 6 people randomly. Order of subjects in particular groups how decisions will be made is also randomly selected. After each round groups are reorganized in order to avoid undesirable learning from each other. Decision time will be measured from the moment signals are shown till the decision is made. Total number of rounds is 16.

Subjects earn a show up fee equal among each other and might get extra money according to performance in the experiment. There will be 8 treatments with rewards in tokens from {25; 50; 100; 200; 400; 800; 1600; 3200} each repeated twice, randomly ordered. Each treatment is repeated twice in order to increase the number of desired decisions obtained.

Experiment will include a short questionnaire asked in the end of each session. Subjects will be asked on gender, age, reached education and field of study/profession. A significance of these variables in decision making will be studied.

Rewards will be paid privately after the experiment. In order to prevent from decreased motivation in later rounds, which may arise when subjects are successful in earlier rounds and earn considerable amount, a lottery is imposed. Four treatments out of eight are randomly chosen, and one realization out of two is again randomly selected. Only for performance in those selected rounds subjects are paid. Converting rate is 10 tokens = 1 CZK. Expected payoff for performance will range from 19 to 300 CZK. Additionally, everyone earns a show up fee 150 CZK.

3.5. Percentage of desired observations

Under a desired observation is mean a decision where subject faces two contradictory signals of equal informativeness. Such a decision shows the inner preferences of a subject, whether to mimic somebody sooner in a sequence or to trust private signal.

According to the model outlined above, we can expect such decisions only with subjects whose order in a sequence is even, not odd. Player on the second

position will face contradictory signals with probability 4/9, at player on the fourth position this probability is lower, 8/81. Probability that we arrive at interesting decisions at sixth player is very low, 32 out of 6561 decisions. Altogether, the probability that one desired observation will be captured is 0.54 per cent per one sequence of decisions.

To arrive at at least 30 observation per treatment, 6 sessions including 30 people each, will be needed.

3.6. Suggested data analysis

Eight treatments with different incentives are run for a reason. A relationship among those treatments will be found, leading either in confirming the main hypothesis that more important and more expensive situations result in less herding behaviour and trust in private signals. Within-subject treatment is used, meaning that each subject will face each treatment.

Variables which will be controlled for will be the following: decision made, private signal, public signal, order in a sequence, size of a reward, gender and decision time.

When data is gathered, econometric analysis will be done. In the first model we are interested in relationship between treatments, i.e. between the levels of money at stake. Only observations where two contradictory signal of same informativeness are present will be included in this model. We will control for the effect of size of a reward on the preferred signal.

$$percprivate = \alpha_0 + \alpha_1 stake + (\alpha_2 stake^2) \qquad (12)$$

- *percprivate* – percentage of decisions where private signal corresponded with decision made, for each treatment separately
- *stake* – the mount at stake in particular treatment

In this model, equation (12), positive value of α_1, if significant, would be explained as increase in rewards leading to increase in relative amount of decisions based on private information, therefore less herding behaviour. The square of reward can be also included to involve the trend in the data. In the case that α_2 is significant and negative, there is a diminishing effect of *stake* when certain level of *stake* is exceeded. This would imply a quadratic relationship.

Secondly, we run a probit model, as in equation (13). As we have more observations for each person, we will apply robust standard errors on individual level. G_1 (and also G_2) is a function taking values strictly between zero and one, for probit model it is the standard normal cumulative distribution function.

$$P(decision = 1) = G_1(\beta_0 + \beta_1 dirprivate + \beta_2 cumdirpublic + \beta_3 stake + \beta_4 stake^2) \quad (13)$$

- *decision* – 1 if blue was chosen, 0 if yellow
- *dirprivate* – direction of private signal, 1 if blue, 0 if yellow
- *cumdirpublic* – cumulative direction of public signal, 1 if max{B,Y} is B, 0 otherwise; where B and Y describe how many times predecessors chose B or Y
- *stake* – amount at stake in particular treatment

Thirdly, we run probit model controlling for all variables, as shown in equation (14). In this model additional relationships and effects are controlled.

$$P(decision = 1) = G_2(\beta_0 + \beta_1 dirprivate + \beta_2 cumdirpublic + \beta_3 stake + \beta_4 stake^2 + \beta_5 round + \beta_6 female + \beta_7 time) \quad (14)$$

- *cumdirpublic* – number in interval (0,1) as a share of public signals corresponding with decision made
- *round* – number of round from a session to control for order effect
- *female* – 1 if decision maker was female
- *time* – decision time

All models will be tested for significance of coefficients and validity of assumptions, such as homoscedasticity, multicollinearity and normality of residuals. Additionally, for probit model the recalculation of coefficients $G\beta$ to β has to be done for comparisons of magnitudes.

3.7. Possible extensions

As this is the first time when a task importance factor is being experimentally tested in connection with herding behaviour, many changes and variations can be done to test for additional factors. The original version of the design above introduces as simple version as possible for two reasons. The first reason is to be able to directly compare the results with the very first design by Anderson & Holt (1997) and change only one parameter tested. The second reason is that the analysis will be much easier with less complicated design. One additional change of the design is suggested: introducing the factor of buying signals only when preferred or necessary. On the other hand, an analysis would be quite complicated.

Extension to the design:

Subjects can choose what kind of signal to obtain by a possibility to buy them. They face three options:

(a) to buy one signal, either private signal or public one, for 5x

(b) to buy both signals together on discounted price 9x
(c) choose action (a) and then buy the second not chosen signal for higher price 10x,
where x is a converting ratio same as in the original above experiment.

Under receiving private signal we mean as in the original design that one ball randomly drawn from the selected urn is shown to the subject. Ex ante, each ball is equally likely to be drawn. But conditional probability of B urn being selected when blue ball is drawn is 2/3 while conditional probability of Y urn being selected when blue ball is drawn is 1/3.

Public signal reports to revealing decision of one person, randomly taken from a group of pilot version of predecessors when the same urn was selected, not knowing which signal(s) this person had. In a pilot version we make a standard cascade, meaning that subjects decide in a sequence one after another. The first subject has only the opportunity to buy a private signal which rises her minimum expected payoff. The second person can either ignore public information from the previous person (has value of one private signal) or take only this public signal with analogous information for the same cost. The third option is to get two signals - her private together with action of the first player - in this case both signals can be either in the same direction or they may contradict each other, therefore she decides with the probability 1/2. The information contained in the public signal is at least one private signal given to a predecessor who have bought a signal or absolutely random if she has bought no signal.

In the case a subject has only one signal, she will either decide according to its direction or will try to obtain an additional signal to confirm her suspicion and uncertainty. If she has two signals of the same direction, solution is trivial, she will choose the confirmed option. The setup of interest emerges when the second signal is opposing to the first one. These situations will be of our interest and reveal which signal is preferred - public one confirming herding behaviour or private one detecting independence.

If subject chooses action (a) to obtain only one signal, the nature of signal chosen reveals his preference to one nature of signal. If she chooses (b) to get both signals we are only interested in situation of contradictory signals where consecutive decision reveals preference. In the case of possibility (c) and contradictory signals we are interested whether more expensive or the first signal is more valuable despite same statistical informativeness.

3.8. Additional hypotheses

Hypothesis 2: With lower value of x, subjects will buy less signals in order to gain more money (in absolute, not relative value).

Although the cost of signals remains the same for all treatments, people might be motivated differently. In the "cheaper" treatment people may want to maximize their earnings by simple guessing the right answer without any information or by obtaining only one signal.

Hypothesis 3: Subjects will rather choose option (b) - two signals together - because they want to get all accessible information before making a decision.

By this hypothesis we test whether are people willing and trying to collect all obtainable information. We suppose that subjects will not regret spending more money on additional signals and allocate more time on subsequent processing information and weighing alternatives. Along with that they hope to assure themselves about correctness of their decision by receiving two signals of same direction.

Hypothesis 4: Subjects choosing option (c) - buying second signal for higher price - will decide according the latter signal as it was more expensive, therefore more valuable for them personally.

The option (c) as a whole tests the willingness of people to getting additional information to assure them of correctness of their previous signal and their guess. In the case when the second signal is of opposite direction from the first one, person gets frustrated for having paid for additional confusing signal and might therefore change her mind. As the second signal is more expensive, she will irrationally evaluate it as more informative in order not to throw away the money spent.

Conclusion

In this thesis, I provide critical review of herding behaviour literature and outline an experiment studying the effect of decision importance on propensity to engage in herding behaviour. Herding behaviour is a phenomenon, in which people or even animals observe others and copy their actions or opinions. It is being studied in various fields, such as sociology, psychology or economics, particularly on financial markets. Herding is a part of everyday life and might be rational and utility maximizing. Together with that, consequences of wrong decision based on irrational reasoning can lead either to positive or to adverse effects. These effects are much bigger when addressed to important, life decisions. Importance of a decision is a crucial factor influencing the relationship of a person towards a problem. Although everyone has different ranking of values, some decisions considerably affect our future lives while other do not matter. The question is, whether people are distinguishing among importance in the context of herding behaviour.

Prior contributions on herding behaviour focused mainly on existence of cascades, rational reasoning and fragility. Informational cascade is such a situation where herding behaviour is present in a sequence of decisions made and additionally a private information is abandoned. It is a commonly used tool how to test for herding behaviour in laboratory. Other factors influencing the presence of information cascades, like penalty of delay, capacity constraints, cost of signals, group decision making or imperfect information were studied. However, the decision importance factor was omitted.

On the other hand, this factor is very important in bargaining games such as dictator or ultimatum games. More interestingly, in one prior work in psychological research similar hypothesis to the main hypothesis was tested. But the methodology (and therefore possibly also outcome) is different from the economical methodology.

The experiment is based on prior design by Anderson & Holt (1997) with added decision importance factor. Binary decisions are made in a sequence of six people. Each can observe one private signal and decisions of all predecessors. The probably of signal accuracy is known, therefore Bayes updating can be used.

Decision importance is measured by varying the money at stake, as money is nowadays most commonly used and motivating incentive. In the design I differentiate the decision importance by eight differently incentivized treatments. Only this factor is being varied, other factors remain constant within rounds. Possible data analysis how to obtain a relationship refusing or not refusing our main hypothesis is outlined. The hypothesis is, that people will rely more on their private information as more is

at stake. As the importance rises, people should decide rationally according to all information available, not abandoning additional signals.

The effect of decision importance to propensity to engage in herding behaviour can be combined with other variations in herding experiments. Including the cost of information in herding behaviour experiment is designed and briefly described. There also exist more possible variations in cascade model where decision importance can be implemented in the future, such as imperfect information or group decision making.

Bibliography

Alevy, J.E., Haigh, M.S. & List, J.A., 2007. Information Cascades: Evidence from a Field, Experiment with Fianncial Market Professionals. *The Journal of Finance*, LXII(1), pp.151–180.

Allsopp, L. & Hey, J.D., 2000. Two experiments to test a model of herd behaviour. *Experimental Economics*, 3(2), pp.121–136.

Andersen, S. et al., 2011. Stakes matter in ultimatum games. *American Economic Review*, 101(December), pp.3427–3439.

Anderson, L.R. & Holt, C.A., 1997. Information Cascades in the Laboratory. *The American Economic Review*, 87(5), pp.847–862.

Asch, S., 1951. Effects of group pressure upon the modification and distortion of judgments. In *H. Guetzkow, Groups, Leadership, and Men*. pp. 177 – 190.

Avery, C. & Zemsky, P., 1998. Multidimensional Uncertainty and Herd Behavior in Financial Markets. *American Economic Review*, pp.724–748.

Baddeley, M. et al., 2010. *Impacts of personality on herding in financial decision-making*, University of Cambridge, Faculty of Economics.

Banerjee, A., 1992. A simple model of herd behavior. *The Quarterly Journal of Economics*, 107(3), pp.797–817.

Baron, R.S. et al., 1996. The Forgotten Variable in Conformity Research : Impact of Task Importance on Social Influence. *Journal of Personality and Social Psychology*, 71(5), pp.915–927.

Bikhchandani, S., Hirshleifer, D & Welch, I, 1992. A theory of fads, fashion, custom, and cultural change as informational cascades. *Journal of political Economy*, 100(5).

Çelen, B & Kariv, S., 2003. Distinguishing informational cascades from herd behavior in the laboratory. *American Economic Review*.

Çelen, Boğaçhan & Kariv, S., 2005. An experimental test of observational learning under imperfect information. *Economic Theory*, 26(3), pp.677–699.

Cialdini, R.B. & Goldstein, N.J., 2004. Social influence: compliance and conformity. *Annual review of psychology*, 55(1974), pp.591–621.

Cipriani, M. & Guarino, A., 2008. Herd behavior and contagion in financial markets. *The B.E. Journal of Theoretical Economics*, 8(1).

Croson, R., 2005. The Method of Experimental Economics. *International Negotiation*, 10(1), pp.131–148.

Devenow, A. & Welch, Ivo, 1996. Rational herding in financial economics. *European Economic Review*, 40(3-5), pp.603–615.

Duan, W., Gu, B. & Whinston, A., 2009. Informational cascades and software adoption on the Internet: An empirical investigation. *Mis Quarterly*, 33(1), pp.23–48.

Fahr, R. & Irlenbusch, B., 2011. Who followas the crowd - Groups or individuals? *Journal of Economic Behaviour and Organization*, p.10.

Forsythe, R. et al., 1994. Fairness in simple bargaining experiments. *Games and Economic Behaviour*, 6, pp.347 – 369.

Goeree, J.K. & Yariv, L., 2007. Conformity in the Lab.

Güth, W., Schmittberger, R. & Schwarze, B., 1982. An experimental analysis of ultimatum bargaining. *Journal of Economic Behavior & Organization*, 3, pp.367 – 388.

Hertwig, R. & Ortmann, A., 2001. Experimental practices in economics: a methodological challenge for psychologists? *The Behavioral and brain sciences*, 24(3), pp.383–403; discussion 403–51.

Hirshleifer, David & Hong Teoh, S., 2003. Herd Behaviour and Cascading in Capital Markets: a Review and Synthesis. *European Financial Management*, 9(1), pp.25–66.

Jones, M.T., 2012. *Essays on Bounded Rationality in Applied Game Theory*.

Kelman, H.C., 1958. Compliance, identification, and internalization: Three processes of attitude change. *The Journal of Conflict Resolution*.

Keynes, J.M., 1936. *The General Theory of Employment, Interest and Money*,

Kraemer, C., Nöth, M. & Weber, M., 2000. Information Aggregation with Costly Information and Random Ordering: Experimental Evidence.

Kübler, D. & Weizsäcker, G, 2004. Limited depth of reasoning and failure of cascade formation in the laboratory. *The Review of Economic Studies*, 71(2), pp.425–441.

Machiavelli, N., 1910. *The Prince, 1515* Vol. 36., PF Collier & son.

Martínek, D., 2013. Ekomat. *Lidové noviny*, 19 April, p.10.

Persky, J., 1995. Retrospectives: the ethology of homo economicus. *The Journal of Economic Perspectives*, 9(2), pp.221–231.

Raafat, R.M., Chater, N. & Frith, C., 2009. Herding in humans. *Trends in cognitive sciences*, 13(10), pp.420–8.

Roth, A.E., 1993. On the Early History of Experimental Economics. *Journal of the History of Economic Thought*, 15(Fall), pp.184 – 209.

Sasaki, S., 2005. Signal Qualities, Order of Decisions, and Informational Cascades: Experimental Evidences. *Economics Bulletin*, 3(34 S 1).

Sgroi, D., 2003. The right choice at the right time: A herding experiment in endogenous time. *Experimental Economics*, 6(2), pp.159–180.

Sherif, M., 1935. The psychology of social norms. *Archives of Psychology*, 187(60).

Scharfstein, D. & Stein, J., 1990. Herd behavior and investment. *The American Economic Review*, pp.465–479.

Simon, H.A., 1972. Theories of bounded rationality. *Decision and organization*, 1, pp.161–176.

Sims, C. a., 2003. Implications of rational inattention. *Journal of Monetary Economics*, 50(3), pp.665–690.

Slezak, S.L. & Khanna, N., 2000. The Effect of Organizational Form on Information Flow and Decision Quality: Informational Cascades in Group Decision Making. , 9(1).

Smith, A., 1880. The Theory of Moral Sentiments. *London: George Bell*.

Stahl, I., 1972. *Bargaining Theory*, The Economic Research Institute (EFI).

Stallen, M. et al., 2012. The Herding Hormone : Oxytocin Stimulates In-Group Conformity.

Weber, R.A. & Camerer, C.F., 2006. " Behavioral experiments " in economics. *Experimental Economics*, 9(3), pp.187–192.

Weizsäcker, Georg, 2008. Do we follow others when we should ? A simple test of rational expectations. *The American Economic Review*, pp.2340–2360.

Welch, Ivo, 1992. Sequential sales, learning, and cascades. *The Journal of Finance*, 47(2), pp.695–732.

Wiederholt, M., 2010. Rational Inattention. *The New Palgrave Dictionary of Economics (Online Edition ed.)*.

Zhang, J., 2010. The Sound of Silence: Observational Learning in the U.S. Kidney Market. *Marketing Science*, 29(2), pp.315–335.

Ziegelmeyer, A. et al., 2002. *Fragility of information cascades: an experimental study using elicited beliefs*, mimeo, University of Strasbourg.