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Anchoring Effect as A Cognitive Bias: An Example of a Classroom Experiment

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Abstract:

Over the last decades, standard economic assumptions are questioned due to some empirical violation examples of the rationality principle in economic theory. Behavioral economists suggest that it is more realistic to call individuals and firms "bounded rational" than rational to solve this inconsistency. Hence, one of the primary sources of these irrationalities comes from cognitive biases and heuristics, according to many psychologies and behavioral economics studies. It is assumed that anchoring effect is one of the most robust cognitive bias since it might occur without the individual's awareness. In this study, anchoring effect as a cognitive bias is analyzed with its theoretical and psychological background. In the last section of the study, the findings of a class experiment are presented and discussed. According to the results, when the anchoring effect increases, the anchors' impact on the mean estimations of the subjects also increases. Moreover, when the subjects are explicitly directed to the anchor value, anchoring effect is more influential than a regular incidental anchoring effect. Hence, increases in anchoring effect result in a larger influence on the estimations of the subjects.

Key Words:

Anchoring Effect, Anchoring-and-Adjustment, Incidental Anchors, Experimental Economics

Introduction

Rationality term in economic theory is violated by many controlled experiments and real-life observations over the last decades (i.e., Kahneman, Tversky, 1974, 1979; Samuelson, Zeckhauser, 1988; Thaler, 1980, 1999). According to the studies from psychology and behavioral economics, one of the leading causes of these irrational behaviors is cognitive biases and heuristics. Behavioral economics analyzes some cognitive biases and heuristics with the help of experimental methods in the behaviors of individuals. Behavioral economics is a fresh branch of economics that aims to use psychological methods to understand the economic behaviors of individuals in a better way. As economics investigates how resources are distributed by individuals and institutions such as companies and markets, it will be useful to involve psychological factors to economic theory. Because the psychology of individual behaviors can bring a meaningful basis to economic theory in the same way as physics support chemistry or archaeology support anthropology. Hence, ‘behavioral economics’ as a fresh branch of economics, aims to use the psychology of economic behavior to support economics but simultaneously maintain stressing the importance of mathematical models and field data (Camerer, 1999, 10575). Moreover, while reunifying psychology and economics, behavioral economics does not reject standard economics assumptions wholesale. Behavioral economics consider these assumptions are useful and applicable to different forms of economics since they bring theoretical frameworks to economic theory. (Camerer, Loewenstein, 2003, p. 3).

Behavioral economics analyzes some cognitive biases and heuristics in the behaviors of individuals. Although the terms ‘’bias’’ and ‘’heuristic’’ are very similar, they represent different things. The heuristic can be defined as mental shortcuts that simplify the decision-making process by helping individuals make quick and efficient decisions. Bias is the result of the application of one or more heuristics. “Cognitive bias is a systematic deviation from rationality in judgment and decision-making common to all human beings, which can be due to cognitive limitations, motivational factors, and/or adaptations to natural environments.” (Wilke, Mata, 2012, p. 531).

Anchoring effect is a type of cognitive bias that leads individuals to take unrelated information and consider it a reference point to form a judgment about unknown values. Although there are more than 100 cognitive biases and heuristics in the literature (Ehrlinger et al., 2016, p. 3), anchoring effect was chosen for this study for several reasons. First of all, anchoring effect is quite influential bias and according to Furnham and Boo (2011, p. 35), it is one of the most robust ones. He also claims that anchoring effect has many implications in all decision-making processes. Moreover, the findings of Wilson et al. (1996, p. 387-402) demonstrate that individuals might be influenced by the anchor values even when there are prewarning manipulations. Therefore, it is assumed that anchoring effect is worth to be analyzed.

In the first section of this study, the literature review of anchoring effect will be presented. In the second section, an experiment conducted by the author of this study will be analyzed with its empirical findings.

Literature Review

Anchoring is a type of cognitive bias that leads individuals to take unrelated information and consider it a reference point to form a judgment about unknown values. According to Tversky and Kahneman (1974, 1128), estimations of individuals in most cases start from an initial point, and later this initial point is adjusted by them to yield a final estimation. For instance, some numbers in daily life implicitly might be stuck in individuals' minds such as a number of a building they just wrote down or a price of a product they just purchased in a shopping center (Wilson et al., 1996, p. 388). These numbers might have a particular impact on their daily life decisions without their awareness. A simple example of how anchoring effect works is illustrated as follows:

In one of their studies regarding anchoring effect, Tversky and Kahneman (1974, p. 1128-1129) analyze the influence of an initial number on the participants' estimations. They ask one group of subjects to calculate in 5 seconds, while another group of subjects was asked to calculate in 5 seconds. The mean of the estimations in the first group was 512, while it was 2250 in the second group according to the estimations of the subjects (The correct answer in both questions is 40320). Presumably, most of the subjects made their estimations based on the initial numbers. Hence, since the initial numbers in the first group are much less than the initial numbers in the second group, the median of the estimations is much less in the first group.

Silovic (1967) is the first scholar who analyzes anchoring effect (Chapman and Johnson, 1999 as cited in Furnham, Boo, 2011, p. 35). However, anchoring-and-adjustment is one of the dominant views about how anchoring effect was first introduced by Kahneman and Tversky (1974) in a study about decision under uncertainty. Anchoring can be used as a shortcut to predict an unknown value, It can help to estimate the target value by starting from a piece of information that is already known by the subject. Anchoring and adjustment work in a way that the anchors are accepted as a possible answer, then the adjustment process starts to make it available or acceptable in terms of the target value (Epley, Gilovich, 2001, p. 391). Kahneman and Tversky (1974, p. 1128-1130) state that individuals mostly make an insufficient adjustment when they form their judgments based on an initial value. The adjustment is not sufficient, and it creates biased predictions and estimations toward the anchor.

According to the literature review, anchoring effect is visible in many areas such as probability estimations (Kahneman, Tversky, 1974), general knowledge assessments (Epley, Gilovich 2001, 2005), willingness to pay decisions (Ariely et al., 2003), negotiations (Galinsky, Mussweiler, 2001), marketing strategy (Wansink et al., 2011) and even global warming estimations, (Joireman et al., 2010). Nevertheless, in anchoring literature, general knowledge estimations are one of the most commonly studied subjects. For instance, Epley and Gilovich (2001, p. 391-396) ask several estimation questions such as "How many states were in the United States in 1840?" or "What is the freezing point of vodka" to the subjects. In another study of them, Epley and Gilovich (2005, p. 199-212) tested the general knowledge of the subjects with several questions such as "What is the population of Chicago" or "What is the height of Mount Everest". The famous example of Tversky and Kahneman (1974, p. 1124-1131), who ask the subjects to estimate the number of African nations in the United Nations, is another estimation example in the anchoring literature.

In the presence of an anchor value, individuals might tend to benefit from it during their estimation process. They might consider anchor values as a possible answer due to several reasons. First of all, if the anchor value is informative and individuals do not know anything about the estimation question, it is logical that individuals will tend to benefit from it. For instance, in one study, the listing prices that were given by the conductors to the subjects were taken as anchor value for the estimations of real estate appraisals (Northcraft, Neale, 1987, p. 84-94). Therefore, informative anchors can not represent an irrational way of thinking; thus, they will not be part of this study.

As the most exciting type of anchor, individuals might consider the anchor value as a possible answer even when the anchor is uninformative, and people are not asked to consider it as a possible answer, or they are not explicitly invited to benefit from the anchor value (Wilson et al. 1996, p. 394). These types of anchors are called "incidental" anchors (Ünveren, Baycar, 2019, p. 2). For instance, in one study, a photo of a football player was shown to the subjects, and it was asked to guess the athletic success of the footballer. The same photo was shown on the other subjects, but the jersey number was shown as 54 in one group while it was shown as 94 in another group. The jersey number is an irrelevant factor for the athletic success of the footballers. However, the results show that the numbers had significant effects on estimations (Critcher, Gilovich, 2008,

p. 246-248). Moreover, the subjects were not explicitly invited to benefit from the anchor value, thus this is a good example of incidental anchoring.

In this study, incidental anchor will be investigated. The anchors that are given to the subjects are uninformative and randomly determined. After presenting the literature review, an experiment that was conducted by the author will be presented with its empirical findings in the next section.

A Classroom Experiment of Anchoring Effect

In this study, college students were chosen as sample, and thus the experiment was conducted in classroom environments. The sample was chosen from the University of Wroclaw in Poland with an overall 90 undergraduate Law students. Fifty-six of these students were male, and thirty-four of them were female. There were thirty students in the first group, twenty-nine in the second, and thirty-one in the third group. The author decided to choose this sample size since he used to be an exchange student at the University of Wroclaw during this research. It is a natural process for researches to choose the place as a research field they belong to. For instance, one of the most important behavioral economists, Dan Ariely, a professor at Duke University, analyzes several experiments that he conducted at Duke University (Ariely, 2009, p.1-242). Therefore, he chose the University of Wroclaw as a research field to experiment with the anchoring effect**.**

Some scholars argue that college students tend to display different behaviors than other late adolescents during the experimental process, such as more persuasive cognitive skills and a greater tendency to follow the authority (Sears, 1986, p. 521). On the other hand, Druckman and Kam (2009, p. 3) argue that Sears (1986) does not provide any empirical findings supporting his idea that student subjects pose a problem for experimental research. According to him, using students as subjects does not create a problem for researches' external validity. "External validity refers to the extent to which the causal relationship holds over variations in persons, settings, treatments (and timing), and outcomes" (Shadish, Cook, Campbell, 2001, 83 as cited in Druckman, Kam, 2009, p. 3). External validity generally investigates if this result happens outside the experimental environment, namely in other experiments with different experimental designs. The internal validity of an experiment, however, refers to the design of the experiment. More specifically, it mostly investigates if the experiment is consistent and valid in itself and is there any causal relationship between the dependent and independent variables. This causal relationship is essential regarding the internal validity of the experiment. Moreover, it investigates if there are any biases in the experimental design such as omitted variable bias or a biased estimator (Druckman, Kam, 2011, p. 2).

An experimental design which is applied to both student and non-student samples demonstrated that there is no significant difference between the samples. In general, the means of the answers of the subjects were quite similar in the experiment about topics related to politics such as partisanship, ideology, political information. Therefore, they could not find any significant difference between student and non-student samples (Kam, 2005 as cited in Druckman, Kam, p. 2011, 39).

Druckman and Kam (2011, 4-6) argues that there are many other dimensions of the external validity except for the characteristic of the sample such as settings, timing and the way of the employment. For instance, the same experimental research might provide different results in different time contexts. This might happen due to the nature of the world at that time. The authors conclude that especially political scientists are obsessed with the sample by ignoring other critical dimensions of external validity. When questioning the external validity of experimental research, they must include all the external validity dimensions. They also conclude that experimental realism is important during the evaluation of external validity, and using students as subjects does not reduce experimental realism (Druckman, Kam, 2011, p. 23-24). Moreover, according to the authors, using students as subjects does not pose a problem for experimental research, as mentioned above.

Design of the Study

As a first task, in order to overcome the language barrier, English classes were chosen for the study. Thus, the subjects were able to understand the basic English level that was sufficient to conduct the study. Nevertheless, it kindly asked professors to translate the questionnaire forms into Polish to ensure that the subjects understood their tasks.

As a design of the study, the subjects were randomly assigned to three different groups. The first group of subjects was asked to estimate the number of cities in Turkey without any information. Therefore, consider this group of subjects was considered as a control group. In the second group, the subjects were asked to write the last two digits of their phone number to the questionnaire paper that was distributed to them. As an estimation question, they received the same one as the previous group. In this manner, it is aimed to be tested if the subjects will be influenced by the last two digits of their phone number when they estimate the number of cities in Turkey. Therefore, this number must be considered as an uninformative value since the last two digits of their phone number can not give any information about the number of cities in Turkey. Hence, in the second experimental design, the last two digits of students' phone numbers can be considered 'incidental anchor'. To further the study, the third group of subjects was explicitly directed to benefit from the anchor value. More specifically, the subjects were invited to consider the anchor value as a possible answer for the target value. In this case, it is expected from the subjects to be influenced by the anchor value more than the second group.

The questionnaire forms were randomly distributed to the subjects are presented as follows:

Group 1

- What is your best guess about the number of cities in Turkey?

Group 2

- Please write the last two digits of your phone number.
- What is your best guess about the number of cities in Turkey?

Group 3

- Please write the last two digits of your phone number.
- Is the number of cities in Turkey less or more than the number you wrote above? What do you think? Less or more?
- What is your best guess about the number of cities in Turkey?

In this study, following two hypotheses are tested:

- ***H_1:*** *An arbitrary or uninformative number can influence the estimations of individuals on average when they need to estimate an unknown value.*
- ***H_2:*** *When the subjects are explicitly directed to the anchor value, the influence of the anchor value in the estimations of the subjects will increase.*

The main aim of the research is to compare the mean of the subjects' predictions in each group. It is assumed that when the anchoring effect increases, the anchors' impact on the mean estimations of the subjects also increases. In the second group, since the subjects wrote down the last two digits of their phone number, they were expected to be influenced by this number on average. With the same logic, in the third group, since the subjects were explicitly invited to use the anchor as a possible answer, they were expected to be influenced more than the subjects in the second group, on average. In this manner, it will also be possible to compare the influences of the incidental anchor (second group) and the anchor that was created by increasing the anchoring effect.

Method of the Study

The SPSS program was used for statistical analysis of the study. The SPSS calculated the means of the estimations and the standard deviations of each group. Moreover, correlations between the subjects' estimations and the anchor value were also calculated. According to the findings from Wilson and others (1996, p. 387-402), Ariely et al. (2003, p. 73-106), anchors might influence the decisions of individuals even when they are uninformative. The study's findings demonstrate that there is no significant correlation between the anchor values and estimations of the subjects. However, since the main purpose of this study is to determine whether there are any significant differences between the mean of the estimations in the presence of anchor values, the study was furthered by comparing the means of the estimations of each group. Hence, a significant effect size between the groups was expected. Cohen's d effect size was used to calculate it. Cohen's d effect size is one of the most common effect size calculators. Therefore, it will be used to determine whether the results of this study are meaningful.

Cohen’s d effect is one of the most common effect size calculator and it is formulated by Cohen (1988, p. 20) as follows:

$$Cohen's\ d = \frac{M_2 - M_1}{PooledSD}$$

Moreover, since the sample sizes are less than 50 in this study, the usage of a correction factor is needed (Hedges, Olkin 1985, as cited in Durlak, 2009, p. 919).

$$Correction\ Factor = \frac{N-3}{N-2.25} * [\sqrt{\frac{N-2}{N}}]$$

In the next section, the results of the study will be presented

Results

First of all, five outlier estimations were determined (2 in the first group, 1 in the second group, and 2 in the third group). Therefore, the statistical results analyzed among 85 subjects overall. Moreover, since there was no anchor value in the first group, the statistical analysis will be based on only the estimations of the subjects. According to the results, the subjects estimated the number of cities in Turkey as 1181 on average in the first group. In the second group, the subjects estimated this value as 838, while the third group of subjects estimated it as 411 on average. More detailed results are presented as follows:

Table 1: Results of the Groups

	Last two digits of students' phone number on average (Approx)	Estimations of students on average (Approx)
Group 1		1181
Group 2	59	838
Group 3	52	411

Source: Created by the author

A multiple line graph of the number of cities over the case number can be plot for the statistical analysis where the lines represent the groups.

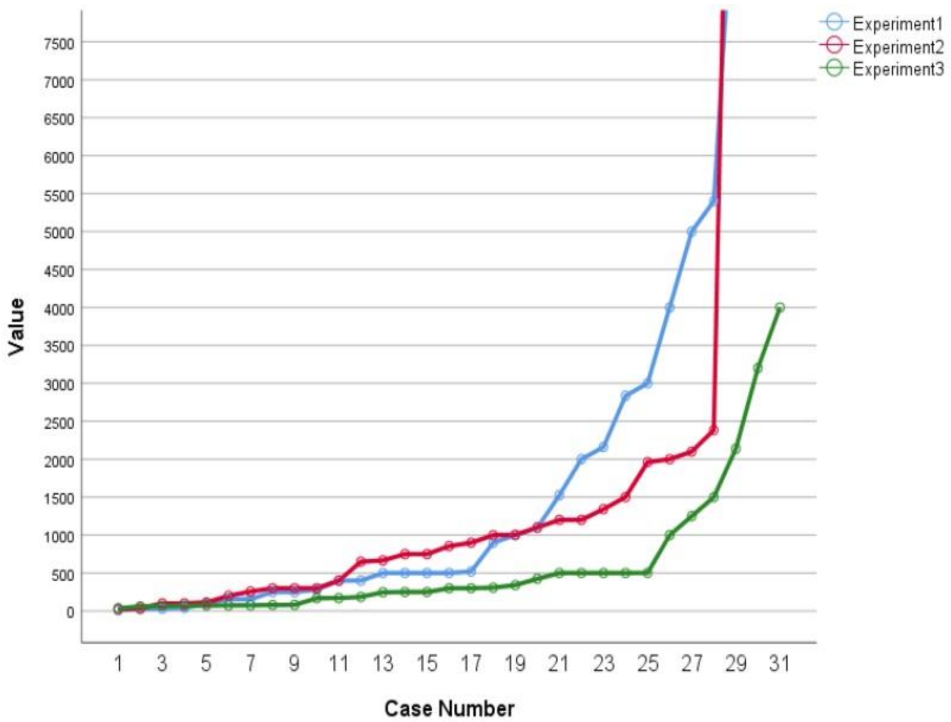

Figure 1: Distributions of the Estimations

Source: Created by the author (SPSS)

*The graph includes the outlier estimations too. They were excluded during the statistical analysis.

It can be observed from the graph that

- In Group 1, 17 subjects estimated the number of cities to be less than 500 and then it gradually increased.
- In Group 2, 26 subjects estimated the number of cities to be less than 2000 and then it gradually increased.
- In Group 3, 26 subjects estimated the number of cities to be less than 5000 and then it increased remarkably.

After presenting the findings of the study, basic statistical analysis of the groups are given as follows:

Table 2: Basic Statistical Analysis of the Groups

	Group 1	Group 2	Group 3
Mean (Approx)	1181	838	411
N	28	28	29
Standard Deviation (Approx)	1510	680	485

Source: Created by the author (SPSS)

The statistical analysis states that the standard deviation and the mean of the estimations is the highest in group 1, lower in group 2 and the lowest in group 3. Since group 3 has the smallest standard deviation, it can be said that the data is closer to the mean value on average relatively to the other groups.

Table 3: Correlation Analysis of the Second Group

		Last two digits of phone number of students (Approx)	Estimations of students
Last two digits of phone number of students (Approx)	Pearson Correlation	1	,037
	Sig. (2-tailed)		,850
	N	28	28
Estimations of students	Pearson Correlation	,037	1
	Sig. (2-tailed)	,850	
	N	28	28

Source: Created by the author (SPSS)

The correlation between the last two digits of the phone number of students and the mean of the estimations regarding the number of cities in Turkey is very low (0,037) and since the 2-tailed significant level (0,850) is higher than the p-value (0.01), the results are statistically not significant. Therefore, there is no significant correlation between the last two digits of the phone number of students and the estimations regarding the number of cities in Turkey in the second group, according to the statistical results.

Table 4: Correlations Analysis of the Third Group

		Last two digits of phone number of students (Approx)	Estimations of students
Last two digits of phone number of students (Approx)	Pearson Correlation	1	-,112
	Sig. (2-tailed)		,564
	N	29	29
Estimations of students	Pearson Correlation	-,112	1
	Sig. (2-tailed)	,564	
	N	29	29

Source: Created by the author (SPSS)

The correlation between the last two digits of the phone number of students and the mean of the estimations regarding the number of cities in Turkey is very low (-0,112), and since the 2-tailed significant level (0,564) is much higher than the p-value (0.01), the results are statistically not significant. Therefore, there is no significant correlation between the last two digits of the phone number of students and the estimations regarding the number of cities in Turkey in the second group, according to the statistical results. Moreover, the correlation is negative, but it is not at a significant level.

To sum up, there was no significant correlation between the anchor value and the estimations in group 2 and group 3. However, it is assumed that there must be a significant effect size between the groups due to substantial differences in each group's estimations. There are remarkable decreases between the estimations of the group when the anchoring effect increases. More specifically, since the mean of the estimation is highest without an anchor value when there is an uninformative anchor, it is getting closer to the anchor value, and when the subjects were explicitly directed to the anchor value, it is getting much closer to the anchor value. Therefore the effect sizes between group 1-2 and group 2-3 must be calculated.

Effect Size Calculation

Since the main purpose of this study is to compare the anchoring effects between the groups and observe whether the subjects are influenced when the level of anchoring increases, the study should be carried out with the calculation of Cohen’s d effect size. In this way, the estimations of each group can be compared. Cohen’s d effect is one of the most common effect size calculators, and it is formulated by Cohen (1988, p. 20) as follows:

$$Cohen's\ d = \frac{M_2 - M_1}{PooledSD}$$

$$PooledSD = \sqrt{\frac{1}{2}(SD_1^2 + SD_2^2\ )}$$

To calculate the formula, all the indicators which are given in the formula must be calculated. The components of the formula are:

- **M_1** = The mean of group 1
- **M_2** = The mean of group 2
- **SD_1** = The standard deviation of group 1
- **SD_2** = The standard deviation of group 2

All indicators that are given in the formula is already presented the Table 4. Therefore, Cohen’s d effect size can be calculated easily as follows:

$$\frac{M_2 - M_1}{\sqrt{\frac{1}{2}(SD_1^2 + SD_2^2\ )}}$$

$$\frac{1181 - 838}{\sqrt{\frac{1}{2}((1510)^2 + (680)^2)}}$$

= 0.29

Since the samples in each groups are less than 50, the usage of a correction factor is required (Hedges, Olkin 1985, as cited in Durlak, 2009, p. 919).

$$Correction\ Factor = \frac{N-3}{N-2.25} * [\sqrt{\frac{N-2}{N}}]$$

Since in both group 1 and group 2 the sample sizes are equal (28), they can be put on the formula. After making a proper calculation, the correction factor can be calculated as follows:

$$Correction\ Factor = \frac{25}{25.75} * [\sqrt{\frac{26}{28}}$$

$$Correction\ Factor = 0.92$$

After multiplying the correction factor with 0.29, Cohen's d effect size can be calculated as follows:

$$Cohen's\ d\ (1,2) = 0.29 * 0.92 = 0.26$$

According to Cohen (1988, 25-27), effect sizes are described as small if Cohen's d = 0.2, medium, if equal to 0.5, and large if it is equal to 0.8. Since 0.5> 0.26> 0.2, we can say that there is a small effect of the anchor value in the second group's estimations. More specifically, the effect of the anchor value in the second group is significant since the effect size calculated as meaningful.

After calculating the effect size between groups 1 and 2, the effect size between groups 2 and 3 can be calculated using the same method. After making the proper calculation, the effect size between group 2and 3 can be calculated as follows:

$$\frac{838-411}{\sqrt{\frac{1}{2}((680)^2+(485)^2)}}$$

Cohen's d $= 0.72$

The usage of the correction factor is required here as well since the sample sizes in each group are smaller than 50. The sample size of the the group 2 will be used in the formula since it is the control group.

$$Correction\ Factor = \frac{N-3}{N-2.25} * [\sqrt{\frac{N-2}{N}}]$$

$$Correction\ Factor = \frac{25}{25.75} * [\sqrt{\frac{26}{28}}$$

$$Correction\ Factor = 0.92$$

$$Cohen's\ d\ (2,3) = 0.72 * 0.92 = 0.26$$

Since 0.8> 0.66> 0.5, there is a medium-sized effect between the second and third groups. From the first group to the second group, since the level of anchoring effect increases from zero to a significant level, and it also increases from the second group to the third group in a significant level according to the results from the Cohen's d calculations, it can be inferred that the hypotheses that were presented above correct and they can not be rejected.

After interpreting the results, a general discussion of the study will be presented in the next section.

General Discussion

The predictions are high on average, comparing the estimations and the real answer of the estimation question (81). Moreover, there was no significant correlation between the anchors and the estimations, as mentioned before. However, these high estimations of the subjects drew the author's attention. Therefore, after the experiment, the number of cities in Poland was kindly asked one of the subjects. Because it is assumed that the number of cities in Poland might have influenced the subjects. It is also assumed that individuals tend to find an anchor to make their estimations meaningful even in the absence of an anchor value. The student said that there are around 900 cities in Poland. The author searched this information, and there are more than 900 cities in Poland, in fact.

According to the results, the mean of the estimations in the first group is 1181. Considering there was not any anchor value in the first group, presumably, the subjects considered the number of cities in Poland as an anchor value. Since they do not know the number of cities in Turkey, they perhaps adjusted the number of Poland cities to their estimations to make their estimations meaningful.

In the second group, the estimations are lower on average than the estimations of the first group and the number of cities in Poland. Hence, the anchor particularly influenced the subjects' estimations on average since there was a small effect size between groups 1 and 2. This anchor value can be considered as an incidental anchor since the anchor value is not informative. The anchor value was determined randomly in the second group.

In the third group, since the anchoring level increases when the subjects were explicitly directed to use the anchor value as a possible answer for their estimations, the mean of the estimations decreases on average compared to the second and the first groups. The influence increases when the level of the anchoring effect increases, but the correlation is still very low between the numbers and estimations. The mean of the estimations in the second group is more or less twofold of the third group.

It can also be inferred that since the effect size between the third and the second group (0.66) is larger than the effect size between the first and the second group (0.26), inviting the subjects to use the anchor value was more effective way than the incidental anchor according to the results. The impact of the anchoring increases when the level of anchoring increases.

One of the most valuable features of this study is about the way of determining the anchor values. In this study, the anchors were determined by the subjects' natural environment in the experimental design. Therefore, the anchors determined randomly. However, there was still a significant change between the group estimations on average, considering the effect size calculations between the groups were significant (0.26 between the first and the second group and 0.66 between the second and the third group).

In most of the studies about the anchoring effect, the anchor values were not determined randomly. More specifically, the anchors were given by the experimenters instead of a random selection process. In many of them, there were low and high anchors that were given by the experimenters. As the next step in a typical anchoring effect analyzes, the mean estimations of low and high anchors are compared to measure the anchoring effect. In this manner, the comparison can help us to measure the impact of anchoring.

For instance, in one study, judges were influenced by random anchors during their judgment process for a case. In the study, a file that tells a thief story of a woman was presented to 52 judges in Germany. Later, it was asked the judges to throw a pair of dices that was arranged as tricky since the dices were showing only 3 or 9. As the next step of the study, the judges were asked whether they would like to give the number from the dice as punishment.

According to the results, the judges who received number 9 expressed that they would like to give eight months on average as a punishment, while those who got number 3 were ready to give five months on average as a punishment. The experimenters gave the anchors. Moreover, it is quite interesting that an uninformative number influenced a serious decision (Kahneman, Tversky, 2011, p. 118).

Many psychological indicators can be demonstrated experimentally, but most of them are hard to be measured. Fortunately, it is possible to measure the anchoring effect. An anchoring index can be calculated and easily interpreted. The anchoring index is easy to calculate. The formula of anchoring index is given as follows:

An anchoring index should be between 0 and 1. Zero anchoring index means there is no anchoring effect, while one represents the average predictions by the participants match up with the value they took as a reference (anchor) to shape their decisions (Kahneman, Jakowitz, 1995, p. 1162).

For example, the anchoring index in the German judges' example that was presented above can be calculated easily. When the anchor value was 3, the median of the answers were 5 (months), when the anchor value was 9, the median of the answers were 8 (months). Therefore, the calculations regarding anchoring index will be as follows:

In another example of low and high anchors, the participants were asked to estimate the annual mean temperature in Germany. The subjects were exposed to two anchors: low anchor as 5 degrees or high anchor as 20 degrees. The ones exposed to a higher anchor estimated the annual mean temperature in Germany approximately 2 degrees more than those exposed to low anchor (Mussweiler, Englich, p. 2005, 135-136).

As another form of anchoring design, Mussweiler and Strack (2000, p. 495-518) represent low and high anchors in a plausible anchoring form (an anchor that can be a possible answer of the question) or in an implausible anchoring form (an anchor that can not be considered as a possible answer) to the subjects. They asked the subjects to estimate the age of

Mahatma Gandhi when he died. In the implausible anchoring form, the subjects were given 9 (low anchor) and 140 (high anchor). In plausible anchoring form, the subjects were given 61 (low anchor) and 86 (high anchor). 61 or 86 can be possible answers since it can be expected from a human being to die in this age range, while 9 or 140 does not seem possible answers for the estimation question.

Epley and Gilovich (2001, p. 391-396) analyze several examples about creating an anchor value by the type of question. For instance, in one study, the subjects were asked to estimate in what year George Washington was elected as a president. Most of the subjects know that the U.S. gained its dependence in 1776; therefore, the presidency of George Washington must be after this period. Therefore, the subjects could make their estimation by taking this date as a reference and adjust it to a reasonable answer. In this example, 1776 was a natural anchor, and therefore, these types of anchors were called self-generated anchors. In their study, the main purpose was comparing the results of self-generated anchors with a given anchor by the experimenters. According to their results, self-generated anchors led the subjects to explain their estimation process with anchoring and adjustment significantly more than the ones who were given an anchor value by the experimenters. However, this is still completely different than the anchoring selection process of this study.

In one of the exceptional studies conducted by Ariely, Loewenstein, and Prelec (2003, p. 73-103) to test the impacts of anchoring effect in WTP decisions, the anchor values were determined randomly. In the study, the subjects were asked to write down the last two digits of their social security numbers in a paper. In this way, the conductors attempt to analyze if these anchor values will impact the WTP decisions of the subjects. Next, many products (computer accessories, wine bottles, luxury chocolates, and books) were shown. Later, the subjects were asked if they would be willing to pay the numbers they wrote down on their paper as a dollar for these products. As a second question, the students were asked how much they would be willing to pay (maximum) for each product.

Social security numbers of students were divided into five categories to interpret the results. For instance, the highest anchors are from 80 to 99, and the lowest is from 1 to 20. The results demonstrate that the higher the anchors are, the higher the willingness to pays were. For instance, the students with the lowest-ending social security numbers were willing to pay $11.73 for a rare wine, while the students with highest-ending social security numbers were willing to pay $37.55. The results were similar for each product. "Overall, subjects whose social security numbers above the average refers values from 57% to 107% more than did subjects whose social security number below the average". In general, in 5 different categories regarding the anchor values and 6 different products, the authors determined a significant correlation between the anchor values and WTP of the subjects. The correlations were found between 0.3 and 0.5 at six different products. (Ariely et al., 2003, p. 75-76).

Their study does not consist of any "less or more" question. Instead, it consists of a "yes or no" question since the conductors ask the subjects whether they would be willing to pay the same amount with the anchor value to several products. More specifically, the subjects were asked to accept or reject to pay the same amount with the anchor value. However, in this study, the experiment's design required less or more questions since it was based on an estimation problem instead of a WTP decision. Nevertheless, the third group in this study was inspired by Ariely's example.

To sum up, this study's main target is not based on the observation of the correlation between the anchor values and the estimations. It is aimed to be observed the degree of anchoring effect between the mean estimations of each group. Cohen's d effect size calculator was used to observe this impact. According to the results, the hypotheses that were presented above can not be rejected.

Conclusion

The findings of behavioral economics demonstrate that the rationality of individuals is bounded for several reasons. One of the main reasons why individuals act irrationally comes from cognitive biases and heuristics. It is assumed that anchoring effect is one of the most robust cognitive bias and eliminating it is quite difficult. Moreover, anchoring effect is influential even when it is uninformative according to several studies. Furthermore, anchoring can not be eliminated by pre warnings. According to the literature review, anchoring effect is visible in many areas such as probability and general knowledge estimations, negotiations, consumer choices, legal and willingness to pay decisions, and even legal judgments.

In this study, the author attempts to demonstrate that anchors' impact increases when the level of anchoring increases. The findings reveal that when there was not an anchor, the subjects attempted to create an anchor by finding a similar case to the estimation question. Moreover, when there was an incidental no, the subjects' estimations were influenced by the anchor value on average. When the anchoring effect was increased by inviting the subjects to benefit from the anchor value, the impact of anchoring effect increased on average.

In the anchoring effect literature, there is no study comparing the different types of anchors regarding the estimations of the subjects on average in different groups. Considering there were three different groups in this study and the mean estimations of each group, it was possible to make a comparison between the groups regarding the level of anchoring effect. In this manner, the author hopes that this study will make a small contribution to anchoring literature.

References

Ariely, D., Loewenstein, G., and Prelec, D. (2003). Coherent Arbitrariness: Stable Demand Curves Without Stable Preferences. *The Quarterly Journal of Economics*, *118*, 73-106.

Camerer, C. (1999). Behavioral Economics: Reunifying Psychology and Economics. *Proceedings of the National Academy of Sciences*, *96*, 10575-10577.

Camerer, C. F., and Loewenstein, G. (2003). Behavioral Economics: Past, Present, Future.

Chapman, G. B., & Johnson, E. J. (1999). Anchoring, Activation, and the Construction of Values. *Organizational Behavior and Human Decision Processes*, *79*, 115-153 (as cited in Furnham, A., and Boo, H. C. (2011). A Literature Review of the Anchoring Effect. *The Journal of Socio-Economics*, *40*, 35-42).

Cohen, J. (2013). *Statistical Power Analysis for the Behavioral Sciences*. Routledge.

Critcher, C. R., and Gilovich, T. (2008). Incidental Environmental Anchors. *Journal of Behavioral Decision Making*, *21*, 241-251.

Druckman, J. N., and Kam, C. D. (2011). Students As Experimental Participants. *Cambridge Handbook of Experimental Political Science*, *1*, 41-57

Durlak, J. A. (2009). How to Select, Calculate, and Interpret Effect Sizes. *Journal of Pediatric Psychology*, *34*, 917-928.

Ehrlinger J., Readinger W.O., Kim B., *Decision-making and Cognitive Bias*, ,,Encyclopedia of Mental Health”, 12, 2016.

Epley, N., & Gilovich, T. (2001). Putting Adjustment Back in the Anchoring and Adjustment Heuristic: Differential Processing of Self-Generated and Experimenter-Provided Anchors. *Psychological Science*, *12*, 391-396.

Furnham, A., and Boo, H. C. (2011). A Literature Review of the Anchoring Effect. *The Journal of Socio-Economics*, *40*, 35-42.

Galinsky, A. D., & Mussweiler, T. (2001). First Offers as Anchors: The Role of Perspective-Taking and Negotiator Focus. *Journal of Personality and Social Psychology*, *81,* 657.

Hedges, L. V., & Olkin, I. (1985). Statistical Methods for Meta-Analysis. New York: Academic Press (as cited in Durlak, J. A. (2009). How To Select, Calculate, and Interpret Effect Sizes. *Journal of Pediatric Psychology*, *34*, 917-928).

Jacowitz, K. E., & Kahneman, D. (1995). Measures of Anchoring in Estimation Tasks. *Personality and Social Psychology Bulletin*, *21*, 1161-1166.

Joireman, J., Truelove, H. B., and Duell, B. (2010). Effect of Outdoor Temperature, Heat primes and Anchoring on Belief in Global Warming. *Journal of Environmental Psychology*, *30*, 358-367.

Kahneman, D., Tversky, A. (2011). Thinking, Fast and Slow. New York: Farrar, Straus and Giroux.

Kahneman, D., Tversky. A. (1979). *Prospect Theory: An Analysis of Decision Under Risk*, 263-292.

Kam, C. D. (2005). Who toes the party line? Cues, Values, and Individual Differences. *Political Behavior*, *27,* 163-182 (as cited in Druckman, J. N., and Kam, C. D. (2011). Students As Experimental Participants. *Cambridge Handbook of Experimental Political Science*, *1*, 41-57.

Mussweiler, T., & Englich, B. (2005). Subliminal Anchoring: Judgmental Consequences and Underlying Mechanisms. *Organizational Behavior and Human Decision Processes*, *98*, 133-143.

Mussweiler, T., & Strack, F. (2000). Numeric Judgments Under Uncertainty: The Role of Knowledge in Anchoring. *Journal of Experimental Social Psychology*, *36,* 495-518.

Samuelson, W., and Zeckhauser, R. (1988). Status Quo Bias in Decision making. *Journal of Risk and Uncertainty, 1*, 7-59.

Sears, D. O. (1986). College Sophomores in the Laboratory: Influences of a Narrow Data Base on Social Psychology's View of Human Nature. *Journal of Personality and Social Psychology, 51*, 515-529.

Shadish, W. R., Cook, T. D., & Campbell, D. T. (2001). Experimental and Quasi-Causal Designs for Generalized Causal Inference (as cited in Druckman, J. N., and Kam, C. D. (2011). Students As Experimental Participants. *Cambridge Handbook of Experimental Political Science*, *1*, 41-57).

Thaler, R. H. (1999). Mental Accounting Matters. *Journal of Behavioral Decision Making*, *12*, 183-206.

Tversky, A., and Kahneman, D. (1974). Judgment Under Uncertainty: Heuristics and Biases. *Science*, *185*, 1124-1131.

Ünveren, B., and Baycar, K. (2019). Historical Evidence for Anchoring Bias: The 1875 Cadastral Survey in Istanbul. *Journal of Economic Psychology*, *73*, 1-14.

Wansink, B., Kent, R. J., and Hoch, S. J. (1998). An Anchoring and Adjustment Model of Purchase Quantity Decisions. *Journal of Marketing Research*, *35*, 71-81

Wilke A., Mata R., Cognitive Bias, ,,Academic Press", 2012.

Wilson, T. D., Houston, C. E., Etling, K. M., and Brekke, N. (1996). A New Look at Anchoring Effects: Basic Anchoring and Its Antecedents. *Journal of Experimental Psychology: General*, *125*, 387.