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Ego-utility and Endogenous Information Acquisition; An Experimental Study

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Ego-utility and Endogenous Information Acquisition; An Experimental Study

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Abstract

This paper examines endogenous decisions to acquire useful information. My experimental design tries to test predictions of ego-utility theories and other relevant theories about the decision-making process of agents in the environment with costless signals. Only slightly more than half of the subjects acquired an optimal number of the signals for payoff maximization. The results suggest that for the subjects making sub-optimal decisions, aversion to cognitive dissonance is the prevalent channel. Contrary to this, I find much less support for the ego-utility theory and theory of information ignorance in my setting. The availability of information alone does not automatically lead to an improvement in decisions.

Keywords: information acquisition, experiment, overconfidence

JEL Classification: C91, D03

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1 Introduction

It is not surprising to claim that people do not always make optimal decisions, at least from financial point of view. Instead of an exhaustive list of such occasions I would like to point out the areas of health care, financial investments, and job safety, where such non-optimal decisions may have serious monetary or even fatal consequences[1]. But regardless of the reasons for such bad decisions, a simple remedy exists. One needs proper information for better decision making.

Additional information is usually enough to steer the decision making process back to optimal choices. Evidence of such an improvement in decisions can be found in many studies (e.g. Grieco and Hogarth, 2009, Juslin et al., 2000, Arkes et al., 1987, Ryvkin et al., 2012). So why do we still observe non-optimal decisions, even in cases where relevant information is widely available (and even for free)?

The problem is that information acquisition and use of this information is based on the endogenous decisions of the agents. Information has been exogenously provided to the agents in the mentioned studies. But the situation is usually different in many day-to-day situations. Information is available to the agents but they make decisions on how much of it to acquire and to what extent it will influence their decisions. Availability of information alone does not automatically lead to an improvement in decision making.

There are a few theories predicting different information acquisition decisions and their processing by subjects. The classical approach clearly predicts that agents should use each available piece of information and base their decisions on it. However, theories exist which do not predict full information acquisition. I focus mainly on the ego-utility theories (Köszegi, 2006) and their predictions about signal acquisition. They claim that agents may prefer to sacrifice monetary payoffs in order to increase their utility through positive beliefs about their own skills. I also present other theories, such as cognitive dissonance or confirmation bias, relevant for endogenous signal acquisition. Their basic assumptions and predictions are explained in the next section. Furthermore,

[1]For more evidence and explanation see for example Dunning, Heath, and Suls, 2004, Kines, Andersen, Spangenberg, Mikkelsen, Dyreborg, and Zohar, 2010, Sawacha, Naoum, and Fong, 1999, Odean, 1998

it is not always clear how the acquired information is translated into the final decision. Most of the theories mentioned in the next sections assume a Bayesian updating approach for information processing. However, Bénabou and Tirole (2002) explain the confirmation bias which allows the agents to selectively choose which information will be taken into account.

This paper experimentally tests the predictions of the mentioned theories about the decision making process in situations where useful information is available but the decision of how to deal with such availability is left to the agents. Such situations describe many real-life situations with serious monetary or non-monetary consequences to our lives. Therefore it is important to shed light on the "decision making black-box" between making the information available and the actual decision of the agents. If the reason for low information acquisition[2] is the cost of information, the remedy would be to decrease this cost. If the problem is an unwillingness to acquire the information, then mandatory acquisition would improve the decisions. The most cumbersome situation would occur if people did not follow the acquired information. Then some enforced decision might be desirable in situations with the most serious consequences.

The subjects are asked to make a choice between two lotteries in my experiment. The outcomes of the lotteries are based on their performance in the knowledge quiz from the topic of their choice. They can improve their decision by acquiring costless (but noisy) signals. They can acquire up to 10 such signals which are easy to interpret. There are two treatments for the purpose of exploring ego-utility motives. Subjects have an opportunity to create positive beliefs about their performance (and increase their utility derived from these nice beliefs) in the first treatment, while the second treatment switches-off such an opportunity for additional ego-utility.

Only slightly more than one half of the subjects acquire the full amount of signals. Interestingly, most of the subjects with a sub-optimal amount of information acquire either no or only one signal. This paper cannot examine all possible parametrizations and subtle changes in the environment. However, I find support mainly for rational agents theory (profit maximizing Bayesian updaters) and for cognitive dissonance aversion. On the other hand, I find a little or no evidence for the ego-utility theory and minor support for the theory of self-deception in my setting.

[2]Lower than the socially desirable optimum.

2 Related literature

There are several theories predicting the different optimal information acquisition decisions and their processing by people. This paper examines the behavior in the environment with costless information (or "signal") which is noisy but still informative. The reason for this simple framework is to abstract price effects from information and to reflect the essence of most of the day to day decision problems (for example sufficiency of free but sometimes imprecise information from the internet). In this case, the classical approach clearly predicts that the agents should use each available piece of information and base their decisions on it. This claim relies on the fact that information is in a form which does not require cognitively costly processing and therefore the marginal cost (explicit plus processing cost) of each additional signal is virtually zero. In fact, this is not what we observe in reality. I already mentioned examples of such behavior. The obvious conflict of supposedly rational behavior and observed behavior has been explained by several alternative theories.

2.1 Ego utility

The overconfidence, or ego-utility, stream of literature predicts a sub-optimal level of signal sampling in some situations (from a payoff maximizing point of view). Dunning et al. (2004) and Merkle and Weber (2011) describe the situations affected by the presence of overconfidence[3]. People tend to derive utility from having positive beliefs about themselves. The essential idea in this stream of literature is that beliefs about one's own ability (or about beauty, health, etc.) directly enter the utility function. If we assume that a signal updates beliefs, then it also influences the utility of the decision maker. Köszegi (2006), Jermias (2006), Carrillo and Mariotti (2000) claim that decisions about information acquisition can be influenced by our beliefs.

Köszegi (2006) introduces a model in which the agent has to decide whether to take more ambitious but risky action or to not take any action. Success in the ambitious action is positively correlated

[3]For more evidence on overconfidence see for example Svenson (1981); Grieco and Hogarth (2009); McKenzie, Liersch, and Yaniv (2008); Karelaia and Hogarth (2010); Odean (1998)

with a level of certain skill. The agent can estimate her skill from the costless noisy signals and can stop receiving signals at any time. The crucial feature of this model is that agents derive "ego-utility" from considering themselves as types with higher skills. So they stop collecting signals once the last signal gives them the feeling that they are skilled (even though it may not be correct because of the noise in the signal). With the described signal sampling process some agents may sacrifice monetary payoffs (by not sampling all possible signals) in order to preserve a positive self-image. If people start with on average correct initial beliefs, they would end up on average with overconfident beliefs.

The ego-utility model of Köszegi (2006) predicts aversion to additional information if a person already holds positive beliefs about their own ability. But there are also opposite views in the existing literature. Ko and Huang (2007) introduce their model and conclude that overconfidence leads to higher information acquisition. Mobius, Niederle, Niehaus, and Rosenblat (2011) provide evidence that around 10% of their subjects are averse to new information and underconfidence is more likely to cause aversion to additional information. Eil and Rao (2011) claim that signal acquisition behavior is actually influenced by the direction of the previous signal. A negative signal is likely to lead to information aversion. Although the mentioned studies come to different predictions, they also have common features important for this study.

Simplifying their conclusions, the theories divide belief space into two areas, either with positive or with negative beliefs about one's own ability. One of them is associated with being information averse and the other with information seeking behavior. Once a person is in the information averse part of belief space, there is decreased willingness for signal sampling. While Köszegi (2006) claims that positive signals update the beliefs about one's own skills in the information averse area, studies by Mobius et al. (2011) and Eil and Rao (2011) claim that negative signals would lead to information aversion.

All ego-utility theories assume that some uncertainty is needed in order to create a possibly biased self-image. Once the exact and objective information is present, the ego-utility cannot be based on biased beliefs. So if the information about one's own skill or ability or performance is provided, then ego-utility is prevented[4]. However, there is another notion which can potentially interact with ego-utility motives. As uncertainty creates potential for manipulating beliefs about one's own skills (and theoretically leads to a lower desire for information), it might also give rise to curiosity (increasing the desire for information).

Curiosity could be described as "yearning for information". Although there could be more psychological explanations for curiosity. It could be defined as a kind of impulsive behavior (e.g. Hartig and Kanfer, 1973) or using information-gap theory (e.g. Loewenstein, 1994). I am not going to stick to either one or another definition. Regardless of its psychological underpinning, curiosity might lead to increased information acquisition if the objective feedback about one's own skills is reduced.

2.2 Cognitive dissonance

Besides the ego-utility theories, there are also other theories which predict specific behavior either for information acquisition or information processing. The stream of cognitive dissonance theories (introduced in Festinger, 1962) provides an explanation for signal acquisition below the optimal levels. It is based on discomfort resulting from two (or more) contradictory beliefs at the same time. In order to avoid this discomfort one may not want to get an additional signal if it may be in conflict with the previously acquired signal. Assuming noise in the signals, the second signal may be contradictory to the first one. This might cause the person to stop an information search after the first signal is observed (regardless of its value). Another kind of dissonance follows from the conflict between prior beliefs and the acquired information, if this information does not support the prior beliefs. This might prevent any signal acquisition at all.

> "When dissonance is present, in addition to reduce it, the person will actively avoid situations and information which would likely increase the dissonance" (p. 3, Festinger, 1962)

[4]This does not hold for agents with really high skills or abilities who are aware of the level of their skills even without feedback.

Harmon-Jones and Mills (1999) provide a more detailed overview of cognitive dissonance theory and its implications. The main implication for my experimental testing is that even in the situations with costless information, signal acquisition may not even happen or may stop immediately after the first signal.

There are many similar studies concluding that the optimal information acquisition for the agents might be below the maximum available amount (e.g. Hirshleifer, 1971, Carrillo and Mariotti, 2000). The essential characteristic of the listed studies was that each piece of information is processed in a rational (Bayesian[5]) way (this holds only partially for Mobius et al. (2011)[6]).

2.3 Confirmation bias

Another stream of studies relies, to a certain extent, on the fact that even after the information is acquired, it is processed in a biased way. The agents can control their beliefs to confirm their initial preferences or choices (e.g. Akerlof and Dickens, 1982; Kunda, 1990 explain this approach[7]).

Bénabou and Tirole (2002) incorporate ego-utility into their decision making model. However, improvement in self-image is not achieved through optimal acquisition of the information but through a self-deception process. This process relies on the endogenous selection of information which will be taken into account. Therefore endogenous information acquisition depends on the parameters of their model. If self-deception is costless, any information acquisition is possible (in the framework of this study) as this does not influence the final beliefs about one's own skills. If the acquired signals are processed in a biased way, the resulting action or choice may not correspond to the optimal one (conditional on the acquired signals).

There are many theoretical and experimental papers studying the effects of exogenous information on decision-making (e.g. Grieco and Hogarth, 2009, **?**). However, such an environment does not resemble many day to day situations. This paper contributes to the literature in the situations

[5]See Charness et al. (2007) and Charness and Levin (2005) for examples of Bayesian approach experimental testing.

[6]Bayesian processing is present only for the neutral tasks not affecting self-confidence.

[7]More references to similar studies can be found in Jermias (2006).

where the availability of information is endogenous. There are a few contradictory theoretical predictions, based on the mentioned theories, for such situations (Carrillo and Mariotti, 2000, Köszegi, 2006, Bénabou and Tirole, 2002). The first contribution is to experimentally test these theoretical predictions in a unified framework to find out which theory is prevalent in actual decision-making for information acquisition. There are two experimental papers (Mobius et al., 2011; Eil and Rao, 2011) testing the predictions of particular theories (ego-utility and confirmation bias) about endogenous information acquisition . They conclude that willingness to acquire additional information depends on the direction of the previous signals. However, their conclusions contradict theoretical predictions of ego-utility theory by Köszegi (2006). The second contribution of this paper is to explore whether and how decision making to acquire information is dependent on the previous signal. Mobius et al. (2011) use a combination of exogenous and the possibility of endogenous signals, Eil and Rao (2011) use the BDM mechanism (Becker et al., 1964) in order to elicit willingness to pay for information. I use a very simple environment with only endogenous information acquisition of costless signals.

3 Experimental design

There are a few crucial requirements for experimental design in order to distinguish among the possible motivations for information acquisition. First, there must be an initial task allowing for subjective, possibly biased, self-assessment. This is important for the possible effects of cognitive dissonance and ego-utility to take place in the consequent information acquisition process. Second, the information acquisition process must be in the form of acquiring an informative, but noisy, signal in order to allow for confirmation bias and strategic ignorance. Third, the information acquisition must create a dilemma between monetary payoff maximization and cognitive dissonance aversion/ ego-utility preservation. This requirement could disentangle the effect of profit maximization from other motivators. Fourth, in order to isolate the ego-utility motive, there must be variation in treatments changing the opportunity to create ego-utility.

3.1 Structure of the experiment

The experiment consists of two decision-making stages, questionnaire and feedback phases. In the first stage of the experiment, the subjects are asked to answer a knowledge quiz with 20 questions (multiple choice, one correct answer) from the topic they prefer. The topic they can choose is one of the following: Science, Sport, Geography, Art, or History. The subjects are advised to choose the topic in which they think they can achieve the best result. The subjects do not have any other information about the consequent stage except the hint that each correct answer increases their earning opportunities in the next stage. The reason for not providing additional information is to prevent strategic behavior which might occur if they know more about the second stage. Grieco and Hogarth (2009) show that this kind of task, even without the choice of the topic, is capable of inducing biased beliefs about one's own performance.

In the second decision-making stage, they are asked to choose one of two lotteries. They are labeled as "Option A" and "Option B"[8]. The first lottery (Option A) consists of known probabilities of winning either 30 CZK or 150 CZK[9]. The second lottery (Option B) offers the same potential prizes but they are informed that the probability of winning 150 CZK is equal to the proportion of the correct answers from the first stage (which is unknown to the subjects at this point). In order to create a dilemma for everybody, the probability for Option A is set in a way that it equals the actual performance in the quiz plus/minus 2 percentage points (+/- sign set randomly). The subjects do not know that the probabilities they observe for Option A are set in this way. So even with beliefs about their own performance close to the true value (or any suspicion that probabilities in Option A are set close to the actual performance), it is unlikely that some additional information about own performance would not be helpful for making the optimal choice.

The subjects have an option to acquire additional information (signal) about their own performance. The additional requirement for the design is that the signal acquisition and processing cost are so low that they do not interfere with other possible motives in the information acquisition process. Therefore, in line with the previous reasoning, the subjects can acquire costless

[8]Due to the possible negative connotation of the word "Lottery" in Czech.

[9]1 EUR was approx. 27.5 CZK and 1 USD was approx. 20 CZK at the time of experiment.

information which are supposed to help them to make a more profitable decision. The information is in the form of a message stating if their actual performance in the quiz is "Above" or "Below" the known probability of winning 150 CZK in the first lottery (Option A). The signal is true with a probability of 2/3 and false with a probability of 1/3. They can acquire up to 10 such signals. All previous signals remain on the screen. The only cost of signal acquisition is just click on the button and its interpretation should not be problematic. All acquired signals stay displayed on the screen in order to remove forgetting effects and allow easier signal processing[10].

In order to test for the presence of ego-utility I vary the treatments with respect to feedback in the final stage. The subjects receive information about their actual quiz performance in half of the treatments (denoted by F) and do not receive any feedback[11] about their performance in the other treatments (NF). No feedback about the actual performance can lead to the creation of biased beliefs about one's own abilities (Köszegi, 2006). According to ego-utility theory, the true information about your own ability prevents bias in self-assessment while an absence of such information allows for biased self-assessment. If the preservation of ego-utility is the prevailing motivator in the information acquisition process, then we should observe a lower number of signals taken in the NF treatments. The feedback type is known before the lottery choice (without any remark about the alternative feedback type).

After the lottery choice and before the feedback stage the subjects are asked to complete a very brief demographic questionnaire. The questionnaire contains questions about basic demographic characteristics (e.g. age, country of origin, number of siblings, education, etc.) and about the perceived level of risk taking preferences. Then the structured feedback follows. It displays the lottery choice, all possible signals taken and random choice of computer about the earnings. Moreover, for F treatments, it displays the actual performance in the quiz.

[10]In order to prevent possible contagion of the results by unintended order effects, the layout of the screen is randomized with respect to the order of options and with respect to the placement of the signal list on the screen.

[11]Not even after the whole experiment is over.

3.2 Logistics

The experiment was conducted in the Laboratory of Experimental Economics at the University of Economics in Prague in January 2014. The subjects were recruited using the ORSEE system (Greiner et al., 2004). Altogether 138 subjects participated in six sessions (3 F treatments, 3 NF treatments) with 63% of the participants being males. The experiment was programmed using the zTree software (Fischbacher, 2007). The average payment was 205 CZK[12] (including a 100 CZK show-up fee) which was paid at the end of the experiment in cash. The subjects were mostly students from different Prague universities. Most of the subjects were Economics or Business students (almost 75%) mostly coming from the Czech Republic or Slovakia. The average age was slightly above 23 years.

4 Results

In the first stage of the experiment all 5 quiz topics were chosen by some participants. The average number of correct answers was 12.3 (s.d. 3.2) and the number of the correct answers ranged from 6 to 20, with only two people achieving the best performance of 20 correct answers. Even assuming the possibility of strong bias in the beliefs about the correct answer, more than 91% of the subjects were at least 4 correct answers from the possible maximum performance. So it can be supposed that for the vast majority of the subjects the signal should be helpful even for the strong bias in their beliefs about their own performance.

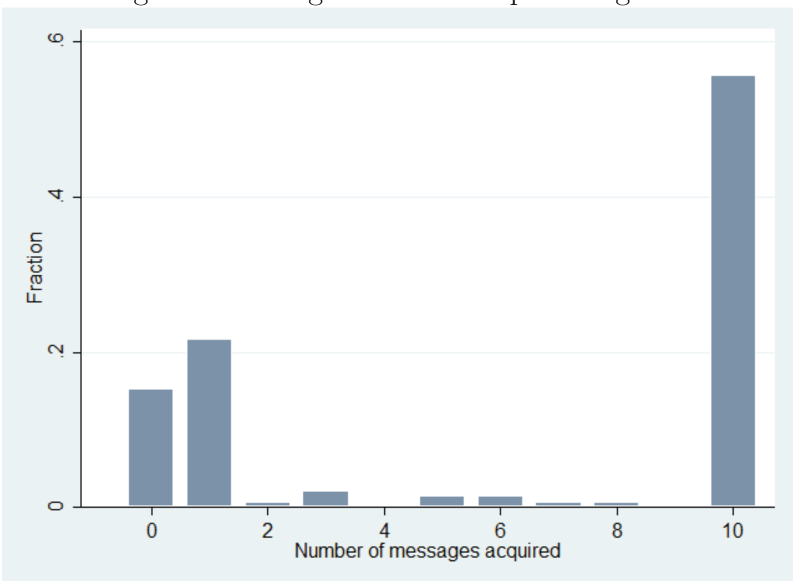
4.1 Overall signal acquisition

The average number of acquired signal is 6.14 which is apparently below the predicted optimal level. One could argue that in order to make the optimal decision the subjects could also stop signal acquisition before the maximum amount. The reason could be that the already acquired

[12]approx. 7.5 EUR or 5 USD at the time of experiment.

signals have updated the actual beliefs about the performance in such a way that even if all the remaining possible signals were in the opposite direction, it could not lead to a change in the lottery decision. With heterogeneity in beliefs and randomness in the signals, this would most likely lead to signal acquisition counts spread over the whole domain of possible number of signals. However, the data exhibit a different pattern. Closer inspection of the data (Figure 1) does not support the described reasoning for not taking the full set of signals for most of the subjects.

Figure 1: Histogram of the acquired signals



The subjects are very sharply selected into four main groups. Only ten subjects (7.25%) took more than two and less than nine signals. For most of those 10 subjects it was the case that one signal was strongly prevalent and they made their decision following the prevalent signal. The rest of the subjects took either the full set of 10 signals (55.8%), or one signal (21.74%) or no signal at all (15.21%). There is mixed support for such results in the discussed theories. Signal acquisition was neither correlated with the achieved score in the quiz ($\rho = 0.06$) nor with the quiz topic (highest value of ρ is 0.12). After splitting the subjects into two groups based on their number of correct answers being above/below the median, there is no statistical difference between signal acquisition of these two groups[13]. There was also no correlation of signal acquisition with other

[13]Using the Wilcoxon ranksum test.

social or demographic characteristics like age, country of origin, field of studies, highest earned degree, monthly spending, and number of siblings. There was a higher mean number of acquired signals for a group of subjects who self-report averse attitude towards risk[14] compared to the group reporting risk-seeking attitudes[15] (5.5 vs. 6.8 of acquired signals) which consist of almost 40% of the subjects. However, this difference is not statistically significant (with a p-value of 0.113). Male subjects acquired more signals but the difference is again not statistically significant.

In the following section of this article I relate my results to the existing literature. The full set of 10 signals is consistent with the standard monetary earnings maximization approach. For this approach, the prediction is relatively clear and no other number of signals than 10 would be rational. But this is not case for 44.2% of the subjects. So employing the standard approach only slightly more than half of the observed behavior could be explained. However, the full set of signals does not exclude cases of signal acquisition predicted by the ego-utility theory (Köszegi, 2006). Here, the subjects could simply be still in process of "fishing" for the right set of signals, giving them upward bias in self assessment. In fact, I found the exact opposite effects compared to the ones predicted by this theory.

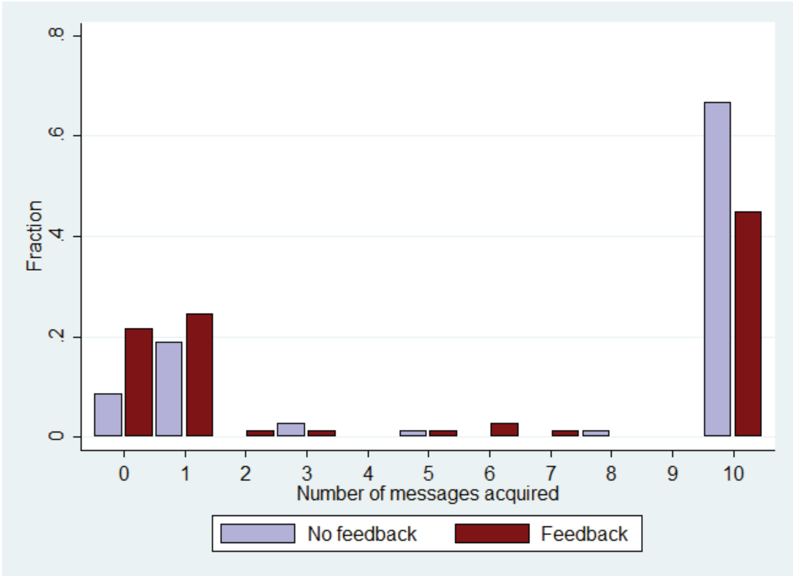
4.2 Ego-utility

The theory of ego-utility (Köszegi, 2006) has no clear predictions about the number of signals acquired. It suggests only that the subjects will stop information acquisition if their beliefs are enough to create a positive self-image. A necessary condition for enjoying the "ego-utility" is the absence of objective information about true performance otherwise positive self-image cannot be created. Therefore only NF treatments allow creation of a positive bias in self-image. Figure 2 presents a histogram of signal acquisition by treatments.

The number of signals is surprisingly greater in NF treatments. The difference between shares of subjects choosing 0 or 10 signals in different treatments is statistically significant at the 5% level[16],

[14] "very averse" or "quite averse" or "somewhat averse" response in the questionnaire.
[15] "quite risk-seeking" or "somewhat risk-seeking" response in the questionnaire.
[16] p-values of 0.033 and 0.010 respectively using two tailed t-test.

Figure 2: Signal acquisition by treatment



the difference for the shares of subjects acquiring 1 signal in different treatments is not statistically significant. Contrasting only the ego-utility stream of literature with the classical approach, there would not be any reason against going for 10 signal in the Feedback treatment. However, all the mentioned ego-utility theories predict that depending on your beliefs about your own performance, your willingness to acquire the signals is not stable. So one can argue that a higher number of signals might be caused by the subject having such beliefs which make them seek the signals. But that argument is not consistent with almost no signals between 2 and 9 because due to the random character of the signal, some subjects would have become averse to the signals during the acquisition process.

Different signal acquisition across the treatments could be explained by curiosity. Van Dijk and Zeelenberg (2007) show that curiosity may be a sufficiently strong motivator and it can override other widely accepted motivators (like regret in their case). So the willingness to know one's own performance can be a stronger motivator than building up biased beliefs for some subjects. This is the case in this experiment. But I cannot disentangle ego-utility from curiosity within the scope of this design in order to quantify their amplitudes.

For ego-utility based theories, I can test their different predictions of signal acquisition depending on the direction of the previous signal [17]. But given the distribution of the signal acquisition data, only very basic comparison is possible. Looking at the data pooled over the treatments, 78.8% of the subjects who received a negative first signal continued to sample more signals. While out of those subjects who received a positive signal, 70.8% continued in the signal sampling. But the difference is not statistically significant (p-value of 0.320). More relevant comparison would be for NF feedback subjects only as they have an opportunity to create biased beliefs. For NF treatment, 83.3% of the subjects continued sampling after the negative first signal and 76.9% of the subjects continued sampling after the positive first signal. More subjects sampling the signals after the negative first signal would favor Köszegi (2006) theory over Mobius et al. (2011) and Eil and Rao (2011). But again, this difference is not statistically significant (p-value of 0.542). Due to an insufficient data structure and low number of subjects I cannot perform more tests in an effort to distinguish between the predictions of the different mentioned ego-utility theories, so I will leave this for future studies.

This whole part commenting on the ego-utility theories is based on the assumption that the created environment triggers overconfidence. Even though I did not elicit the beliefs of the subjects, I can infer, to a certain extent, the level of overconfidence from the choices of the subjects. If some person exhibits overconfidence (after the signal acquisition) in this experiment, she will choose Option B. An under-confident person would choose Option A. This distinction is not completely clear as a person with unbiased beliefs may chose both options. However, I use it as a proxy to the direction of the bias as a sufficiently underconfident person never chooses Option B and an overconfident person never chooses Option A. Looking at the pooled data, there is no statistical difference from the 50-50 split of the chosen options. However, having biased beliefs which survive more than a few moments is possible in the NF treatment and not in the F treatment. The subjects have chosen Option B in the NF treatment in 60.9% of the situations, while in the F treatment in 46.4% of the situations[18]. The choice of the Option B is also negatively (significantly) correlated with the number of correct answers, which is in line with the previous overconfidence literature

[17] Described in detail in the second section of this paper.

[18] The difference is significant at the 10% confidence level, using a two-sided t-test.

(e.g. Ryvkin et al., 2012). This result may be simply driven by a smaller opportunity for being overconfident for high performers. But given the range of correct answers mentioned earlier, this would be the case only for extremely biased beliefs about performance, which would be possible only for a few top-scoring subjects.

The evidence suggests the presence of overconfidence in the choices of the subjects in the NF treatment. But there is no clear support for any of the ego-utility based theories regarding the signal acquisition conditional on the direction of previous signals due to insufficient variation in decisions.

4.3 Cognitive dissonance

The theory which could explain such a clear distinction in the number of acquired signals is based on the aversion to cognitive dissonance. Festinger (1962) suggests that people may avoid acquiring signals if they expect some conflict between available information. A similar action could also be observed if the possible information were in conflict with their beliefs. As mentioned earlier, following that reasoning, if decision making is mainly driven by cognitive dissonance motives, the subjects would acquire either 0 or 1 signal. This holds for almost 37% of the subjects (27.54% for NF treatment, 46,38% for the F treatment). Even though there is a higher share of the subjects taking one signal than taking no signal, the difference between them is not statistically significant[19].

The theory of cognitive dissonance is the only one among the mentioned alternative theories which predicts such a clear cut between taking at most one signal and more than one signal. The other theories could also lead to either no or one signal. But those theories do not exclude acquisition of two or more signals.

[19]Using proportion t-test (p-value is 0.16).

4.4 Confirmation bias

Using only confirmation bias (Bénabou and Tirole, 2002) to explain the overall patterns of signal acquisition would not be very successful. If one is waiting for a signal which would be in favor of the initial beliefs, it would be enough to stop after the first occurrence of such a signal. This could potentially hold for those who acquired only one signal. But there was no subject with 10 signals who sampled only one signal of a certain value. This theory deals more with following the signal than with signal acquisition. Due to distribution of the signal acquisition it makes sense to examine the behavior for the subjects taking either one or ten signals.

For the subjects acquiring only one signal the analysis is straightforward. Overall, 30 subjects took one signal. Consequently, 25 out of those 30 subjects (83.33%) followed this signal. So the subjects with only one signal mostly follow this signal when making their decision. This could be in line with the information ignorance approach only in a very unlikely case that those solo signals were confirming the initial belief of the subjects about their performance.

Out of 77 subjects who took the full set of ten signals, eight of them observed equal division of signals. For the remaining 69 subjects, one signal (ABOVE or BELOW) was dominant. Moreover, everybody acquiring ten signals received at least two signals of each kind. So the first appearance of the "expected" signal did not stop the signal acquisition. But this fact, by itself, does not contradict the confirmation bias theory as any number of unfavorable signals might be ignored.

The sets of ten signals were followed in 59 cases (85.51%). So, for both groups of subjects (taking either one or ten signals) the signal(s) were not followed only in approximately 15% of cases. There was no statistical difference in the share of subjects following the signal[20] between the subjects acquiring 1 and 10 signals. Moreover, such behavior was optimal for the given randomly drawn signals. Following the signal led to 3.2 times higher probability of optimal decision in the "one signal" group and to 7.6 times higher probability of optimal decision in the "ten signals" group.

I can identify only those subjects who made a decision not in the line with the observed signals. I cannot identify the agents with initial beliefs in line with the signal. But given the random nature

[20] Using a proportion t-test (p-value is 0.665).

of the signals, I cannot conclude that there is strong support for the confirmation bias theory. Additional experimental design features would be needed in order to make deeper examination of confirmation bias theory predictions. As the testing of confirmation bias theory was not the main focus of this study, I will refrain myself from making additional claims about the reflection of this theory in the decision making process at this point.

5 Conclusion

The first goal of this paper was to experimentally test the theoretical predictions for endogenous signal acquisition. I find a prevalence of monetary maximization or cognitive dissonance theory (Festinger, 1962). For a small group of the subjects, there is the suggestion of confirmation bias (Bénabou and Tirole, 2002) being present. I find no support for endogenous signal acquisition being driven by ego-utility (Köszegi, 2006).

The second goal was to explore the effect of previous signals on further information acquisition. However, the sharp cut data structure is insufficient to make any strong conclusions. I find slight support for Köszegi's (2006) theory over Mobius et al. (2011) and Eil and Rao (2011) but differences are statistically not significant, so this question is left for future research.

The initial knowledge quiz created an opportunity for biased beliefs about one's own performance in one treatment. The consequent lottery choice could be improved with the help of at most ten costless signals. The results show that only slightly more than half of the subjects acquired an optimal amount of signals (following the payoff maximization objective). There were almost no choices between 2 and 9 signals. The remaining subjects acquired either one or no signal.

This paper cannot examine all possible parametrizations and subtle changes in the environment, but some general conclusions can be reached. From the perspective of the mentioned theories, these results suggest that the aversion to cognitive dissonance is the prevalent motivator for those who did not choose the full set of signals. Comparing no-feedback and feedback sessions, the difference between the number of acquired signals is statistically significant but in the opposite direction than predicted by the theory of ego-utility (Köszegi, 2006). One possible explanation for this non-intuitive result could be the curiosity of the subjects about their own performance (See Van Dijk and Zeelenberg, 2007). The mentioned division of the subjects into three groups (0 or 1 or 10 signals) did not allow a proper examination of other ego-utility theory predictions. Namely, those connected with signal acquisition depending on the direction of previous signals. Another important result is that once the signals are acquired, they are mostly followed (in 85% of the cases) regardless of the number of acquired signals. This finding is not massively supportive for the theory of Benabou and Tirole (2002). However, around 15% of the subjects make decisions against the acquired signals what might be economically significant group in some situations.

Summing it up, almost half of the subjects did not acquire the optimal number of signals which, if followed, led to an increase in the monetary payoff. So it seems that only making useful information available does not necessarily lead to an improvement in decisions. If the negative consequences of a non-optimal decision are serious, some paternalistic or behavioral policies aimed at information acquisition support may improve the choices of the agents.

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Abstrakt

Tato studie zkoumá endogenní rozhodnutí k získání užitečné informace. Můj experimentální design testuje predikce “ego-utility” teorií a dalších relevantních teorií o rozhodovacím procesu agentů v prostředí s bezplatnými signály. Jenom mírná většina subjektů získala optimální počet signálů pro maximalizaci výplaty. Výsledky naznačují, že pro subjekty, kteří dělají neoptimální rozhodnutí, je averze ke kognitivní disonanci převládající motivací. Naopak, ve svém výzkumu nacházím mnohem menší podporu teorie “ego-utility”a teorie informační ignorace. Samotná možnost informace automaticky nevede k lepšímu rozhodování.

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