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IMPACT OF NATIONAL CULTURE ON PUPILS PISA RESULTS: THE CASE OF EUROPEAN COUNTRIES

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ABSTRACT. Objective: This paper aims at finding out whether the national cultural dimensions affect the quality of European education systems. The research question therefore focuses on whether and how large is the impact of national cultural dimensions on pupils' results measured by PISA results. **Methodology:** We used data on the national cultural dimensions from the GLOBE project and we used the PISA results for pupils' results. We did Structural Equation Model (SEM) for our empirical analysis. This model was preferred because it helped to establish the causal relationship between the cultural dimensions and pupil's performance. **Results:** Our results have demonstrated that: pupils' performance are influenced by some national cultural dimensions. PISA results correlate negatively with the cultural dimension values of Uncertainty Avoidance and Future Orientation, on the other hand PISA results positively correlate with performance Orientation values and Assertiveness values. **Implication**: This research presents and elucidates significant cultural factors that affect pupils' results. It gives an impulse to understanding the cultural formulas that apply in the learning process. This knowledge allows for the appropriate and timely implementation of effective learning methods that have a positive impact on pupils' results.

Keywords: *Pupils' results, national cultural dimensions, culture, quality of education*

JEL Code: *I21, I24, I29*

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Introduction

Culture is a very difficult word to define although it is a familiar word for everybody. Young (1983) admits that culture is one of the two or three most complicated words in the English language. Culture can be defined broadly as well as narrowly. Geertz (1973, p. 45) suggests that culture is "… historically transmitted pattern of meanings embodied in symbols, a system of inherited conceptions expressed in symbolic form by means of which people communicate, perpetuate, and develop their knowledge about attitudes toward life". Hofstede (2001, p. 12) defines culture as "… the collective programming of the mind which distinguishes the members of one group or category of people from another". Furthermore, Hofstede argues that the core element of any culture is its values. He further defines values as broad tendencies to prefer certain states of affairs over others. The value tradition (Hofstede, 1980; Schwartz, 1994; Triandis, 1995) sees culture as a shared set of core values that regulate behavior in a population. Recently, several cultural psychologists have adopted other conceptions of culture - that of culture as "knowledge structure" (Chiu et al., 2000; Hong et al., 2000; Peng, Ames & Knowles, 2001; Peng & Nisbett, 1999). This approach portrays culture as a constellation of knowledge structures, or folk theories, that embody individuals' basic beliefs about the world and guide inferences in different domains.

Traditional cultures discourage individual' ambition in education and work. Exploring the relationship between national culture and student learning was dealt with by (Dumont & Wax, 1971; Planel, 1997; Peng & Knowles, 2003), Eldridge & Cranston, 2009; Dennehy, 2015; Choy et al., 2015; Sørensen et al., 2016). This relationship appears to be significant and it is important to understand the behavior of actors in educational systems shaped by national cultures and the potential impact of culture on education.

The aim of this paper is to find out whether national cultural dimensions affect the quality of European education systems measured by PISA results. We formulated the research question as to whether and how large is the impact of national cultural dimensions on pupils' results measured by PISA results.

Pupils' results as an indicator of quality of education

The quality of education has been a frequently debated topic in recent years. Opinions about what constitutes the quality of education and how best to express it differs among authors. One of the first authors to study the quality of education was Barro (1991). He approximated the quality of education in growth models using the ratio of the number of pupils to teachers. It is based on the hypothesis that the more children come to the teacher, the lesser the quality of teaching the teacher is able to provide. Quality enters the model as an independent variable and shows a negative relationship with growth for primary education. However, for the same variable for secondary education, the results are not statistically significant. Barro and other authors (Mankiw, Romer & Weil, 1992; Levine & Renelt, 1992; Pritchett, 2001) perceive the quality of education rather from a quantitative point of view. According to them, quality of education is influenced by the number of pupils per teacher, or by the average number of years of school attendance. Other authors who measured the quality of education by quantitative indicators include Mazouch & Fischer (2011). These economists dealt with the calculation of the educational potential of a society (EPS). In this method, coefficients are assigned to individual degrees of study, which are then aggregated into one value of the EPS coefficient by weighing according to the relative representation of individual groups. Another method used by these authors is the average length of education (ALE), i.e. the standard number of years required to reach a certain level of education in individual countries. However, it is criticized by the abovementioned authors for the fact that they operate with a small number of relevant parameters that cannot capture the characteristics of formal education as a whole (Průcha, 2018).

There are other views on the quality of education that are in the opposition against the views outlined above. Card & Krueger (1996) and Hanushek & Woessmann (2012) consider the quantitative concept of quality to be inaccurate and prefer a qualitative concept. These authors claim that students' knowledge and cognitive skills are a benchmark for assessing the quality of education. This knowledge is measured using standardized tests (PISA, TIMSS, or PIRLS). Hanushek (1997) argues that the influence of class size or the number of pupils on teachers on learning outcomes is small or not. He states that the acquired knowledge and skills of people predestine economic growth in the long term. He further states that"… the results of tests from the international comparison of 15-year-old called PISA do not only tell us what the results of education are attained by children in schools, but they also predict how high-quality workers will be in their adulthood" (Kartous, 2014).

PISA (Programme for International Student Assessment) is the most significant study that measures and compares the cognitive skills of pupils in education systems. The PISA project is one of the activities of the Organization for Economic Co-operation and Development (OECD). The aim of this program is to evaluate education systems around the world (member countries, but also some OECD non-member countries) by testing the skills and knowledge of 15-year-old pupils (at the end of their compulsory education) in three basic subjects - science, reading and mathematics. This project applies the unified form and content of tests in different countries, so it provides the basis for credible comparison and evaluation of education systems. Hanushek & Woessmann (2012) use their research results only in the fields of science and mathematics, because in an international comparison, identifying a common set of competencies for these subjects is easier than reading. It should be emphasized that the results in mathematics and science are highly correlated with the results of reading tests and therefore omission of reading tests does not distort the results of the analysis. PISA results are among the most objective indicators of education quality at present. Janoušková & Maršák (2008) state that this indicator, which is set at the international level, is often a very important impetus for discussions concerning pupils' educational outcomes and which clearly show the interconnection of the educational, economic and political subsystem. Table 1 lists the PISA results for 2015 in the European OECD countries in which our analysis is conducted.

Table 1: PISA 2015 results

Country	Science	Mathematics	Average
Finland	531	511	521
Slovenia	513	510	511,5
Netherlands	509	512	510,5
Germany	509	506	507,5
Denmark	502	511	506,5
Ireland	503	504	503,5
Poland	501	504	502,5
Great Britain	509	492	500,5
Portugal	501	492	496,5
Austria	495	497	496
France	495	493	494
Sweden	493	494	493,5
Czech Republic	493	492	492,5
Spain	493	486	489,5
Italy	481	490	485,5
Hungary	477	477	477

Note: Countries are ranked from the highest average PISA score to the lowest.
Source: OECD (2016)

National culture

Culture is defined as a set of shared values, beliefs, and expected behaviors (Hofstede, 1980). Culture can be defined as those customary beliefs and values that ethnic, religious and social groups transmit fairly unchanged from generation to generation. Deeply embedded, unconscious, and even irrational shared values shape political institutions as well as social and technical systems, all of which simultaneously reflect and reinforce values and beliefs. It follows from these claims that cultural behavior is unchanging after a long time.

Hofstede (1980) and Hofstede & Bond (1988) identified five societal values that can be used to describe a country's national culture: Uncertainty Avoidance, Individualism, Power Distance, Masculinity and Confucian dynamism, later referred to as Long-term Orientation. Hofstede created ordinal scales for countries for each of these dimensions based on a standardized factor analysis of questionnaires administered between 1968 and 1972 to 88,000 national employees in more than 40 overseas subsidiaries of a major American corporation. Hofstede's work has proven valuable in that it presents a concise taxonomy of significant cultural dimensions for explaining the behavioral preferences of people not only in business organizations.

House et al. (2002) carried out a ten-year research program, known as GLOBE, to examine culture in terms of values and practices. Cultural values are acquired early in life and are the deepest and most enduring aspects of culture. Cultural practices, on the other hand, are the superficial rituals and norms. While practices may be reflections of cultural values, they are more subject to change. National cultures are examined in terms of nine dimensions: Performance Orientation, Future Orientation, Assertiveness, Power Distance, Humane Orientation, Institutional Collectivism, Uncertainty Avoidance, and Gender Egalitarianism. The methodology of this study is based on the methodology of Hofstede (1980) - six culture dimensions had their origins in the dimensions of culture identified by him. The proponents of the cultural dimensions approach introduced the practice of calculating scores on each dimension for each culture enabling relative ranking among them. These typologies and dimensions are especially useful in providing explanations when we encounter differences in outcomes that seem to originate from the differences in cultural values and practices. Researchers in variety of fields ranging from education to epidemiology have explored the potential impact of cultural variables on outcomes that vary from educational accomplishments to depression. The GLOBE project will set the standard for national cultural research well into the future because all aspects have been thoroughly researched, and the scope of the project is immense. It assessed 62 different countries and identified important cultural and leadership norms. Table 2 gives definitions of individual cultural dimensions.

Table 2: The national cultural dimensions

Dimension	Definition
Power Distance	The extent to which the members of a society expect power to be distributed equally. It reflects the degree to which a community maintains inequality among its members by the stratification of individuals and groups with respect to power, authority, prestige, status, wealth, and material possessions.
Uncertainty Avoidance	The extent to which individuals in a society rely on social norms, rules, and procedures to alleviate unpredictability of future events. It reflects the attempts of people to avoid vague situations by providing norms, values, and beliefs in a form of rules, laws and regulations.
Future Orientation	The extent to which individuals engage in future-oriented behaviours such as delaying gratification, planning and investing in the future. It reflects the degree to which a community places a higher priority on long term success, have a strong capability and willingness to imagine future contingencies, formulate future goals, and seek to achieve goals and develop strategies for meeting their future aspirations.
Institutional Collectivism	The degree to which organizational and societal institutional practices encourage and reward collective distribution of resources and collective action. It reflects the degree to which people in a community are integrated into strong cohesive groups, group goals take precedence over individual goals, people emphasize relatedness with a group, and individuals are likely to engage in group activities and make greater distinctions between in-groups and out-groups.
In-group Collectivism	The extent to which individuals express pride, loyalty, and cohesiveness in their organizations or families. It reflects the degree to which emphasis is on the family and pride for and loyalty to the organization.

Dimension	Definition
Humane Orientation	The degree to which a collective encourages and rewards individuals for being fair, altruistic, generous, caring, and kind to others. It reflects the extent to which people are tolerant of mistakes, friendly, sensitive, and value harmony.
Performance Orientation	The extent to which a collective encourages and rewards group members for performance improvement and excellence. It reflects the extent to which a society encourages and rewards innovation, high standard, and performance improvement.
Gender Egalitarianism	The extent to which a collective minimizes gender inequality. It reflects the extent to which a society seeks to minimize differences between the roles of females and males in homes, organizations, and communities.
Assertiveness	The degree to which individuals are assertive, confrontational, and aggressive in their relationships with others. It refers to the degree to which individuals in a society are assertive, tough, dominant, and aggressive in social relationships.

Source: House et al. (2002)

Methodology

We used the explanatory study approach for this study. The explanatory study determines the relationship between variables, meaning it allows to study situations, by trying to exam the relationship among variables. As shown in this study we aim to establish the relationships between cultural backgrounds (we used GLOBE's national cultural dimensions in terms of values) and how it influences student performance. Mostly, three approaches are employed to decide on investigating a problem in study; correlational, clarification, and causal. This study employed the causal investigation. Causal relationship elucidates how a variable causes changes in other concepts or variables (Bayat & Fox, 2007). We used the structural equation model (SEM) for our

empirical analysis. This model was preferred for this study because we intend to analyze the structural relationship between measured variables and latent constructs. SEM combines multiple regression analysis and factor analysis, and this is the method of choice for estimating multiple and interrelated dependence in an analysis (Henseler, 2017; Van Riel et al., 2017). The SEM displays standardized regression coefficients (path coefficients) therefore it can be used to measure the relationships among latent variables. The model specification of the SEM partial least square is given by Zawojska (2010) as:

$$z_k = \beta_0^{(k)} + \sum \beta_i^{(k)} z_i + v_k$$

where:

z_k = explained variable (student performance – PISA results) (1)

$\beta_0^{(k)}$ = constant term

$\beta_i^{(k)}$ = regression coefficient

v_k = residual term.

Results and discussions

After performing the analysis, we obtained the following model (see Figure 1). We measured the model's internal consistency and reliability with the composite reliability, which is the recommended method to deal with reflective measurements (Hair et al., 2012). The composite reliability helps to estimate the reliability of the total scores relating to a reflective model. The composite reliability technique of Dillon-Goldstein's rho (or Jöreskog's rho) (ρc), is increasingly gaining popularity among researchers with minimum values of 0.70 indicating acceptable reliability, with the maximum threshold of 1 (Henseler & Chin, 2010; Dijkstra & Henseler, 2015). The Dillon-Goldstein's rho does not assume all scale constituents are of equiproportional importance, because it uses factor loadings instead of the inter construct correlations, this makes it to be a more precise reliability measure (Vinzi et al., 2010). From Table 3 below, it is evidence that all our constructs achieved values greater than the minimum acceptable 0.7 threshold, since we had only single indicators for all our constructs.

Table 3: Construct Reliability Tests

Construct	Jöreskog's rho (ρc)
Uncertainty Avoidance	1.0000
Future Orientation	1.0000
Power Distance	1.0000
Institutional Collectivism	1.0000
Humane Orientation	1.0000
Performance Orientation	1.0000
In-group Collectivism	1.0000
Gender Egalitarianism	1.0000
Assertiveness	1.0000
PISA results	1.0000

Source: authors' processing

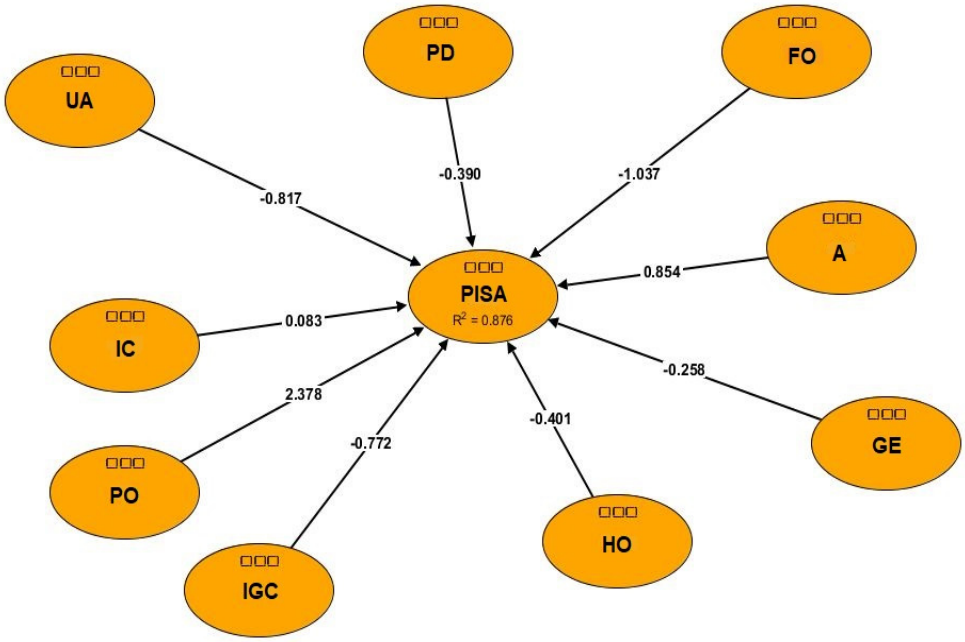

Figure 1: Results of model
Source: authors' processing

Legend: FO = Future Orientation, A = Assertiveness, GE = Gender Egalitarianism, HO = Humane Orientation, IGC = In-Group Collectivism, PO = Performance Orientation, IC = Institutional Collectivism, UA = Uncertainty Avoidance, PD = Power Distance

In this model, we can see Beta values for individual cultural dimensions, which are also listed in Table 4. According to R-squared, statistically significant cultural dimensions predict the PISA results by 88 %.

Table 4: Regression analysis results

Variables	Beta	Std Er	P values
Uncertainty Avoidance	-0.817	7.538	0.055*
Future Orientation	-1.037	7.210	0.058*
Power Distance	-0.390	9.616	0.408
Institutional Collectivism	0.083	6.054	0.741
Human Orientation	-0.401	9.618	0.443
Performance Orientation	2.378	6.213	0.004***
In-group Collectivism	-0.772	10.083	0.114
Gender Egalitarianism	-0.258	7.940	0.391
Assertiveness	0.854	6.586	0.019**
(Constant)	616.629	76.156	0.000***

Source: authors' calculations
Legend: P < 0.05 (*); P < 0.01 (**), and P < 0.001 (***)

Regression coefficients show that there are significant positive correlations between the PISA results and the national culture values of Performance Orientation (β = 2.378) and Assertiveness (β = 0.854). Conversely, there was a significant but negative correlations between the PISA results and the national culture values are for Uncertainty Avoidance (β = -0.817), and Future Orientation (β = -1.037). For these two cases, however, the significance is lower.

The results in Table 4 show that high performance orientation is positively associated with PISA results. This implies that high performance-oriented societies tend to value those individuals and groups who produce results and accomplish their assignments (House et al., 2002). They believe that schooling and education are critical for success,

value training and development, emphasize results more than people, value competitiveness, and value taking initiative. They are expected to be rich in human capital and have individuals that are better educated and developed than do low performance-oriented societies. In addition, societies with high performance orientation practices are economically more successful and globally more competitive than their counterparts with low performance orientation practices. The societies that are less performance-oriented focus on maintenance of tradition, family, affiliation and social ties than on individual achievement. They value one's role and position in society. In communication, they prefer subtlety and pay attention to context (House et al., 2004). Such an attitude may favor concrete experience. Such an attitude may favor less action and demand more reflection from the members of those societies. Countries with high performance orientation are Slovenia, Poland, or Finland.

Our results also support the assertion that there is a statistically significant and positive relationship between assertiveness and PISA results. Assertiveness is related to the nature of the relationship of individuals, groups, and societies with the outside world (Hartog & Dickson, 2004). Assertiveness implies the degree to which individuals in organizations or societies are assertive, confrontational and aggressive in social relationships (House et al., 2004). Countries with high assertiveness culture do well in global competitiveness, emphasize success, results and progress more than relationship between people. Societies that are low on assertiveness consider assertiveness unacceptable and endorse modesty and tenderness. They cherish people and relationships and are cooperative. They value self-possessed conduct. In communication, they are indirect (House et al., 2004). They have a more 'being' orientation than 'doing'. In learning, they may be more attuned towards using reflection than action. Countries with high assertiveness are Slovenia, Czech Republic, Spain, or Ireland.

As shown in Table 4, there is a significant and negative association between uncertainty avoidance and PISA results. This implies that countries with low uncertainty avoidance culture tend to take more risks and are more tolerant of deviant behavior and innovative ideas (Hofstede, 1980). In addition, countries with high uncertainty avoidance perceive a need for rules and regulations, and, therefore, tend to be

information-intensive. There is fear of failure and preference for tasks with sure outcomes, clear guidelines and less risk. Pupils from countries with a strong avoidance of uncertainty (Slovenia, Spain, Poland, or Italy) like structured lessons with clearly defined goals, detailed tasks and a fixed time schedule. They like learning situations with one correct answer and reward accuracy. They assume their teachers are able to answer all questions. Members with high uncertainty avoidance resort to abstract conceptualization and reflection and refrain from exposing themselves to new experiences and experiments while learning. Pupils from countries with low uncertainty avoidance are more tolerant of breaking rules, less resistant to change and innovation, and willing to take risks. They believe in one's ability to influence one's life and others. Children are encouraged to experience novel situations. In education, they prefer open-ended learning situations where there is room for sense of empiricism, relativity and original and unconventional ideas. The members of such societies may find it easier to learn from concrete experiences and active experimentation. Countries with low uncertainty avoidance are Netherland, or Sweden.

Furthermore, we also found that there is a significant but negative relationship between future orientation and PISA results. This means that societies with a high future orientation culture have organizations with a longer strategic orientation, have flexible and adoptive organizations and managers, place a higher priority on long term success, have a strong capability and willingness to imagine future contingencies, formulate future goals, and seek to achieve goals and develop strategies for meeting their future aspirations (House et al., 2002). Future orientation requires being flexible, open to taking risks and persistent. Future orientation thus fosters abstract conceptualization and active experimentation. Less future oriented societies are able to engage more in the present and enjoy the moment. They may show incapacity or unwillingness to plan to accomplish goals in the future. While planning, the thrust is to ensure that they are compatible with the customs and traditions. Only past experience can legitimate innovation and experience (House et al., 2004). Short-term orientation in society is reflected in the effort to achieve results quickly and to seek out pleasures and spending. Long-term culture members

perceive goals over a longer time horizon, characterized by self-discipline, postponement of satisfaction, continued effort, with results coming later (Hofstede & Hofstede, 2005). Pupils in countries with a high index of future orientation attribute success to school efforts and the failure of its shortage, while students from countries with a low index of long-term orientation attribute success and failure to coincidence. Countries with low future orientation are Denmark or Sweden. Interestingly, countries with lower future orientation achieve better learning outcomes. Countries with low PISA results and high future orientation are Italy, Hungary, or Spain.

Contrary, our results have demonstrated that there is no relationship between the following cultural dimensions and PISA results (power distance, institutional collectivism, human orientation, in-group collectivism and gender egalitarianism). They all didn't influence pupils PISA results positively. These cultural dimensions described above are focused on performance, pupils' energetic behavior, or open-end learning that enhance student performance. However, other factors such as the relationships between the actors of learning, their human values, or the integrating of students into groups appear to be insignificant in influencing the learning outcomes.

Our findings are consistent with those reported by Sørensen et al. (2016), or Lopes (2017). These authors studied the educational outcomes of second-generation immigrants from different cultures, but who receive the same education and otherwise live in similar neighborhoods in their new country. This standard identification strategy allows to isolate the effect of culture from other influences. These authors for student performance also used PISA results and TIMSS (Trends in International Mathematics and Science Study) results. Also, according to their results, national cultural values play an important role in student achievement.

Conclusion

This research explored the influence of national culture on student performance. The above research question can be answered in the way that pupils' results measured by PISA results are influenced by some national cultural dimensions. While R-squared of these cultural

dimensions predict the PISA results by a significant percentage -about 88. PISA results correlate negatively with the cultural dimension values of Uncertainty Avoidance and Future Orientation, on the other hand, the PISA results correlate positively with Performance Orientation values and Assertiveness values. We can state that, a higher student performance is associated with lower Uncertainty Avoidance, lower future orientation, higher Performance Orientation, and higher Assertiveness.

Therefore, cultural factors can influence the way an individual learns. Cultural patterns are extremely stable over time (Hofstede, 2001). Individuals in the culture undergo certain changes, but there are still residual cultural differences that modernization of a society cannot entirely wipe out. Although Hofstede (1984) has treated culture as something that is static, other researchers have suggested that it may be more fluid in nature. Osland & Bird (2000) warn against cultural stereotyping. They caution about the need for students to understand the complexities of their own culture and to use the various cultural stereotypes as basic tools to better understand themselves. If culture indeed plays a part in learning, it is necessary for students to make sense of their social environment and create an awareness of their own culture that would help them learn better deeply rooted cultural values and modes of thinking that are difficult to separate from learning processes (Nisbett & Masuda, 2003).

In any country, there are major cross-cutting differences according to ethnic group, social class, religion, region, age and gender. Nevertheless, it is maintained that despite such complexities and despite the similarities that exist between intercountry social characteristics, the intercountry differences are substantial and significant. They need to be defined and their potential role in learning needs to be examined. It is also argued that intercountry comparisons help to reveal national educational values, even when countries under comparison are as geographically close and as historically interconnected as some European OECD countries, which we have included in our research sample.

The limitation of our study may be the absence of purification of other influences that affect student performance (as performed e.g. aforementioned authors (Sørensen et al.,2016; Lopes 2017) - in order to isolate the effect of culture from those of institutions and markets and other economic factors and non-economic factors. However, it is clear

from our previous research that, in particular, economic factors do not have a decisive impact on student performance in European OECD countries (Provazníková & Chlebounová, 2018).

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