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Anchoring and Overconfidence: The Influence of Culture and Cognitive Abilities

Abstract

Anchoring and overconfidence are some of the best-known biases in psychology and behavioral finance literature. While a number of studies have investigated the evidence of these biases and explored the motives and human factors that contribute to the one's susceptibility to the effects, little is known about the cultural factors behind these heuristic biases. This paper aims to fill the research gap and shows the differences in proneness to the anchoring effect and overconfidence in two samples of students from Poland and India. The purpose of the study is twofold: to analyze susceptibility to behavioral effects relative to cultural background; and to consider the subjects' cognitive abilities as a potential factor in their exposure to behavioral biases and confirm that subjects with higher cognitive skills, measured by the cognitive reflection test (CRT) display less susceptibility to the above heuristic biases.

Keywords: anchoring, overconfidence, culture, cognitive reflection test
JEL: G02, C91

Introduction

Literature about behavioral finance shows that people often rely on heuristic biases to predict values [Tversky, Kahneman, 1974]. Heuristics are mental shortcuts that allow

people to solve problems quickly and make more accurate decisions with less effort [Gigerenzer, 1996]. However, they can also lead to biases in judgments in the condition of uncertainty [Kahneman, Tversky, 1996].

One of the best-known heuristics is anchoring, which implies that individuals judgments often assimilate irrelevant numerical values to which they have been previously exposed. Many studies found undisputed evidence of anchoring in general knowledge [Tversky, Kahneman, 1974; Epley, Gilovich, 2001, 2005], probability estimates [Chapman, Johnson, 1999], legal judgments [Englich, Mussweiler, 2001; Englich et al., 2006], purchasing decisions [Ariely et al., 2003], credit card payments [Stewart, 2009], forecasting [Critcher, Gilovich, 2008], negotiations [Galinsky, Mussweiler, 2001] and self-efficacy [Cervone, Peake, 1986].

The literature review by Furnham and Boo [2011] presents a list of studies that concerns human factors which contribute to anchoring bias susceptibility such as: mood, knowledge/experience, motivation, personality and cognitive ability. However, little is known about the cultural factors behind that heuristic.

Another well-known behavioral bias is overconfidence. Moore and Healy [2008] described it as: (1) overestimation of one's actual performance, (2) overplacement of one's performance relative to others, and (3) excessive precision in one's beliefs. Again, the literature provides evidence of overconfidence in general knowledge [Kahneman, Tversky, 1977; Kahneman, 2011], experimental design [Camerer, Lovallo, 1999; Oskamp, 1965; Klayman et al., 1999], and financial settings [Barber, Odean, 2001; Malmendier, Tate, 2005; Scheinkman, Xiong, 2003; Daniel et al., 2001]. However, susceptibility to overconfidence is not unequivocal and is due to behavioral factors [Kahneman, Tversky, 1977], personality traits [Rzeszutek, 2015], cognitive factors [Hoppe, Kusterer, 2011] or cultural reasons [Antonczyk, Salzmann, 2014; Acker, Duck, 2008].

This study attempts to explain the differences in susceptibility to the anchoring bias and overconfidence among two samples of undergraduate students from Poland and India. The purpose of the study is twofold.

The first is to analyze the roles played by cultural backgrounds. The study of human factors considered in the anchoring literature [Furnham, Boo, 2011] is expanded to include a new human component, namely culture. The traditional assumption of "*homo economicus*", a person who is supposed to behave in exactly the same way in Poland and India, is tested. Based on cultural studies (Cheek and Norem, 2016; c), this paper investigates whether the culture has an impact on the anchoring bias and overconfidence. Therefore, the first hypothesis is that subjects coming from different cultures will vary in their susceptibility to the heuristic biases of anchoring and overconfidence.

The second purpose is to consider cognitive abilities as a potential factor in proneness to anchoring bias and overconfidence. Cognitive skills are measured by the cognitive reflection test [Frederick, 2005]. The hypothesis based on Bergman et al. [2010], Oechssler et al. [2009] and Hoppe and Kusterer [2010] states that subjects with higher cognitive

skills display lower susceptibility to the behavioral heuristics and biases such as anchoring and overconfidence.

Study 1: Anchoring and Overconfidence in a Cultural Dimension

A substantial body of literature indicates that national culture influences human values [Hofstede et al., 2010; Breuer, Quinten, 2009] and economic outcomes [Guiso et.al., 2006; Siegel et al., 2011; Zheng et al., 2012; Frijns et al., 2013; Braginsky, Mityakov, 2015]. Zingales [2015] argues that in the last ten years there has been an explosion of economic research on culture, which originates from the failure of traditional economic models to explain the reality of "*homo economicus*" embedded in a cultural context. Aggarwal and Goodell [2014] suggest that there is ample opportunity to further investigate the impact of national culture on finance.

Cultural finance literature (as defined by Breuer and Quinten [2009]) deals mainly with differences between Western and Asian cultures. Members of Western societies tend to focus on salient pieces of information and rely more on analytic reasoning. Asians seem to rely more on context and are described as intuitive and holistic thinkers [Nisbett, Masuda, 2003]. Therefore, in the field of behavioral finance, culture started to play an important role in understanding the economic behavior of investors, e.g. the effect of framing, as described in the prospect theory by Kahneman and Tversky [1979], is more noticeable among members of Asian cultures [Wang, Fischbeck, 2004; Levinson, Peng, 2007].

Studies of heuristic biases and cognitive disorders from a cultural perspective show that managers in individualistic countries are characterized by a higher belief in their own abilities and are more susceptible to overconfidence [Antonczyk, Salzmann, 2014; Heaton, 2002; Hackbarth, 2008]. Children who grow up in individualistic countries have the conviction that they are unique, above-average and are born winners. This behavior leads to a strong conviction about their high abilities and infallibility of their estimates [Markus, Kitayama, 1991].

Overconfidence can also affect the investment strategy used by investors. Chui et al. [2010] show that culture can effect stock return patterns and that individualism is positively associated with volume, volatility and profits from momentum strategies. Chui et al. [2010] argue that investors in different cultures interpret information in different ways and are subject to different biases. Investors from less individualistic cultures place lesser weight on information that they come up with by themselves, and more weight on the consensus of their peers and are therefore less prone to overconfidence or self-attribution bias.

Other studies show, however, that Asians are more confident than Britons, although this has more to do with overplacement and the underweighting of the risk of losing [Acker, Duck, 2008; Yates, Lee, 1996; Yates et al., 1996, 1997]. The studies of Jlassi, Naoui and Mansour [2014], which were based on 27 stock exchanges in various cultural regions of the world, confirm that Asian markets (including Hong Kong, India and the

Philippines) experience the highest level of price changes and that Asian investors are subject to overconfidence.

One of the most popular and most common heuristic biases – anchoring – was also analyzed. Studies by Cheek and Norem [2016] sought to verify the hypothesis that people who think holistically should be more affected by anchoring than those who think analytically. Holistic thinkers are considered inter-dependent because they focus largely on the context instead of specific elements, and therefore should be subject to anchoring to a greater extent. Although individuals characterized by analytic thinking consider themselves independent, they should be more suspicious with regards to the anchor given [Choi et al., 2007; Nisbett et al., 2001]. Empirical studies by Cheek and Norem [2016] have not, however, confirmed this hypothesis and show that people characterized by a holistic way of thinking are less susceptible to heuristic anchoring than those characterized by analytical thinking.

Study 2: Anchoring and Overconfidence – The Influence of Cognitive Abilities

The experimental study outlined in this section examines the extent cognitive skills play a role in decision-making behavior involving heuristics, especially anchoring and overconfidence.

Due to bounded rationality, people are unable to make fully logical decisions. Kahneman and Tversky [1984] state that cognitive information is processed in our brain by system 1 or system 2. System 2 requires us to conduct effortful, demanding and reflective mental activities while system 1 operates quickly, automatically, intuitively and without requiring a lot of time or effort.

The Cognitive Reflection Test (CRT) proposed by Frederick [2005] is a 3-item task that measures the extent to which individuals form their judgments intuitively, as opposed to through reflection. The CRT is designed to measure the tendency to override a prepotent response alternative that is incorrect and to engage in further reflection that leads to a correct answer [Toplak et al., 2011]. Studies showed that CRT predicts the susceptibility to decision-making biases and heuristics better than intelligence tests [Toplak et al., 2011, 2014] and is not just a mathematical test but measures something above and beyond general skills, namely cognitive reflection [Campitelli, Gerrans, 2013]. Pennycook et al. [2016] provide the evidence that CRT is more a measure of reflective than intuitive thinking.

The CRT has been used in several studies to measure the effect of cognitive abilities on the susceptibility to behavioral biases [Oechssler et al., 2009; Duttle, Inukai, 2015; Toplak et al., 2011]. In almost all cases, the higher CRT scores [Frederick 2005] were correlated to lower incidences of analyzed heuristics or behavioral biases.

Two recent studies explored the case of anchoring and cognitive ability. Bergman et al. [2010] showed that the anchoring effect decreased, but did not vanish, with a higher cognitive ability measured by a cognitive ability test (CAT) and the CRT. However, they suggested that CAT is a better predictor of anchoring than the CRT instrument. Oechssler

et al. [2009] also tested some behavioral biases in the context of cognitive abilities with the CRT, but found that test scores had no influence on the degree of anchoring.

Hoppe and Kusterer [2011] explored the issue of overconfidence and cognitive ability using a CRT. They showed that more intuitive decision makers are relatively less successful in assessing the right number of correct answers to questions related to general knowledge, although there was no clear tendency indicating that they are more overconfident than analytical decision makers.

Experimental Design

Students from two countries (Poland and India) were studied between 2014–2015. The sample groups were selected to represent two different cultural regions: Eastern Europe and Southern Asia.

The Polish respondents in the study included students from the Warsaw School of Economics. The group comprised 77 people. In the studied sample group, there were 40 women and 37 men. They were mainly Finance and Accounting majors. The group of students from India from the Management Development Institute in Gurgaon comprised 66 MBA program students, comprising 31 women and 33 men.

The study had a quasi-experimental (comparison) character. With regards to classification variables like gender or culture, one has to make use of the existing levels of the respective variable. In this scheme, one is able to study the difference between groups, although it is not possible to randomly select the study groups, because the author measured and compared naturally distinct groups. Consequently, the non-probability technique of selecting samples was random sampling, based on convenience sampling. This selection method was also chosen due to the considerable difficulties and high costs associated with using other techniques of sample selection when studying foreign respondents.

The study relied on a questionnaire composed of questions concerning the extent of anchoring effect and overconfidence (*overprecision* and *overplacement*). The drafting of questions in the questionnaire was based on the work by Jacowitz and Kahneman [1995], Soll, Klayman [2004], Larrick et al. [2007]. Questions were intentionally simple and referred to universal objects (height of the tallest tree in the world) and neutral opinions (American debt, personal evaluation of one's ability) as to avoid a lack of understanding between two groups of students (see Appendix 1, question 1, 2, 3). In order to measure cognitive ability, the three-item cognitive reflection test (CRT) introduced by Frederick [2005] was used (see Appendix 1, question 4, 5, 6).

Differences Between Polish and Indian Sample Based on the Model of Hofstede

According to Hofstede et al. [2010], 4 fundamental cultural dimensions can be distinguished: the individualism dimension (IDV), power distance (PDI), uncertainty

avoidance (UAI) and masculinity (MAS). Dimensions for Poland and India are presented in Table 1.

TABLE 1. Dimensions of Hofstede's cultural model for: Poland and India

Dimension	Individualism (IDV)	Power distance (PDI)	Uncertainty avoidance (UAI)	Masculinity (MAS)
Poland	60	68	93	64
India	48	77	40	56

S o u r c e : own study based on: Hofstede et al. [2010].

The biggest difference between Poland and India concerns the uncertainty avoidance dimension. Poland is a country with one of the higher UAI indicators, while India is a collectivist country with an average UAI. Citizens of countries with a high UAI index are, on average, more emotional, express more social concern and, in general, have a higher aversion to risk. On the other hand, countries with a low UAI index accept and cope better with unstructured situations, changes in the social environment, and prefer less regulation. Citizens of these countries seem to be more pragmatic and have a better tolerance to change. They are also characterized by a lower aversion to risk.

Cultural Dimensions and Anchoring

Respondents had to state what they thought the height of the tallest tree in the world was and were split into two groups. The first were asked the question with an anchor of 55 meters, and the second with an anchor of 365 meters (see Appendix 1, question 1). The drafting of the question was based on the work by Jacowitz and Kahneman [1995, p. 1163] "height of the tallest redwood".

The aim of the study was to examine to what degree the students' responses would be close to the anchoring values stated. The anchoring indicator was calculated using the following formula (Jacowitz and Kahneman [1995], Kahneman [2011]):

$$\text{Anchoring indicator} = \text{difference between average estimates} \,/\, \text{difference between the anchors.}$$

According to Kahneman [2011], the typical value of this indicator fluctuates around 55%. A high value of this indicator means that the test subjects were affected by the studied heuristic bias to a large extent. If people slavishly cling to the anchoring values, the anchoring indicator is 100 percent. If people were able to completely ignore the anchoring value, it would amount to 0 percent.

Cultural Dimensions and Overconfidence – Overprecision

The study was subject to miscalibration in the form of overconfidence about the precision of information held – also known as *overprecision*. Respondents had to estimate the level of American public debt as per 04.07.2014. They were asked to state a range about which they were 98% certain (see Appendix1, question 2). The question was based on the work by Soll, Klayman [2004], where participants were asked to provide interval estimates.

The task is assessed positively if the respondent specifies such a wide range that the right answer to the question is between the stated brackets. The variable of overconfidence was the precision of the forecast. If the forecast value was within the range, 1 point was awarded, otherwise no points were granted. Subsequently percentages were calculated for the correct and incorrect estimates for each attempt and country. The variable of overconfidence at aggregate level equaled the percentage of incorrect estimates (incorrect ranges).

Cultural Dimensions and Overconfidence – Overplacement

The study considered the inclination to assume one is a better person in a particular area than the average unit, *overplacement*, by asking typical questions about the chances of the person who was the subject of the study completing their course with an above-average grade (see Appendix 1, question 3). The drafting of the question was based on the work by Larrick et al. [2007]. In this case, *overplacement* meant that the majority of subjects replied positively to the above question, while *de facto* more than half respondents cannot be above average.

Results

Anchoring – Influence of Culture

In order to check whether the students were affected by the anchoring, and (if so) whether the degree to which they were affected differed by country, an inter-group comparison was performed using the Mann-Whitney *U* test. In the analyses performed, the group variable was the amount of the anchoring value (365 m *versus* 55 m), and the dependent variable was the height of the tallest tree in the world estimated by students. The comparison was performed separately in groups of students from Poland and India. The results are summarized in Table 2.

This indicates that estimations by both groups about tree height differed to a statistically-significant level, depending on the anchoring value. Where the anchor was 365 m, the average estimated height of the tree in all student groups was greater than in groups where the anchor was 55 m. The values of the anchoring indicator show that students from Poland were less affected by heuristic bias (anchoring value = 35.5%) than students from India (anchoring value = 72.8%).

TABLE 2. **The effect of anchoring values on the estimation of the height of the tallest tree in the world, based on nationality**

Country	Anchor: 365 m			Anchor: 55 m			Mann-Whitney test		Anchoring indicator
	n	*M*	*SD*	*n*	*M*	*SD*	*Z*	*p*	
Poland	38	195.55	157.75	33	85.39	42.01	3.78	< 0.001	**35.5%**
India	27	340.07	271.85	27	114.26	168.31	4.37	< 0.001	**72.8%**

S o u r c e : own study.

Overprecision – Influence of Culture

To check whether the propensity to overprecision is due to cultural conditioning, a chi-squared test for independence was performed. In the analysis, interdependence between the examined countries and percentage of students affected by heuristic bias were studied. The results of the test show a statistical tendency $\chi^2(df = 1) = 3.10$; $p = 0.078$. It can be cautiously assumed that the proportion of people affected by overprecision is not the same in the compared groups. The percentage of Indian students affected by overprecision was similar at 85.7% ($n = 42$); for students from Poland, the percentage was lower, 71.7% ($n = 43$). Figure 1 shows the difference between students with regards to overprecision.

FIGURE 1. **Overprecision of students from Poland and India**
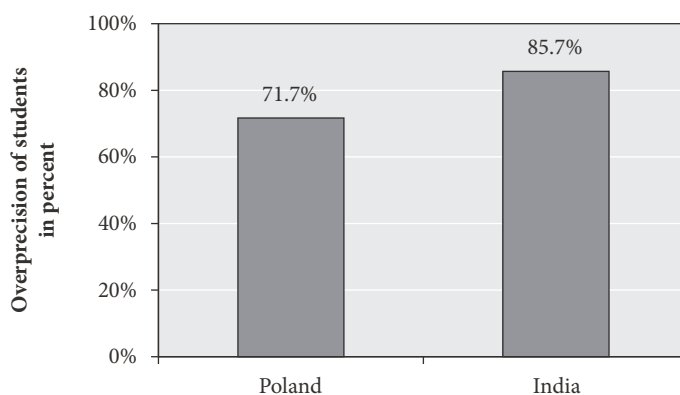
S o u r c e : own study.

The study also examined whether the proportion of people undervaluing, giving the correct answer and those overvaluing differed depending on the country of study (Figure 2). The results of the chi-squared test are not statistically significant, $\chi^2(df = 2) = 3.22$; $p = 0.200$. However, it can be observed that the vast majority of people from India gave

a lower range of values, i.e. they underestimated the value. This could be related to the phenomenon of underestimating the risk of loss [Acker, Duck, 2008; Yates, Lee, 1996; Yates et al., 1996, 1997].

FIGURE 2. Overprecision of students from Poland and India (under- and overestimation)
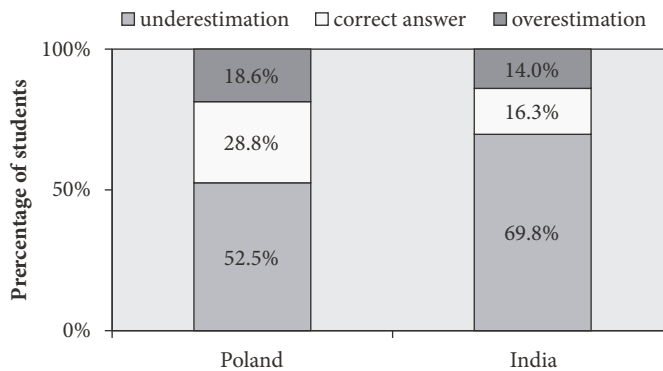
S o u r c e : own study.

Overplacement – Influence of Culture

To check whether the tendency to have excessive confidence in oneself (overplacement) is based on cultural factors, the author performed an analysis using a chi-squared test for independence. In this analysis, interdependence between the examined country and the percentage of students affected by overplacement was studied. The results of the test were not statistically significant, $\chi^2(df = 1) = 0.01$; $p = 0.938$. There are no grounds to state that the level of overplacement differs depending on the nationality of the students. In the groups from Poland and India, the percentage of students expecting to complete their studies with an above-average grade was similar, at 89.5% ($n = 68$) and 89.1% ($n = 57$) respectively.

Anchoring and the CRT (Without a Division by Country)

The analysis considered the influence of anchoring on the estimation of the size of an object, based on the results of the cognitive reflection test. For this purpose, the Mann-Whitney U test was used to compare the estimated height of a tree with anchors of 365 m and 55 m, among all student groups (from Poland and India) with both positive and negative results from the CRT. The answers of all respondents were mixed in order to exclude cultural factors from the analysis and to check exclusively for the influence of cognitive indicators on the degree of susceptibility to the particular heuristic bias. The results of the analysis are summarized in Table 3.

TABLE 3. **Influence of anchoring on the estimation of the height of a tree, based on the results of the CRT**

CRT score	Anchor: 365 m			Anchor: 55 m			Mann-Whitney test		Anchoring indicator
	n	*M*	*SD*	*n*	*M*	*SD*	*Z*	*p*	
Positive	27	236.74	201.60	25	94.20	59.15	4.30	< 0.001	**46.0%**
Negative	35	284.89	256.68	35	104.24	168.94	3.53	< 0.001	**58.3%**

S o u r c e : own study.

The results of the Mann-Whitney *U* test show that estimates based on data from students from Poland and India differ to a statistically significant extent, depending on the value of the anchor. In cases where the anchor was 365 m, the average height estimate for the tree was higher than in cases where the anchor was 55 m. The values of the anchoring indicators show that heuristics bias has less influence on students with a positive score in the CRT. The value of the anchoring indicator in this group was 46.0%. For students with a negative score in the CRT, the value of the indicator was higher at 58.3%. This means that if cultural factors are excluded from the analysis, the results of the CRT, cognitive abilities, have an influence on the degree of proneness to the respective heuristic bias. This confirms the hypothesis of Toplak, West and Stanovich [2011], which states that the CRT is, on the one hand, a measure of rational thinking, and on the other hand the degree of susceptibility to cognitive distortions.

Anchoring and the CRT (with a Division by Country)

Next, I analyzed the influence of anchoring on estimating the size of an object, based on the results of the cognitive reflection test divided by country of origin. Here,, the Mann-Whitney *U* test was used to compare the estimated tree height with anchors of 365 m and 55 m, amongst student groups with both positive and negative results from the CRT. The analysis was performed separately for students from Poland and India. The results of the analysis of the student from Poland are shown in Table 4, and for the student from India in Table 5.

TABLE 4. **Influence of anchoring on the estimation of the height of a sequoia, based on the results of the CRT – students from Poland**

CRT score	Anchor: 365 m			Anchor: 55 m			Mann-Whitney test		Anchoring indicator
	n	*M*	*SD*	*N*	*M*	*SD*	*Z*	*p*	
Positive	16	163.44	97.51	17	93.76	47.12	2.30	0.022	**22.5%**
Negative	21	223.62	192.27	16	76.50	35.11	2.93	0.003	**47.5%**

S o u r c e : own study.

For students from Poland the value of the anchor had a significant influence on the estimated height of the tree. Both in the group with positive and negative results in the CRT, the average estimated height of the tree in cases where the anchor was 365 m was greater than in cases where the anchor was 55 m. At the same time, the anchoring indicator in the group of people with a negative score in the CRT was higher than in the group of people with a positive score in the CRT.

TABLE 5. **Influence of anchoring on the estimation of the height of a sequoia, based on the results of the CRT – India**

CRT score	Anchor: 365 m			Anchor: 55 m			Mann-Whitney test		Anchoring indicator
	n	*M*	*SD*	*N*	*M*	*SD*	*Z*	*p*	
Positive	19	298.47	245.04	18	94.61	70.06	3.58	< 0.001	**65.8%**
Negative	6	499.33	351.81	9	153.56	281.13	1.65	0.098	**111.5%**

S o u r c e : own study.

For students from India the average estimated tree height when the anchor was 365 m was higher, both for people with a positive and negative score in the CRT. However, due to the low number of people with a negative score in the CRT, the difference between estimations where the anchor was 365 m and 55 m is only at the level of a statistical tendency ($p = 0.098$). The values of the anchoring indicators show that people with a negative score in the CRT are more susceptible to anchoring than people with a positive score.

The analysis shows that both cognitive and cultural indicators have an effect on the degree of exposure to the heuristic bias.
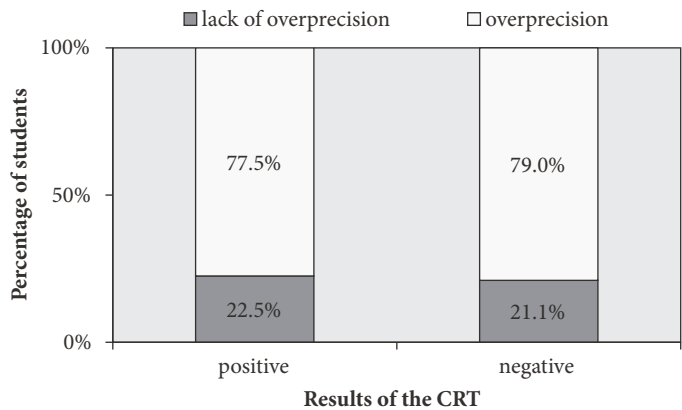
Overconfidence and the CRT (Without a Division by Country)

Analysis of the link between the score in the CRT and overprecision follows. Using the chi-squared test, I checked whether the proportion of people susceptible to this heuristic bias was the same in the group of students with positive and negative scores in the CRT. The results of the chi-squared test were also insignificant statistically $\chi^2(df = 1) = 0.03$; $p = 0.859$. There are therefore no grounds to conclude that the variables are linked. The proportion of people susceptible to overprecision was similar, regardless of the results of the cognitive reflection test. Figure 3 shows the studied dependency.

In the next stage of the analysis, the link between the results of the CRT and overplacement was examined. The chi-squared test was used to check whether the proportion of people susceptible to this heuristic bias was the same in the group of students with positive and negative CRT results. The outcomes of the chi-squared test are insignificant statistically $\chi^2(df = 1) = 0.15$, $p = 0.700$. There are therefore no grounds to conclude that the variables
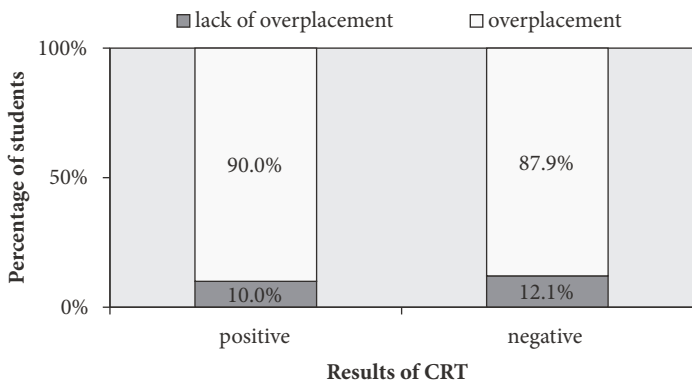
are linked. The proportion of people prone to overplacement was similar, regardless of the results of the cognitive reflection test. Figure 4 shows the studied dependency.

FIGURE 3.   Overprecision based on the results of the CRT

S o u r c e : own study.

FIGURE 4.   Overplacement based on the results of the CRT

S o u r c e : own study.

Overconfidence and the CRT (with a Division by Country)

In the next stage of the analysis, the link between the results of the CRT and overprecision was studied. The chi-squared test was used to check whether the proportion of people susceptible to this heuristic bias was the same in the group of students with positive and

negative results in the CRT. The analysis was performed separately for students from Poland and from India. The results of the chi-squared test are shown in Table 6. The proportion of people susceptible to overprecision was similar for students from Poland and India, regardless of the results of the cognitive reflection test.

TABLE 6. Overprecision based on the results of the CRT, by country

Country	CRT score		Chi-squared test		
	positive	negative	χ^2	df	p
Poland	69.7% ($n = 23$)	74.1% ($n = 20$)	0.14	1	0.708
India	84.2% ($n = 32$)	91.1% ($n = 10$)	0.00	1	0.944

S o u r c e : own study.

The link between the results of the CRT and overplacement was also examined. The chi-squared test was used to check whether the proportion of people affected by this heuristic bias was the same in groups of students with positive and negative CRT scores. The analysis was performed separately on students from Poland and India. The results of the chi-squared test are shown in Table 7. The results obtained indicate that there is no basis to believe that the variables are linked. The proportion of people vulnerable to overplacement was similar for students from Poland and India, regardless of the results of the cognitive reflection test.

TABLE 7. Overplacement based on the results of the CRT, by country

Country	CRT score		Chi-squared test		
	positive	*negative*	χ^2	df	p
Poland	94.6% ($n = 35$)	84.2% ($n = 32$)	1.17	1	0.279
India	86.0% ($n = 37$)	95.0% ($n = 19$)	0.39	1	0.534

The percentages represent the amount of people susceptible to excessive confidence.
S o u r c e : own study.

Discussion of Findings and Conclusion

The statistical analysis performed in study 1 revealed that respondents from the two studied groups were affected by anchoring, and the degree to which they were influenced by the respective heuristic bias differed depended on their country of origin. The values of the anchoring indicator show that students from Poland (35.5%) are less susceptible

to heuristic bias than students from India; the value of the anchoring indicator was twice as high at 72.8%. The higher anchoring indicator for students from India, compared to students from Poland, confirms the hypotheses of Choi, Koo & Choi [2007] as well as Nisbett, Peng, Choi & Norenzayan [2001], which states that people who think in a holistic manner are more susceptible to the phenomenon of anchoring and are therefore more prone to context manipulation relating to aspects of the situation.

Our statistical analysis also showed key statistical differences in the susceptibility to overconfidence, depending on the country of respondent's origin. In the case of miscalibration due to overprecision, the percentage of people with overconfidence among students from India was 85.7%. For students from Poland the percentage was 71.7%. The Polish students, characterized by a higher indicator of individualism than students from India, were less exposed to overconfidence. This did not confirm the results of the tests by Antonczyk, Salzmann [2014], Heaton [2002] Hackbarth [2008], Markus and Kitayama [1991] or Chui, Titman, Wei [2010], who showed evidence of a positive dependence between the indicator of individualism and overconfidence. An in-depth analysis of the structure of responses showed, however, that the higher confidence from students in India was primarily due to an underestimation of the estimated results, which would confirm the hypothesis of Acker and Duck [2008], who consider the underweighting of downside risk by Asian cultures. This is confirmed by an analysis of the Hofstede indicators [Hofstede et al., 2010], which shows that the UAI scores for India are amongst the medium and low scores internationally, indicating that these societies are less averse to risk-taking than, for example, Poland (which has one of the highest scores for UAI worldwide).

When examining the tendency to believe in being above-average in a particular area (*overplacement)*, it was shown that the level of overconfidence did not differ to a statistically significant degree by student nationality. In both groups the percentage of students expecting to complete their studies with an above-average grade was similar at 89.5% and 89.1% respectively.

The statistical analysis performed in study 2 verified the hypothesis that subjects with higher cognitive skills display weaker proneness to behavioral heuristics. The hypothesis was confirmed with regards to anchoring. Both at the aggregate and individual level the author shows that people with a negative score in the CRT are more susceptible to anchoring than people with a positive score. The study results confirm the findings of Toplak et al. [2011, 2014] and Bergman et al. [2010] stating that the results of the CRT are a good forecast tool concerning susceptibility to the heuristic biases.

Clearly, the sample size imposed some limitations on the study, since it was not possible to perform a regression analysis to check whether variables (cultural or cognitive) have a greater effect on the susceptibility to the respective heuristic bias. A second limitation was usage of the Cognitive Reflection Test with open-ended questions as in Kahneman [2011, p. 65]. Such a modification of the CRT could, on the one hand, slightly enhance the

overall CRT results of the students, but on the other, hand eliminate potential mathematical errors mentioned by Pennycook et al. [2016].

In the future analyses, the author hopes to increase the sample size, expand it to cover other countries from different cultural regions, explore the role of gender or religion [Czerwonka, 2014] and expand the analysis by CRT 7 [Toplak et al., 2014].

Notes

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References

Acker, D., Duck, N.W. (2008), Cross-cultural overconfidence and biased self-attribution, *The Journal of Socio-Economics*, No. 37, pp. 1815–1824

Aggarwal, R., Goodell, J.W. (2014), National cultural dimensions in finance and accounting scholarship: an important gap in the literatures? *Journal of Behavioral and Experimental Finance*, No. 1, pp. 1–12.

Antonczyk, R.C., Salzmann, A.J. (2014), Overconfidence and optimism: the effect of national culture on capital structure, *Research in International Business and Finance*, No. 31, pp. 32–151.

Ariely, D., Loewenstein, G., Prelec, D. (2003), Coherent arbitrariness: stable demand curves without stable preferences, *The Quarterly Journal of Economics*, No. 118, pp. 73–105.

Barber, B.M., Odean, T. (2001), Boys will be boys: gender, overconfidence, and common stock investment, *Quarterly Journal of Economics*, No. 116(1), pp. 261–292.

Bergman, O., Ellingsen, T., Johannesson, M., Svensson, C. (2010), Anchoring and cognitive ability, *Economics Letters*, No. 107(1), pp. 66–68.

Breuer, W., Quinten, B. (2009), Cultural finance, SSRN eLibrary, available at: http://dx.doi.org/10.2139/ssrn.1282068 (20.01.2015).

Camerer, C., Lovallo, D. (1999), Overconfidence and excess entry: an experimental approach, *The American Economic Review*, No. 89(1), pp. 306–318.

Campitelli, G., Gerrans, P. (2013), Does the cognitive reflection test measure cognitive reflection? A mathematical modeling approach, *Memory and Cognition*, No. 42(3), pp. 434–447.

Cervone, D., Peake, P.K. (1986), Anchoring, efficacy, and action: the influence of judgmental heuristics on self-efficacy judgments and behavior, *Journal of Personality and Social Psychology*, No. 50, pp. 492–501.

Chapman, G.B., Johnson, E.J. (1999), Anchoring, activation, and the construction of values, *Organizational Behavior and Human Decision Processes*, No. 79, pp. 1–39.

Cheek, N.N., Norem, K. (2016), Holistic thinkers anchor less: exploring the roles of self-construal and thinking styles in anchoring susceptibility, *Personality and Individual Differences*, available at: http://www.sciencedirect.com/science/article/pii/S0191886916300356 (14.04.2016).

Choi, I., Koo, M., Choi, J.A. (2007), Individual differences in analytic versus holistic thinking, *Personality and Social Psychology Bulletin*, No. 33, pp. 691–705.

Chui, A., Titman, S., Wei, K. (2010), Individualism and momentum around the world, *Journal of Finance*, No. 65(1), pp. 361–392.

Critcher, C.R., Gilovich, T. (2008), Incidental environmental anchors, *Journal of Behavioral Decision Making*, No. 21, pp. 241–251.

Czerwonka, M. (2014), The influence of religion on socially responsible investing, Journal of Religion and Business Ethics, No. 3(1), p. 21.

Daniel, K.D., Hirshleifer, D., Subrahmanyam, A. (2001), Overconfidence, arbitrage, and equilibrium asset pricing, *The Journal of Finance*, No. 56(3), pp. 921–965.

Duttle, K., Inukai, K. (2015), Complexity aversion: influences of cognitive abilities, culture and system of thought, *Economic Bulletin*, No. 35(2), pp. 846–855.

Englich, B., Mussweiler, T. (2001), Sentencing under uncertainty: anchoring effects in the courtroom, *Journal of Applied Social Psychology*, No. 31, pp. 1535–1551.

Englich, B., Mussweiler, T., Strack, F. (2006), Playing dice with criminal sentences: the influence of irrelevant anchors on experts' judicial decision making, *Personality and Social Psychology Bulletin*, No. 32, pp. 188–200.

Epley, N., Gilovich, T. (2001), Putting adjustment back into the anchoring and adjustment heuristic: differential processing of self-generated and experimenter-provided anchors, *Psychological Science*, No. 12, pp. 391–396.

Epley, N., Gilovich, T. (2005), When effortful thinking influences judgmental anchoring: differential effects of forewarning and incentives on self-generated and externally provided anchors, *Journal of Behavioral Decision Making*, No. 18, pp. 199–212.

Frederick, S. (2005), Cognitive reflection and decision making, *Journal of Economics Perspectives*, No. 19(4), pp. 25–42.

Frijns, B., Gilbert, A., Lehnert, T., Tourani-Rad, A. (2013), Uncertainty avoidance, risk tolerance and corporate takeover decisions, *Journal of Banking and Finance*, No. 37(7), pp. 2457–2471.

Furnham, A., Boo, H. Ch., (2011), A literature review of the anchoring effect, *The Journal of Socio-Economics*, No. 40, pp. 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*, No. 81, pp. 657–669.

Gigerenzer, G. (1996), On narrow norms and vague heuristics: a reply to Kahneman and Tversky (1996), *Psychological Review*, No. 103(3), pp. 592–596.

Guiso, L., Sapienza, P., Zingales, L. (2006), Does culture affect economic outcomes? *Journal of Economic Perspectives*, No. 20, pp. 23–48.

Hackbarth, D. (2008), Managerial traits and capital structure decisions, *Journal of Financial and Quantitative Analysis*, No. 43, pp. 843–882.

Heaton, J.B. (2002), Managerial optimism and corporate finance, *Financial Management*, No. 31, pp. 33–45.

Hofstede, G., Hofstede, G.J., Minkov, M. (2010), *Cultures and organizations: software of the mind*, 3rd Edition, McGraw-Hill Education, New York.

Hoppe, E.I., Kusterer, D.J. (2011), Behavioral biases and cognitive reflection, *Economics Letters*, No. 110(2), pp. 97–100.

Jacowitz, K.E., Kahneman, D. (1995), Measures of anchoring in estimation tasks, *Personality and Social Psychology Bulletin*, No. 21, pp. 1161–1166.

Jlassi, M., Naoui, K., Mansour, W. (2014), Overconfidence behavior and dynamic market volatility: evidence from international data, *Procedia Economics and Finance*, No. 13, pp. 128–142.

Kahneman, D. (2011), *Thinking fast and slow*, Farrar, Straus and Giroux, New York.

Kahneman, D., Tversky, A. (1996), On the reality of cognitive illusions, *Psychological Review*, No. 103(3), pp. 582–591.

Kahneman, D., Tversky, A. (1977), Intuitive prediction: biases and corrective procedures, available at: http://www.dtic.mil/dtic/tr/fulltext/u²/a047747.pdf (12.09.2015).

Kahneman, D., Tversky, A. (1979), Prospect theory: an analysis of decisions under risk, *Econometrica*, No. 47(2), pp. 263–292.

Kahneman, D., Tversky, A. (1984), Choices, values and frames, *American Psychologist*, No. 39(4), pp. 341–350.

Klayman, J., Soll, J.B., Gonzalez-Vallejo, C., Barlas, S. (1999), Overconfidence: it depends on how, what, and whom you ask, *Organizational Behavior and Human Decision Processes*, No. 79(3), pp. 216–247.

Kwok, C., Tadesse, S. (2006), National culture and financial systems, *Journal of International Business Studies*, No. 37(2), pp. 227–247.

Larrick, R.P., Burson, K.A., Soll, J.B. (2007), Social comparison and confidence: when thinking you're better than average predicts overconfidence (and when it does not), *Organizational Behaviour and Human Decision Processes*, No. 102(1), pp. 76–94.

Levinson, J.D., Peng, K. (2007), Valuing cultural differences in behavioral economics, *The ICFAI Journal of Behavioral Finance*, No. 4(1), pp. 32–47.

Malmendier, U., Tate, G. (2005), CEO overconfidence and corporate investment, *The Journal of Finance*, No. 60(6), pp. 2661–2700.

Markus, H.R., Kitayama, S. (1991), Culture and the self: implications for cognition, emotion, and motivation, *Psychological Review*, No. 98, pp. 224–253.

Moore, D.A., Healy, P.J. (2008), The trouble with overconfidence, *Psychological Review*, No. 115(2), p. 502.

Nisbett, R.E., Peng, K., Choi, I., Norenzayan, A. (2001), Culture and systems of thought: holistic versus analytic cognition, *Psychological Review*, No. 108, pp. 291–310.

Nisbett, R.E., Masuda T. (2003), Culture and point of view, *Proceedings of the National Academy of Sciences of the United States of America*, No. 100(19), pp. 11163–11170.

Oechssler, J., Roider, A., Schmitz, P.W. (2009), Cognitive abilities and behavioural biases, *Journal of Economic Behavior & Organization,* No. 72(1), pp. 147–152.

Oskamp, S. (1965), Overconfidence in case-study judgments, *Journal of consulting psychology*, No. 29(3), pp. 261–265.

Pennycook, G., Cheyne, J.A., Koehler, D.J., Fugelsang, J.A. (2016), Is the cognitive reflection test a measure of both reflection and intuition? *Behav Res Methods*, No. 48(1), pp. 341–348.

Rzeszutek, M. (2015), Personality traits and susceptibility to behavioral biases among a sample of Polish stock market investors, *International Journal of Management and Economics*, No. 47(1), pp. 71–81.

Scheinkman, J.A., Xiong, W. (2003), Overconfidence and Speculative Bubbles, *Journal of Political Economy*, No. 111(6), pp. 1183–1220.

Siegel, J.I., Licht, A.N., Schwartz, S.H. (2011), Egalitarianism and international investment, *Journal of Financial Economics*, No. 102(3), pp. 621–642.

Soll, J.B., Klayman J., (2004), Overconfidence in interval estimates, *Journal of Experimental Psychology. Learning, Memory and Cognition*, No. 30(2), pp. 299–314.

Stewart, N. (2009), The cost of anchoring on credit-card minimum repayments, *Psychological Science*, No. 20, pp. 39–41.

Toplak, M.E., West, R.F., Stanovich, K.E. (2011), The cognitive reflection test as a predictor of performance on heuristics and biases tasks, *Memory & Cognition*, No. 39, pp. 1275–1289.

Toplak, M.E., West, R.F., Stanovich, K.E. (2014), Assessing miserly information processing: an expansion of the cognitive reflection test, *Thinking and Reasoning*, No. 20, pp. 147–168.

Tversky, A., Kahneman, D. (1974), Judgment under uncertainty: heuristics and biases, *Science. New Series*, No. 185(4157), pp. 1124–1131.

Wang, M., Fischbeck, P.S. (2004), Similar in how to frame, but different in what to choose, *Marketing Bulletin*, No. 15, pp. 1–12.

Yates, J.F., Lee, J.-W. (1996), Chinese decision making, in: M.H. Bond (Ed.), *Handbook of chinese psychology*, Oxford University Press, Hong Kong, pp. 338–351.

Yates, J.F., Lee, J.-W., Shinotsuka, H. (1996), Beliefs about overconfidence, including its cross-national variation, *Organizational Behavior and Human Decision Processes*, No. 65, pp. 138–147.

Yates, J.F., Lee, J.-W., Bush, J.G. (1997), General knowledge overconfidence: cross-national variations, response style and 'reality', *Organizational Behavior and Human Decision Processes*, No. 70, pp. 87–94.

Zheng, X., El Ghoul, S., Guedhami, O., Kwok, C.C.Y. (2012), National culture and corporate debt maturity, *Journal of Banking and Finance*, No. 36(2), pp. 468–488.

Zingales, L. (2015), The "cultural revolution" in finance, *Journal of Financial Economics*, No. 117, pp. 1–4.

Appendix 1

1. Is the height of the tallest tree in the world more than 55 meters /365 meters (*second group*)
   ☐ Yes ☐ No
   In your opinion, what is the height of the tallest tree in the world? …

2. Estimate the level of American public debt in USD as per 20.05.2014 (state the range within which the right answer should be in order to have 98% certainty)
   ………………….$ – ………………….$

3. Do you think you can finish your studies with the better score than the average?
   ☐ Yes ☐ No

4. A bat and a ball cost $1.10 in total. The bat costs $1.00 more than the ball. How much does the ball cost?
   ☐ a) $1, ☐ b) $0.05, ☐ c) $0.10, ☐ d) $0.01

5. If it takes 5 machines 5 minutes to make 5 widgets, how long would it take 100 machines to make 100 widgets?
   ☐ a) 500 minutes ☐ b) 100 minutes ☐ c) 50 minutes ☐ d) 5 minutes

6. In a lake, there is a patch of lily pads. Every day, the patch doubles in size. If it takes 48 days for the patch to cover the entire lake, how long would it take for the patch to cover half of the lake?
   ☐ a) 48 days ☐ b) 24 days ☐ c) 47 days ☐ d) 42