



The relationship among cultural dimensions, education expenditure, and PISA performance



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ABSTRACT

We examine the channel relationship between cultural dimensions, public expenditure on education, and country level PISA test scores. We test the hypotheses that cultural dimensions impact aggregate public expenditure on education and higher expenditure improves PISA results. We find a causal relationship between measures of culture and expenditure on education. In particular, we document the negative impact of power distance and masculinity on education expenditure. In contrast, individualism and long-term orientation positively impact public expenditure. In addition, we find a strong positive association between public expenditure on education and PISA scores at the country level. These findings are robust and consistent for all PISA test types. Our research findings shed light on the important role of cultural dimensions on education expenditure and inter-country differences in PISA performance.

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1. Introduction

Culture is “the collective programming of the mind that distinguishes the members of one category of people from those of another” (Hofstede and Bond, 1988). The relevance of culture in the context of decision making has become increasingly accepted in modern economic and social science research. According to Williamson (2000), culture influences decision making by shaping the formal and informal institutional environment in a country. Given the increasingly recognized importance of culture in shaping collective decision making, we examine the channel relationship among national cultural dimensions, public expenditure on secondary education, and test scores using country level PISA data from 2000 to 2012.¹

The literature on the macro determinants of cross-country heterogeneity of performance on PISA exams has documented a relationship between school expenditure and subsequent performance on PISA exams (Brunello and Rocco, 2013; Anderson et al., 2007).² In addition, a limited literature exists on the importance of

culture on education expenditure (Cheung and Chan, 2008). Combining these two strands of research, Hagedorn and Veny Purnamasari (2012) directly explore the impact of culture on PISA performance for one PISA testing wave. However, none of these studies simultaneously examines the relationship between cultural dimensions, education expenditure, and PISA performance. The current research is the first to explore these relationships simultaneously, and endeavors to provide clear guidance of how to improve PISA performance by considering cultural dimensions and expenditure on higher education.

This study addresses the following two major research questions: (1) Do cultural dimensions impact public expenditure on secondary education? (2) Does education expenditure lead to higher PISA scores?³ To examine this channel relationship, we study a broad cross section of countries who participate in PISA testing for which data are available. It is well known that culture has multiple dimensions. Hofstede et al. (2010) propose that culture contains six major components: Individualism–collectivism, uncertainty avoidance, power distance, masculinity–femininity, indulgence–restraint, and long-term orientation. The data of country level scores on six components of culture are available on Geert Hofstede’s webpage.⁴ We pair the culture data with PISA scores and public expenditure data from the World Bank. The causal relationship between cultural dimensions, aggregate education expenditure, and PISA scores along

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¹ The Program for International Student Assessment (PISA) conducted by OECD is a large scale project that measures the cognitive abilities of 15-years-old students, using standardized tests that focus on reading, mathematics and science.

² A large literature exists on the impact of school expenditure and performance within a single country, state or province. The findings of this literature provide a much more nuanced impact of expenditure on educational outcomes (see Hanushek et al. (1996) for an example of this type of work).

³ In our empirical framework, we measure public expenditure as a percentage of GDP.

⁴ <http://www.geerthofstede.nl/index>.

with control variables is examined in a system of seemingly related regression equations (SURE).

We find that some cultural dimensions have a positive causal relationship, while some other cultural dimensions have a negative causal relationship with education expenditure. In particular, power distance and masculinity negatively impact aggregate public education expenditure as a percentage of GDP, whereas individualism and long-term orientation are positively related on country level education expenditure. These findings are robust for all types of PISA testing (i.e. math, reading, and science). Second, this paper documents the strong positive impact of country level aggregate public education expenditure on PISA outcomes. The findings of this study highlight the importance of culture on education expenditure and inter-country differences in PISA test scores.

The remainder of the paper proceeds as follows: Section 2 reviews related literature, Section 3 describes the data and methodologies, Section 4 discusses the empirical results, and Section 5 concludes.

2. literature review

We review related literature along three categories: (1) school expenditure and test scores, (2) culture and expenditure, and (3) culture and performance.

2.1. School expenditure and test scores

Do countries that invest more in education perform better? This is an active research topic both theoretically and empirically. The theoretical framework is often borrowed from the field of economics and attempts to determine the efficient level of educational expenditure. A number of researchers have modeled the impact of educational expenditure on performance using input/output analysis, where higher inputs lead to higher educational capital and higher educational outcomes within limits. A significant portion of the empirical evidence documents that higher expenditure has a positive impact on academic performance at the country level.⁵ Examples of this research include: Greenwald et al. (1996), Wenglinsky (1997), and Park (2008). Greenwald et al. (1996) document that school level resources are systematically related to student achievement. Wenglinsky (1997), focusing on U.S. schools, tackles the question of how school funding matters and documents a link between higher expenditure and better academic performance. In a more recent paper using OECD data on 20 nations and investigating the family size on academic performance, Park (2008) demonstrates that countries that spend more on public expenditure on education reduce the negative impact of growing up in large families.

However, there exists an equally large literature documenting that public expenditure on education may not lead to increased performance on standardized tests. In a comprehensive review of almost 400 articles that examine school resources and student performance in the United States, Hanushek (1997) concludes that there is neither a strong nor consistent relationship between learning outcomes and school resources. Rather, according to Hanushek, it is the use of these funds that are the important determinants of student learning outcomes. Hanushek et al. (1996) use value-added models and aggregated data from high school and beyond, at both the school and the state levels in the U.S. They conclude that additional expenditures alone are unlikely to improve student outcomes in the U.S. Studying 7 transition nations in Eastern

Europe, Ammermüller et al. (2005) use TIMSS 94–95 data and estimate the impact of school resources on mathematics and science achievements of students at the 7th and 8th grades. They find that school resources are less important than variables relating to individual student background. In a similar research that uses panel data models, Häkkinen et al. (2003) study the effects of the changes in school spending on the assessment results for a sample of Finnish secondary school students from 1990 to 1998. Their results do not show a significant effect of teaching expenditure on test scores, but demonstrate that the most important determinants of performance at the student level are school quality and parental education.

Given the large and diverse findings relating to the impact of educational expenditure, our research adds to this active debate by addressing the impact of aggregate public expenditure on PISA scores across countries over several testing periods. Papers most directly related to the current research questions look at the impact of educational expenditure on PISA performance (e.g., Adams and Wu, 2002; Anderson et al., 2007; Afonso et al., 2010; Brunello and Rocco, 2013). In an early technical report using data from the first PISA exam, Adams and Wu (2002) suggest a positive linkage between school expenditure and performance on PISA exams. With the inclusion of the 2003 testing period, Anderson et al. (2007) affirm the strong positive relationship between aggregate expenditure on education and PISA results. In a study on inequality, Afonso et al. (2010) demonstrate that gains from educational expenditure on PISA performance depend on how efficiently those funds are employed and existing levels of inequality within the society, where countries that are more equal are likely to see the biggest gains for increased educational expenditure. Following the release of the 2009 PISA test results, Brunello and Rocco (2013) who use panel data methods for 19 countries document the significant positive association between education expenditure as a percentage of GDP and PISA performance on math, reading, and science.⁶

2.2. Culture and expenditure

Relatively few papers look at the impact of culture on public expenditure, particularly on educational expenditure. However, several researchers do document a relationship between culture and a variety of other decisions. For example, Varsakelis (2001), using a panel of fifty countries, documents a strong linkage between power distance and investment in research and development (R&D). Power distance is a measure of the interpersonal power or influence between the superior and subordinate as perceived by the subordinate. Varsakelis finds that a country with lower power distance tends to invest more in research and development.

Erumban and de Jong (2006) show that Hofstede's cultural dimensions impact information communications technology (ICT) adoption rates in 49 countries. They conclude that the power distance and uncertainty avoidance dimensions are the most significant cultural factors by which some of the differences in ICT adoption rates among countries can be explained.

In a study of a type of corporate investment, Frijns et al. (2013) show the importance of national cultural dimensions on CEO's take-over decisions. They confirm that CEOs located in countries with lower levels of risk tolerance, measured by uncertainty avoidance score, require higher premiums on takeovers, and show that uncertainty avoidance plays a greater role in relatively large takeovers. Additional testing reveals that CEOs from high

⁵ Studies on the relationship between educational outcomes and expenditure within a single country or within small cross-sections of countries produce very mixed findings.

⁶ Other studies conducted on student level data also show that family income and country level GDP contribute to higher test scores. See, Anderson et al. (2009), Afonso and St Aubyn (2006), and Entorf and Minoiu (2005) for examples of this type of research.

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