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MARKET SOPHISTICATION AND METACOGNITION OF WORKERS IN COLLECTIVISTIC VS. INDIVIDUALISTIC COUNTRIES

Marcin Brycz

University of Gdańsk,
Gdańsk, Poland

E-mail: marcin.brycz@ug.edu.pl

ORCID 0000-0002-9017-8915

Hanna Brycz

University of Gdańsk,
Gdańsk, Poland

E-mail: hanna.brycz@ug.edu.pl

ORCID 0000-0001-7003-9793

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Introduction

Many studies have shown a close relationship between psychology and economy since Kahneman, a psychologist who won a Nobel prize in economy in 2003.

As part of our research, we want to highlight the role of the psychology-economy link via cross-cultural studies. This idea is primarily focused on the fact that metacognitive self, as a part of consciousness and self-awareness, is related to the social, technological, and economic status of the country people live in.

1. Literature review

Technology is created, developed, and produced by human beings, but on the other hand, it interacts with humans. Technology as well as economy shape character, influence attitudes, and help resolve many daily problems (Rymarczyk, 2020). Åhman (2017) stresses that human-computer interaction affects self strongly in the terms of distinguishing the sense of oneself. The latter can be realized in many ways, for example by setting external goals (the

instrumental self) or by playing, (the playful self). The way humans interact within the socio-economic relations impacts the technology-human affinity. For example, living in a collectivistic country significantly differs from a life in an individualistic state. In individualistic cultures, people seek out information from official sources. In the collectivistic culture, people acquire information from someone like-minded, who already possesses information about technology or innovation (Lee et. al., 2013). Both technology and human being are parts of the market, so both are affected by the laws of economics.

The main aim of the study was to search for technological and economic factors existing in collectivistic vs. individualistic countries in the sample (Japan, China, Vietnam, USA, Poland, UK, Spain, India) and their relationship with the metacognitive self (MCS, self-awareness of biases). Technology depends on whether a given country is unbiased, open to novelty, and rich enough to employ high-tech on a societal level. Artificial intelligence, for example, is based on algorithms (Giza & Wilk, 2021). Algorithms however have been shown to exclude people of colour and women from a wide range of activities including jobs application. This happens when algorithms are inaccurately produced, either by under or overrepresentation of particular data, or by the personal bias of engineers that is reflected in the collection of data (Jackson, 2021). This discriminatory practice is called algorithmic bias. It seems that the stronger self-awareness of biases (MCS) is, the less technological purposes are executed inaccurately.

The link between human reasoning and technology looks crucial for further technology development. Murray, Rhymer, Sirmon (2021) described different forms of conjoined agency between humans and technologies. The authors highlighted the role of human resources. Human resources are valid for the sustainability and growth of any industry, dealing with product manufacturing or services. Technology means a way, a method developed and implemented to attain more comfort, and happiness in man's life (Rymarczyk, 2021). Many examples can be cited to show the beneficial role of technology throughout the history of mankind (creating fire, using the wheel for many goals, and so on). Today, viewing positive scenes through virtual reality (VR) has been shown to increase positive affect and holds great promise for addressing anhedonic symptoms during the depression (Nawaz, Gomes, Faisal, 2021). Economic growth, moreover, is determined by technology adoption, where human capital plays a crucial role. Skare, Blažević (2021) in their study on 104 countries for a long period (1870 – 2010) had indicated that selective technology adoption policy, accompanied by supporting educational policy, stimulates: technology, diffusion, and knowledge spillover. Technology changes human consciousness and affect. On the other side, accessibility of high-tech is the country-level problem. Maciejewski and Głodowska (2021) analyze the issue in the context of technology adoption and economic growth through financialisation of the market. Rosenbaum, Scott, Russell-Bennett (2021) identified the opportunities for further research on technology and humanity link at the country level: service technology and interaction between service technology and societal prosperity.

Marx's theory might be useful to explain the ongoing technology revolution in certain countries and the lack of such technology progress in others. The theory goes back to the special link between country input and people's consciousness. According to Marx (1859), economy and technology as developmental indicators of each country shall impact simple relation between country-level and the consciousness of its inhabitants.

Marx (1859) states that in the production for existence it is inevitable to enter social relations. The social relation of the production transforms to the social structure with cultural and legal superstructure over them. Marx (1859) wrote here: "It is not the consciousness of men that determines their existence, but their social existence that determines their consciousness." The material forces of production, which are independent of the superstructure come into conflict with the social relation of the production. When the struggle of these forces begins, a

new superstructure can emerge, as a society comes to a new level of development (eg. from feudalism to capitalism). Marx (1859) stated that consciousness must be explained by material life.

A person in the materialistic world is put in the social structure with the superstructure above. When material production forces increase than the rise in social consciousness would lead to moving the society to the next level of social development.

Kawakami (1926) argues for the proper use of the term “consciousness” (Marx, 1859). This term can be regarded as either “economic consciousness” or “social consciousness”. For example, the capitalist class is conscious of how much they possess, despite their capital composition (eg. factory, cash, shares). In the opposition to the above labor, the class can be unconscious of how much their work is worth in terms of the value-added they produce, as they usually know the market value of their wage only. In other words, workers don’t know how much their work is worth to the employer. Similarly, the term “conscious” is appropriate to a machine, as it can be just a machine without application or can enter relation with workers and become capital, that produces commodities. Simply, the gold is just gold without entering social interaction.

The meaning of consciousness in psychology is defined as a broad phenomenon embracing several different constructs. Going back to Marx’s (1859) theory, we specify consciousness as awareness of one’s experiences and reasoning (e.g., Lau & Rosenthal, 2011). In this case, we take under consideration rather meta- consciousness which must be experienced consciously with the experiencer reflecting on this experience (Rosenthal, 2002; Winkielman & Schooler, 2011).

It is the right time to present the dependent variable – the measure of part of consciousness – the metacognitive self.

Metacognition research expanded in scope to fields such as working memory and consciousness (Koriat, 2007, Schraw & Dennison, 1994), creativity (Scholer & Miele, 2016), judgment, decision-making, and persuasion (See, Petty, & Fabrigar, 2008), children’s cognitive development (Flavell, 1979), problem solving and memory (Nelson & Narens, 1990), learning strategies and self-regulation (Efklides, 2008; Efklides & Valachopoulos, 2012), critical thinking processes, attitude change, bias regulation (Brinol & DeMarree, 2012), information processing strategies and many others (e.g. Schwarz, 2015). That suggests the crucial role of metacognition in the process of human self-regulation (Baumeister & Vohs, 2004) – effort spent on the acquisition of self-knowledge and the knowledge of others’ mental states and feelings impact individual decisions and behavior. Schwarz (2015) claimed that acquiring metacognitive pieces of knowledge can fluctuate due to the mental resources’ accessibility and the level of difficulty of knowledge to be learned. The level of fluency creates metacognitive experience on the dynamics of one’s information processing. Such experience of ease or difficulty was defined as conceptual fluency (Whittlesea, 1993). Thus, the interpretation of metacognitive experience depends on the complexity and richness of cognitive network and accessible lay theories. Moreover, metacognitive experience is context-sensitive. Fluent processing increases positive feelings and the likelihood of information acceptance (Schwarz, 2015). Metacognitive experience and knowledge may be linked to the self and self-awareness.

The metacognitive self relates to the interplay between metacognitive thinking about the self and the awareness of biases. The term metacognitive self (MCS) means self-awareness of biases. However, the MCS does not pertain to all the biases discovered by the psychologist. It is recognized nowadays that some biases play self-regulatory roles. The MCS refers to self-awareness of self-regulatory biases.

Irrationality and biases are understood as common rules of thinking, so-called psychological rules of behavior (Larrik, 2004). For example, people tend to overestimate their future success (Koriat, 2016; Weiner, 2014) and underestimate the time required to achieve a

goal or accomplish a task (Buehler, Griffien, & Ross, 1994). This is because they tend to ignore potential obstacles and are focused on factors that might bring success closer. Thus, biases, in this particular case, foster the pursuit of goals. Biases and shortcuts might be related to lay reasoning and serve self-regulatory processes. Many biases that are anchored in heuristics (Kahneman & Tversky, 1973; Weiner, 1972) promote adaptive decision-making. For example, being familiar with an object allows people to make accurate guesses about it (Goldstein & Gigerenzer, 2002). Moreover, it is impossible to imagine good social interactions and pro-social activity taking place without the reciprocity rule, which is often referred to as social glue (Cialdini, 1993). The reciprocity rule can be regarded as a kind of bias as it is not based on rational and logical thinking. In contrast, some biases lead to cruel or antisocial behavior (e.g., the dehumanization of a victim) and others disrupt cognition, perception, and memory. Lewandowsky, Ecker, Seifert, and Schwarz (2012) provided a good demonstration of the spread of misinformation (e.g., that vaccination is linked to autism) via media, fiction, rumors, and so on. They claimed that reliance on misinformation differs from ignorance, which is the absence of relevant knowledge, and set out the societal costs of misinformation. They also demonstrated that it is difficult to ‘debias’ people’s attitudes. They suggest that the rebuttal of misinformation is successful under conditions of active monitoring of the context, which facilitates referring to other sources and even healthy skepticism (Lewandowsky et al., 2012). This points to the crucial role of self-awareness in knowledge acquisition, social, and economic functioning.

As was asserted at the beginning, we hypothesize that the technology and economic level of collectivistic vs. Individualistic countries relate to MCS due to Marx’s (1859) theory. The role of country type (collectivistic vs. Individualistic) is studied by psychologists and economists. Brycz et al (2015) postulated that some cultural differences exist within the level of metacognitive self due to differences in self-construal and information processing, particularly self-perception and attribution. The results revealed that the individuals living in collective cultures are more accurate in judging their own biases (higher level of metacognitive self) than those living in individualistic cultures. These results were explained by the cultural differences in self-construal and information processing. For example, people with individual self describe situations from an actor’s perspective (standing in the center of action), whereas people with interdependent self perceive situations from the third person’s viewpoint (Cohen & Gunz, 2002); people with independent self are used to perceive main object (figure), whereas people with interdependent self are used to perceive objects always connected with the context (Nisbett, Caputo, Legant & Maracek, 1973); people from western cultures mostly classify objects using cognitive categories without respect to their interdependence whereas people from eastern cultures classify objects because of relations between them (Norenzayan, Smith, Kim & Nisbett, 2002). These differences exist in the study (Brycz, et al., 2015), however, the stronger MCS among collectivistic country individuals than individualistic ones may be modified within a more complex model, engaging technological and economic factors of individualistic vs. collectivistic countries.

We use the same database as in 2015 and incorporated the new technology and economic factors. Human technology and economic factors were taken from Cornell University, INSEAD, and WIPO, The Global Innovation Index 2017 – sub-indices of the Global Innovation Index: Market sophistication, and Human Technology: Knowledge workers.

Firstly, we reach for the concept of The Global Innovation Index (GII). GII encompasses a wide area of basic economic and social indicators taken together to assess the level of a country’s innovation. It consists of seven sub-indices, of which the first five are Innovation Input and the remaining are Innovation Output. To develop the economy and as we usually perceive society either, the application of new technology is necessary for innovation. To initiate the process, a country needs to possess sufficient conditions for technology development. Those are institutions, human capital, research, infrastructure, market, and

business sophistication, or simply – the Inputs. The first pillar of the GII measures the institutional environment for the new technology and its practical application – the likelihood of political destabilization, the government’s ability to choose and implement consistent policy, and the cost of redundancy. The second pillar – Human capital and research – measures crucial resources that can be transformed into new technology and its application: efficiency, level, and quality of education. The infrastructure pillar captures the ICT sector, ecology, and power output. The fourth pillar – Market sophistication reflects the availability of credit, access to the internal market, and degree of competition. The final pillar – Business sophistication consists of a) sub-pillar: knowledge workers – employment in the knowledge-intensive sectors, access to professional training, spending on the research and development by firms; b) Innovation linkages sub-pillar reflects universities and firm’s cooperation; (Cornell University et al., 2017).

Innovation input is not necessarily transformed into innovation output, as many determinants play a crucial role in transforming innovation resources into innovation effects. The example of Poland indicates that despite being well equipped with innovation inputs, the country was not able to achieve a high position in the GII ranking. This can be explained by a mismatch between the innovation inputs and the needs of the economy or the insufficient moderators between inputs and outputs (eg. R&D institution, Jankowska et. Al., 2017). Another example provides by Bitarre et. Al. (2008). In Sweden despite very high investment in R&D and innovation resources, the national system of innovation remains low, as a result of problematic sector allocation and globalization of Swedish firms.

Another approach to what determines innovation is the investigation of cross-cultural differences. Cox & Khan (2017) stated that more innovative societies are: individualistic than collectivistic, feminine than masculine, pragmatic than normative, and indulgent than normative. Cox & Khan (2017) assured to verify the hypothesis individualistic countries rather not collectivistic ones foster self-consciousness (here MCS).

As the link between innovation input and output is not easy to explain, another approach emerged – a fuzzy set analysis. The innovation output has not the one leading link from inputs, rather there is a configuration of conditions leading to the high national level of innovation (Khedhaouria & Thurik, 2017).

Our study aims to check the relation between technology, economic factors of collectivistic vs. individualistic countries, and the metacognitive – self. To perform the analysis, we used the dependent variable: metacognitive self; and independent variables: knowledge workers as human technology factor, and market sophistication as an economic factor. The technology-related input is knowledge workers (KW), which consists of substantive factors such as employment in knowledge-intense services; the possibility of many forms of training at the firm level; research and development supported by business enterprise; and the total expenditure spent on research and development. What’s more, KW supports psychological equality, e.g. female employment, and gender labor distribution of nations. Knowledge workers are also represented by professionals engaged in the conception the creation of new knowledge, methods, and systems (Cornell University et. Al., 2017). This group of workers interacts with the technology on the daily basis. They are the most connected group to technology, as it is a major part of their work life. This group has high insight, as they are aware of both: the advantages and threats of technology, so adjust many settings including wi-fi, notification tasks, or removing media out of sight (Karlsen & Ytre-Arne, 2021).

The technology factor favors analytic reasoning and meta – consciousness. On the contrary, input called Market Sophistication (MS) may work in the opposite direction and decrease piecemeal thinking, advantaging impulsive and heuristic human decisions. Market Sophistication (MS) means availability of credits (ease of getting credit), promotes competition, and market dynamism. The MS indicator reflects the intensity of competition in the local market (Cornell University et. Al., 2017). Competition per se causes emotional alert and biological

stress-provoking a higher level of cortisol in the blood, as the result of the activity of the hypothalamic-pituitary-adrenal axis. Competition enhances market development and deteriorates positive effect on rational reasoning, and well-being (Becker, Hartwich, Haslam, 2021). We suspect negative relation between MS and self-awareness of biases.

Our model predicts the beneficial role of Knowledge Workers on metacognitive self (MCS) and the destructive role of Market Sophistication (MS) on self-awareness of biases (MCS). Thus, specific paths between technology and economics among collectivistic vs. individualistic countries might relate to the metacognitive self (Brycz et al, 2015).

The relation between innovation-input and metacognitive-self has its rationale in Marx's theory of technology and capitalism. The forces of production increase consciousness (Marx, 1959).

2. Methodological approach

2.1. Predictions

Brycz, Różycka – Tran & Szczepanik (2015) have found that MCS differed according to the individualistic vs. collectivistic country participants lived in. ANOVA revealed the main effect of the country on the metacognitive self. Collectivistic culture (countries) inhabitants indicated stronger MCS than individualistic cultures ones.

We would like to challenge this simple main effect via verifying another hypothesis: is it possible that the difference between the type of country might be related to economic and technological factors? In other words, we predict that the special role of economic and human technology factors might modify and explain the relationship between the given culture and the metacognitive self.

2.2. Methods

2.2.1. Participants and procedure

All together $n = 985$ students, aged 19 – 26, participated in the study. The participants originated from different countries all over the world: the USA, Spain, England, Vietnam, China, Japan, India, and Poland. Participants were recruited randomly among undergraduate students enrolled in studies at different departments of the following Universities: University of Delhi (India), National Vietnam University in Hanoi (Vietnam), Global University in Barcelona (Spain), City University London, University of East Anglia, University of Kent (Great Britain), Washington University in St. Louis, University of Maryland (USA), and the University of Gdansk, University of Kazimierz Wielki (Poland). We also had an opportunity to include Japanese and Chinese students as separate groups in our sample. These participants were born and grew up in their country of origin and at the time of the study were enrolled in the programs of their choice in Great Britain. The sample sizes are different across the countries represented. The sample size for individualistic countries (USA, UK, Spain, Poland) was $n = 580$ vs. collectivistic (Vietnam, India, China, Japan) $n = 365$. The high-tech and advanced economy are observed in two individualistic countries: USA, UK, whereas a comparable level of high-tech development can be seen only in Japan, among collectivistic cultures. Both levels of MS – market sophistication and KW – knowledge workers are high in the USA, UK, and Japan. Poland, India, and Vietnam displayed a low level of both mentioned high-tech indicators. Spain has a high level of MS and a low level of KW whereas China, on the contrary, proves a high level of KW and a low level of MS.

2.2.2. Materials

The Metacognitive Self Questionnaire (MCSQ – 40, originally Polish, Brycz & Karasiewicz, 2011) was translated (a full back-translation procedure was used) into, Polish, English, Vietnamese, Hindu, and Spanish. The administration procedure was standardized across all countries. The investigator asked participants to fill out the MCS questionnaire, either individually or in groups. Metacognitive self as a dependent variable was measured in percentage (where 0% means no insight into one's own biases and 100% indicates full insight into own biases, operationalized on 140 mm line with beginning anchor 0% and ending anchor 100%; scores were raw numeral digit; participants ticked off on 14 cm line; MCS is a continuous variable). Cronbach α was satisfactory for each country subsequently: Poland: $\alpha = .72$; Vietnam: $\alpha = .81$; Spain: $\alpha = .76$; England $\alpha = .68$; India: $\alpha = .77$; China: $\alpha = .73$; Japan: $\alpha = .77$; USA: $\alpha = .78$.

SPSS.27 database consists of variables: culture and metacognitive self. New variables were added to the existing database from Global Innovation Index 2017, the score 1 vs. 0 value: an indicator of the Technology Development: knowledge workers (KW), and Market sophistication as an economic factor (MS), indicating 1 if the country is in the TOP25 in the ranking and 0 otherwise. We predict a model, where human technology subscale KW coexists with the stronger MCS, while market sophistication shall negatively relate to MCS

3. Results

We postulate the crucial role of human technology and economic factor that may change the main effect of culture on the metacognitive self. Human technology and economic factors, described in the introduction, were entered into the existing database consisting of dichotomized culture levels and MCQS-40. Executing MCSQ-40 gave 40 responses per individual who participated in the study. For further investigation, we use a mean MCS (mean of 40 answers indicating self-awareness of 40 biases, each of which was assessed on a 140 mm line), counted for each participant.

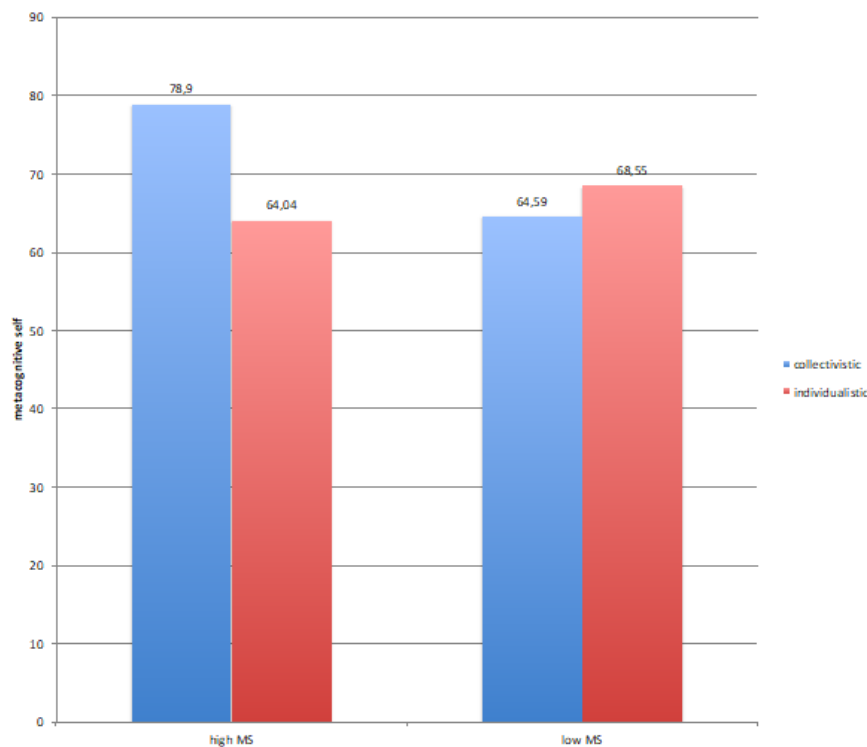
All analyses were conducted in IBM SPSS.27. All tests were two-tailed, and the significance level was set to $\alpha = .05$.

At first, we checked whether the metacognitive self (MCS) fulfills the normal distribution. One-Sample Kolmogorov – Smirnov test appeared to be significant with a mean: $M(945) = 65.5258$, $SD = 11.553$; test statistic: $z = .064$, $p < 0.001$. MCS distribution appeared to be significantly far from normal. Thus, ANOVA, correlation, and any kind of regression are not applicable

To assess the significance of differences between high vs. low level of market sophistication (MS) and knowledge workers (KW) on metacognitive-self non-parametric U Mann – Whitney (with Monte Carlo 99% significance confidence interval) test was applied, separately for individualistic and collectivistic countries. Statistics are presented below:

For the independent variable: market sophistication (MS) on the dependent variable: metacognitive self, among individualistic countries' participants, it appeared significant difference between high MS countries and weak/low MS countries. U Mann – Whitney statistic for dependent measure: the self-awareness of biases: $z = -4.655$; $p < 0.001$. Thus, individualistic values encourage participants to intensify the self-awareness of biases when market sophistication is low ($M = 68.55$), whereas the same individualistic culture equipped with developed markets results in MCS diminishment ($M = 64.04$). Collectivistic culture works opposite to this result. Enrichment of market sophistication among collectivistic countries results in MCS being on the increase ($M = 78.90$), while weakness of market sophistication brings MCS downgrading ($M = 64.59$); $z = -4.621$; $p < 0.001$. The results support and even

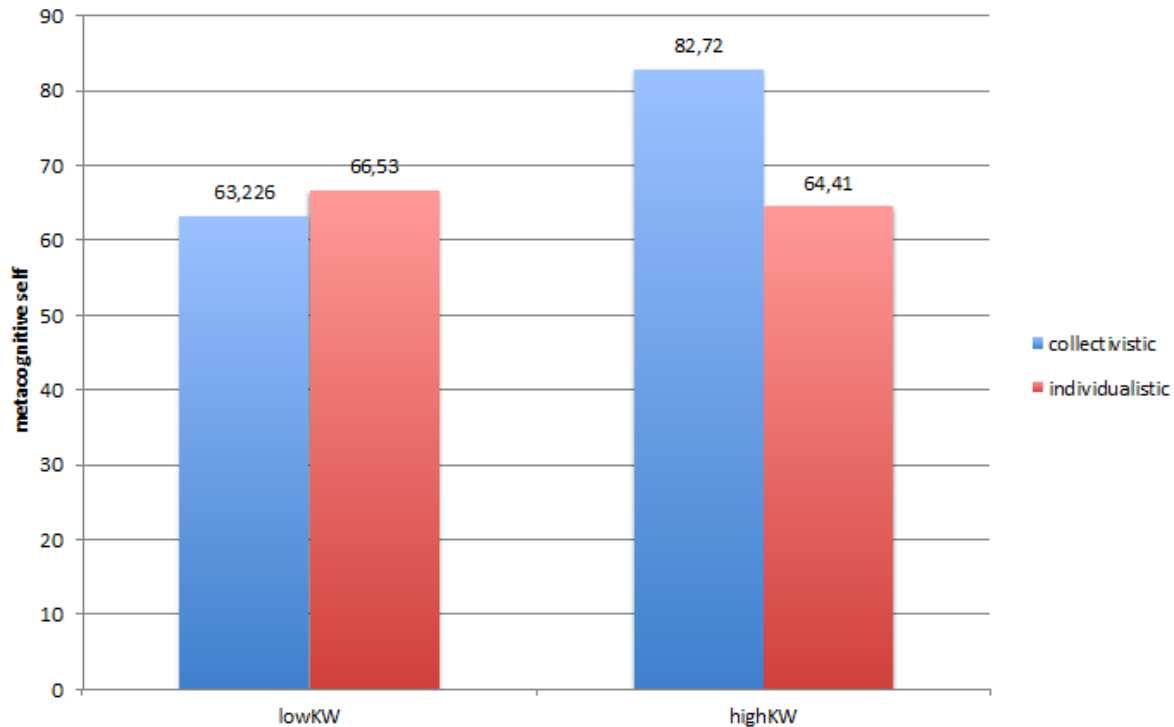
complicate our hypothesis. Economy factor, meaning the ease of credit, competition, etc., for individualistic countries –when low, results in stronger MCS, when -markets are well developed, it scuttles MCS level. The economy factor for collectivistic countries – when low, it results in lower MCS, when markets are better elaborated, it improves MCS scores. Individualistic countries' results are in line with our expectations. Collectivistic countries thanks to spreading special collectivistic values benefit from market sophistication. The latter shows the interrelation between cultural contexts, economic factors, and citizens' consciousness.



Graph 1. The role of market sophistication on metacognitive self among collectivistic and individualistic participants

Source: *own data*

U Mann – Whitney test (Monte Carlo significance: 99% confidence intervals) with human technology factor: knowledge workers (KW) as an independent variable for metacognitive self as a dependent variable, calculated separately for individualistic vs. collectivistic countries showed the other pattern. While individualistic countries participants nevertheless equipped with low ($M = 66.53$) or high ($M = 64.41$) knowledge workers (KW) expressed the same level of self-awareness of biases $z = -1.625$, $p = 0.057$; collectivistic countries individuals' self-awareness of biases benefited by a high level of knowledge workers (KW) ($M = 82.72$) in contrary to immersed in collectivistic culture people suffering from low knowledge workers ($M = 63.24$), $z = -8.207$, $p < 0.001$. According to the predictions, a high level of human technology implies a strong level of metacognitive self. As Marx (1859) stated consciousness must be explained by material life. High pro-social, pro-educational levels of human technology and knowledge workers enhance participants' self-awareness of biases. The effect is highlighted in collectivistic countries: the well-developed knowledge worker factor soups up citizens' MCS, whereas knowledge workers' poor level brings the situation that prevents citizens to develop a higher level of MCS.



Graph 2. The role of knowledge workers for metacognitive self among individualistic vs. collectivistic participants

Source: *own data*

The analysis allowed us to explain the results obtained in 2015 (Brycz, et al., 2015). Collectivistic country's participants expressed stronger MCS thanks to well-developed knowledge workers (human technology factor) and economic factors such as market sophistication. The kind of culture (collectivistic) supported by well-developed human technology resulted in the highest self-awareness of biases (graph. 2). Individualistic countries' inhabitants developed stronger MCS while living in the less economically developed environment (graph 1). Probably individualistic countries that value the rich over the poor inhibited metacognitive self-growth by focusing on economic status and wealth. Human technology that promotes MCS development is not able to overcome the ideology of richness. Individualistic countries' participants, living in less developed countries also valued wealth much.

Thanks to human technology, which focuses on personal growth, participants can create a significantly stronger MCS than their colleagues living in the knowledge workers' poor-level countries.

Conclusion

The prediction about the significant role of economic and technological advancement in the individualistic vs. collectivistic countries for metacognitive self was proved. The technological development of the country increases self-awareness of biases. On the contrary, market sophistication among individualistic countries' citizens, as connected with materialism (Williford, 2020), deteriorates the metacognitive self's level. Materialism (psychologically) is connected with such human traits as envy, possessiveness, and non-generosity. Materialism is negatively related to well-being, health, and happiness in life. Belk (1985) found that his measure of materialism is adequate to explore macro issues of consumer behavior. The MCS

level of collectivistic countries participants benefits from market sophistication. Collectivistic values probably inhibit materialism as a crucial value. At the other end is human technology and the special factor: knowledge workers. The results may be explained via human capital theory which presents a strict distinction between human beings and their labor-power or labor potential as well as the distinction between the value of a human being and the value of the labor-power of that human being. The subject-related model of rational educational decisions underlying human capital theory can be rediscovered as a self-awareness encouragement thesis (Timmermann, 1995). Technology also boosts self-development indicating revolution in science and society (Ulusoy, Atkan, 2019). Generally, measuring the level of the dependent variable along with different countries, as the only indicator, enables us to watch the real predictors of the phenomena, here self-awareness of biases.

Implications for theory and practice

Presented results explain that not only the kind of culture may play an important role in the development of the metacognitive self. Market sophistication which indicates ease of credits, and competitiveness, focus human attention to enlarge their state of possession. Human technology, contrary, points to the value of self-development and encourages people for reaching a better educational level. The latter conduce to self-awareness growth.

Limitation of the study

It is not possible to generalize the results. The study shall be conducted nowadays to fulfill strict replication patterns, so crucial in social science.

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