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Does intelligence affect health care expenditure? Evidence from a cross-country analysis☆

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ABSTRACT

Most of the literature on the determinants of health expenditure is focused on the relationship between health care expenditure and income. We investigate the interactive effect of income and intelligence on health expenditure, using data from 172 countries, over the period from 2009 to 2013. The results show that the income elasticity of health expenditure is greater than 1 but only if a nation's level of IQ score beyond a certain threshold (about 95), while for low-IQ nations, health care is a necessity. Moreover, various robustness checks largely support the robustness of our main findings.

1. Introduction

Since the seminal work of Newhouse (1977), the empirical literature on the determinants of health care expenditure has mushroomed (Hartwig & Sturm, 2014; Wu, Liu, & Pan, 2014), and it is widely shared that there exist a strong and positive relationship between national income and health care expenditure (Narayan, Narayan, & Smyth, 2011; Farag et al., 2012; Lago-Peñas, Cantarero-Prieto, & Blázquez-Fernández, 2013; Yavuz, Yilanci, & Ozturk, 2013). However, whether the income elasticity of health expenditure is greater or less than one is still without any definite conclusion. The income elasticity less than one means that health care is a "necessary", but if the elasticity is higher than one, health will be classified as a "luxury". Advocates of health care being a luxury good, argued that it is a commodity much like any other and is best left to market forces. On the other hand, advocates of health care being a necessity, often support the view of public involvement in the market is needed to achieve better redistribution of health care resources.

Income is one of the main determinants of health care expenditures, and understanding the determinants of health care expenditures is very crucial because of the light shed on the question: what is the optimal amount of health spending for a society? Although health economists have determined which nations spend the most and the least of their GDP on health care, economic theory has yet to determine what the optimal percentage ought to be. Thus, knowing this relationship helps policymakers to make wise judgments, plan health reforms, and allocate resources efficiently.

The recent advances in the intelligence literature show that intelligence has direct effect on wide range of socio-economic outcomes (Lynn & Meisenberg, 2010; Meisenberg, 2012; Burhan, Mohamad, Kurniawan, & Sidek, 2014; Salahodjaev, 2015). Therefore, in this article, we make an attempt to analyze the effect of intelligence on the health expenditure. Intelligence can be measured by national IQ levels or by other alternative indicators. While this relationship may seem far-fetched at first glance, an ocean of scholarly contributions has already built up the necessary groundwork. Intelligence may contribute directly to health expenditure, which primarily through "delay discounting[1]". As a matter of fact, there is empirical evidence supporting the contention that "more intelligent people demonstrate less of a preference for smaller, immediate rewards versus larger, delayed rewards" (Shamosh & Gray, 2008). Or we can interpret it this way: those high-IQ nations are more likely to invest health care expenditure in the present for physical fitness in the future than their low IQ nations. Recent cross-country research by Potrafke (2012) finds that countries with high-IQ populations enjoy less corruption, and their reason is that intelligent people have longer time horizons. On the other hand, as mentioned in the first paragraph, there is now clear evidence that income has a strong and positive effect on health expenditure. Therefore, we

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[1] A psychological term that captures a person's ability to make choices that focus on generating long-run rather than short-run gains.

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want to know whether the intelligence–health expenditure association may vary with GDP per capita levels. If basic income levels are not met, even the high-IQ populations may not increase the health care expenditure. However, after a basic degree of economic development is reached, high-IQ populations are typically preferred to invest up to much of their incomes in health care.

The main contribution of this paper is therefore to examine the relationship of income, intelligence and their interaction effect on health care expenditure. To the best of our knowledge, there is no cross-country study which captures the interaction effect of these two factors (IQ and income). Using data from 172 countries over the period from 2009 to 2013, we establish that the income elasticity of health expenditure varied with a nation's level of cognitive abilities. Our main finding still holds even after controlling for a set of control variables suggested by the literature. The remainder of the paper is structured as follows. Section 2 presents the data and methodology. The empirical analysis and discussion of results are covered in Section 3. Section 4 provides a conclusions and policy implications.

2. Data and methodology

The sample comprises both developed and developing countries covering the period 2009–2013. The dependent variable used in this paper is total health care expenditure per capita measured in US dollars in real prices, adjusted for purchasing power parities (PPP).

Our key independent variable is intelligence. The main measure of intelligence used in this paper is average national IQ scores provided by Lynn and Vanhanen (2012). Although some studies criticized the use of IQ in empirical literature (Barnet & Wiliams, 2004), there is plenty robust evidence indicating that national IQ's are highly correlated with other measures of human capital and social development (e.g. Rindermann, 2007; Salahodjaev, 2015). In addition, some may hold that intelligence is hereditary and that nothing can be done about it, but recent scholarly research finds that about 40%-70% of phenotypic variance in intelligence is of non-genetic origin. (see Plomin, DeFries, Knopik, & Neiderhiser, 2013). The data by Rindermann (2007) is also used in the robustness tests. Rindermann (2007) has defined cognitive ability as equal to student achievement assessments and intelligence test primarily measured for common cognitive ability at the macro-social level. This ability entails intelligence and knowledge.

We also gathered data for the following variables that have been identified by the literature as having a role in determining health care expenditure: population aged 65 or above, government effectiveness and voice and accountability. We include “population aged 65 or above” to account for the important influence of the change in population age structure on health. And we add governance variables to investigate the role of governance in mobilizing resources for health spending. Our data are gathered from the World Bank except IQ. Due to intelligence is available on a cross-sectional basis, this study investigates cross-sectional average data between 2009 and 2013. Table 1 shows the basic statistics.

To get the quantitative impact of IQ on the health care expenditure, first, we estimate the following regression model

$$\ln HE_i = \alpha_0 + \alpha_1 IQ_i + \alpha_2' X + \varepsilon_i \quad (1)$$

Table 1
Descriptive statistics.

Variable	Obs.	Mean	Std. dev.	Min	Max
Health care expenditure (logged)	188	6.32	1.34	3.32	9.06
IQ	185	84.05	10.91	60.1	107.1
GDP per capita (logged)	188	9.12	1.23	6.43	11.78
Percentage of population age 65 (logged)	192	1.83	0.69	−0.24	3.16
Voice and accountability	202	−0.02	1	−2.2	1.68
Government effectiveness	200	−0.02	0.99	−2.23	2.23

where $\ln HE_i$ is logarithm of the real health care expenditure per capita in US$ PPP terms, X is a vector of control variables suggested by the literature, and ε_t is the error term.

Next, to measure what levels of IQ and income matter to influence health care expenditure, the following model is specified as

$$\ln HE_i = \beta_0 + \beta_1 \ln GDP_i + \beta_2 IQ_i + \beta_3 \ln GDP_i \times IQ_i + \gamma' CV + \xi_i \quad (2)$$

where $\ln GDP_i$ is logarithm of the real income per capita in US$ PPP terms, IQ is an average national intelligence, CV is a vector of control variables and ξ_i is the error term. The coefficient$\beta_3$captures the interaction effect of income and intelligence, which is the key focus in this article. Furthermore, the partial effects of income and intelligence on health care expenditure can be computed as follows.

$$\Delta \ln HE_i / \Delta \ln GDP_i = \beta_1 + \beta_3 IQ_i \quad (3)$$

$$\Delta \ln HE_i / \Delta IQ_i = \beta_2 + \beta_3 \ln GDP_i. \quad (4)$$

3. Results and discussion

The main regression results are reported in Table 2. Without any additional control variables intelligence has a positive and statistically significant effect on health care expenditure at the 1% level (column 1). However, intelligence becomes statistically insignificant (columns 2–4) after we include some variables suggested by the literature. Were we to stop here? the conclusion would be that intelligence has no impact on health care expenditure, once income, age structure and governance indicators are accounted for. But the introduction of the interaction term $\ln GDP \times IQ$ in column (5) indicates that income plays a crucial moderating role in the link between intelligence and health care expenditure. Meanwhile, we could also consider the interaction term between intelligence and income from the opposite point of view: raising income increases health care expenditure in general (the coefficient of income), but this effect is even stronger in high-IQ nations. Next what we are concerned with is when the income elasticity of health expenditure is greater than one.[2] Accordingly, further insights into these results can be gained by calculating the turning points.[3] The results in Table 2 show that the threshold level is ranging from 87.47 to 101.74, suggesting the income elasticity of health expenditure is greater than 1 but only if a nation's level of IQ score beyond a certain threshold, while for low-IQ nations, health care is a “necessity” good.

Results for other control variables included in the model are also informative. First, we can conclude that the effect of “Percentage of population aged 65 and above” is consistent across the different specifications. This result implies that the increase in the percentage of the population aged 65 has a significant positive impact on health spending. Second, we also find that the “Voice and Accountability” measure also has a positive and statistically significant effect on mobilizing more resources for health, which is consistent with results of Farag et al. (2012). In addition, one may argue that the intelligence-income interaction might be solely driver by influential observations and does not apply to mean data. Robust regression is an alternative to least squares regression when data is contaminated with outliers or influential observations and it can also be used for the purpose of detecting influential observations. Accordingly, in column (9) we apply robust regression (RREG) proposed by Hamilton (1991). The results show that intelligence, income and their interaction term are all have the expected signs and statistically significant at the 5% level. Moreover, results for other control variables included in the model are also robust.

[2] Our use of a log–log specification means that the coefficient on GDP per capita is the income elasticity.

[3] The threshold values can be calculated by using Eq. (3), i.e., $\Delta \ln HE_i / \Delta \ln GDP_i = \beta_1 + \beta_3 IQ_i = 1$.