Tax Revenues and Intelligence: A Cross-Sectional Evidence

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Abstract
The paper investigates and tests the hypothesis that the intelligent and educated people are honest taxpayer citizens. In order to validate this hypothesis, the empirical part follows a cross-sectional approach, with OLS and robust estimations, across 55 countries. Considering the IQ as main proxy for human intelligence, the obtained results do not allow us to validate this hypothesis.

JEL Code: H20, H11, I2, C21

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Introduction

In the last decades, the human capital became a usual determinant of tax revenues for many researchers who work in the field of taxation. Unfortunately, the human intelligence, as one of the most important valences of human capital, has been completely neglected in the tax area investigations.

The paper investigates the impact of human intelligence on tax revenues, by following a cross-sectional model approach, with 55 countries, from different continents. The countries have different degrees of economic development and type of social systems. The main hypothesis assumes that the human intelligence have a significant impact on tax revenues.

A priori, there are many arguments in favour of the existence of connection between tax revenues and level of human intelligence.

First group of arguments reveal a positive impact of intelligence on tax inputs. The main idea is that the instructed persons have an accentuate tendency to be honest citizens, registering a high level of tax compliance (Dee, 2004; Milligan et al., 2004; Reynal-Querol and Besley, 2011). The same instructed persons take a lot of advantages in respect to public goods and financial transfers receiving. As feed-back, such benefits additionally improve the taxpayer's compliance. On the other hand, these types of connections can also reveal a transitory transmission channel, as the human capital affects the quality of institutions and, as consequence, the level of collected tax revenues (Kodila-Tedika, 2013, 2014; Lynn and Vanhanen, 2012; Kalonda-Kanyama and Kodila-Tedika, 2012; Botero et al., 2012; Potrafke, 2012; Rindermann, 2012). In this case, high intelligence quotient ensures the best institutional quality, which is assimilated to high level of tax compliance.

Second group of works show a negative correlation between tax revenues and human intelligence. In fact, if the theory of rationality is viewed in extreme sense, we can expect the "free rider" behaviour to intelligent persons. In this way, we should accept the idea of large temporal horizon of Potrafke (2012), de Jones (2011), and Jones and Podemska (2010). If this hypothesis is accepted, we can consider that the intelligent persons internalize the tax costs through the free rider behaviour.

Even if we follow the positive or negative direction of "tax revenues - human intelligence" nexus, it is clear that the persons with high intelligence quotient are the taxpayers who can very easy influence the tax collections, based on their cognitive capacity. Moreover, these persons do not have a superior morality in respect to the registered level in the whole society. There are many studies which demonstrate a positive relationship between intelligence and atheism (Lynn et al., 2009; Kanazawa, 2009; Reeve, 2009)[1].

The study offers several contributions to the literature in the field. Firstly, it is one of the first investigations which consider the human intelligence as main determinants of tax revenue. Secondly, the empirical part follows the M-estimators of Huber (1973) and MM-estimator proposed by Yohai (1987). S-estimator introduced by Rousseeuw and Yohai (1984) is also used, by following the fast algorithm proposed by Salibian-Barrera and Yohai (2006). Thirdly, the paper develops the taxation research area, proposing a new tax determinant: the human intelligence.

The paper is organized in fourth sections, including this introduction. The empirical model and data are discussed and presented in Section 2. The empirical results are showed and analysed in Section 3, while the Section 4 concludes.

[1] We consider that the religion is associated with a high level of morality. The works of Barro and McCleary (2003), and McCleary and Barro (2006) have the same motivation, especially for testing the Weber's hypothesis.

Empirical approach and data

In order to investigate the connection between tax revenues and intelligence, we estimate the following basic empirical model:

$$\tau_i = \beta_0 + \beta_i IQ + \delta Z_i + \mu_i \quad (1)$$

where τ is the tax ratio (tax revenues as percentage of GDP), IQ denotes the intelligence quotient, i=1,2... captures the country index, Z = (z_1,... z_k) is the vector of control variables, while μ_i represents the error term that is assumed to be normally and independently distributed. β_0 is the intercept, β_1 captures the effect of IQ and δ=(δ_1, δ_2,.. δ_n) is the parameter vector for "n" control variables. The model is estimated by using the ordinary least squares (OLS). Furthermore, our empirical approach follows the M-estimators of Huber (1973) by using iteratively reweighted least squares (IRWLS) and MM-estimator proposed by Yohai (1987). S-estimator introduced by Rousseeuw and Yohai (1984) is also used, by following the fast algorithm proposed by Salibian-Barrera and Yohai (2006). Comparatively with OLS approach, the advantage of these robust estimators is that they fix simultaneously any issue arises from the existence of outliers and/or heteroskedasticity (non-constant error variances), as Midi and Talib (2008) note.

The tax ratio is the dependent variable and represents the volume of tax revenues as percentage of GDP. The variable is obtained from World Bank online database, being regularly used as dependent variable in many studies, such as: Ghura (1998), Piancastelli (2001), Tanzi (1981), Leuthold, (1991), Stotsky and WoldeMariam (1997), Bird et al. (2006), and Kodila-Tedika and Mutascu (2014).

IQ is the interest variable and illustrates the mean intelligence quotient of the general population. We used this measure as main proxy for human intelligence. Gouillon (2002) affirms that IQ is the tool more used in psychometry. It allows inform simple to quantify a great number of cognitive capacities of the subject and her general intelligence (the factor G). Psychologists regularly resort to it (Neisser, 1998; Larivée and Gagné, 2006). The data on IQ comes from Lynn et al. (2002, 2006 and 2010). We also note that this variable is regularly used in many studies, such as: Kodila-Tedika (2013a, 2012), Lynn and Vanhanen (2012), Kalonda-Kanyama and Kodila-Tedika (2012), and Potrafke (2012).

In order to isolate the effect of interest variable, we entered a set of control variables, which include: per capita GDP (log), share of agriculture sector as percentage of GDP, and share of imports as percentage of GDP, according to Gupta (2007). These data are taken from World Bank. Finally, for robustness, we also include two other determinants: shadow economy and government effectiveness.

GDP per capita is a traditional indicator of economic development. Thus, it is expected that this indicator has a certain positive significant correlation with the tax performance. This hypothesis is plausible especially in virtue of the Wagner's law. The sectorial composition also is an important element of taxation. In Africa, for example, the agricultural sector consists of agriculture substance, but the mining sector may be useful to generate significant tax revenues to the economy if these areas attract large companies. Chelliah (1971) identifies as explanatory variables for the tax share: the mining share, the non-mineral exploitation and the agriculture share.

If the mining share has a positive impact on tax revenues, the agricultural share has a negative one. At the same time, many studies emphasize the role of openness on the income tax (e.g. Keen and Simone, 2004; and Rodrik, 1998). The per capita income and trade share are significant determinants of the tax share (Piancastelli, 2001; Chelliahet al., 1975; Tait et al., 1979). Tanzi (1992) states that half of the tax ration variation is explained by per capita income, import share, agriculture share and foreign debt share. The import share is positively correlated with the tax ratio.

The shadow economy is being estimated by following the DYMIMIC approach. It measures the level of informal economy as percentage of GDP. The sources of data are the studies of Schneider (2005b), with theoretical base in Schneider (2005a, 2005b). This variable is regularly used as dependent variable in many studies, such as: Schneider (2005a), Mazhar and Méon (2012), and Kodila-Tedika and Mutascu (2014).

Finally, the measure of institutional quality is captured by Government Effectiveness and comes from the dataset compile by Daniel Kaufmann, Art Kraay and Massimo Mastruzzi at the World Bank. This sample aggregates indicators of six broad dimensions of governance: Political Stability and Absence of Violence/Terrorism, Government Effectiveness, Regulatory Quality, Rule of Law, and Control of Corruption. These six aggregate indicators are based on 30 underlying data sources reporting the perceptions of governance of a large number of survey respondents and expert assessments worldwide.

Several studies focus on the importance of institutional factors in determining of tax performance. For example, Bird et al. (2006) find factors, such as: corruption, rule of law, and regulations. Corruption, voice and accountability also determine a positive significant impact on tax effort (Bird et al. 2008). On the same note, Besley and Person (2013) put in evidence the positive role of institutional quality in tax revenues collection.

For robustness, we entered two dummy variables: one continental and another one organizational. In the first case, following the trend in the literature, geographical location is captured by distinguishing between the Africa, Asia, Oceania, Europa and America. If the country belongs to the African continent, the continental dummy has the score 1 otherwise 0. This logic was also applied to all other continents. In the second case, the organizational dummy variable captures the country membership to OECD (value is 1 for OECD country and 0 otherwise).

Finally, the school variable of Barro and Lee (1996) is used to perform the mix variable "IQ x School", in order to capture the effect of IQ under school impact. The school variable denotes the average years of schooling for population aged 15 and over.

Table 1 below provides a summary statistics for the variables used in our analysis.

Table 1 - Summary statistics

Variables	Mean	Std. Dev.	Min	Max
Tax revenue	16.966	7.6343	.175	46.186
IQ	90.622	10.900	60	108
Log GDP per capita	8.871	1.188	5.903	11.173
Agriculture share	12.063	13.031	0	67.008
Import share	50.020	29.360	11.52	200.273
Government effectiveness	.113	.993	-1.751	2.217
OECD	.2117	.450	0	1
Shadow economy	32.342	13.126	8.5	65.1
School	7.212	2.879	.892	13.004

The regressors are available for the following countries: Armenia, Australia, Austria, Belgium, Bulgaria, Brazil, Canada, Chile, China, Denmark, Dominican Republic, Egypt, Spain, Estonia, Finland, France, United Kingdom, Germany, Ghana, Hong Kong, Croatia, Hungary, Indonesia, India, Ireland, Iran, Iceland, Italy, Jordan, Japan, Kenya, Lithuania, Malta, Malaysia, Namibia, Netherlands, Norway, New Zealand, Philippines, Poland, Portugal, Romania, Russian Federation, Slovakia, Slovenia, Sweden, Thailand, Tunisia, Uganda, Ukraine, Uruguay, United States, Venezuela, South Africa, and Zimbabwe.

Results

The first results, based on the OLS estimators, by following the White's (1980) heteroskedasticity correction, are presented in Table 2. The interest variable IQ is significant and negatively correlated with dependent variable only in the case of models without "IQ x School" variable.

Table 2 - Main regressions (cross-sectional OLS)

Variable	(1)	(2)	(3)	(4)
IQ	**-.356** **(0.000)**	**-.344** **(0.007)**	.273 (0.416)	.421 (0.176)
Agriculture share	-.176 (0.343)	-.116 (0.587)	-.114 (0.487)	-.080 (0.673)
Import share	-.0012 (0.985)	.009 (0.754)	-.004 (0.868)	.006 (0.814)
Government effectiveness	**4.900** **(0.002)**	**4.415** **(0.006)**	**5.310** **(0.001)**	**4.651** **(0.002)**
OECD	1.749 (0.346)	-.840 (0.684)	2.571 (0.209)	.220 (0.919)
Shadow economy	**.165** **(0.028)**	**.106** **(0.079)**	**.152** **(0.025)**	**.093** **(0.093)**
Log(GDPcap2005)	.083 (0.977)	.601 (0.850)	-.221 (0.935)	.163 (0.954)
School	.149 (0.732)	-.420 (0.278)	**8.337** **(0.048)**	**8.781** **(0.023)**
IQ*School			**-.089** **(0.057)**	**-.099** **(0.017)**
Dummy continental	No	Yes	No	Yes
R-squared	0.3967	0.5708	0.4315	0.6086
Obs.	55	55	55	55

All regressions are estimated using White (1980) heteroskedasticity correction. All regressions include constant. P-values are in parentheses.

On the other hand, only two control variables are significant in all scenarios, heaving positive sign (i.e. government effectiveness and shadow economy). The rest of control determinants are not significant, excepting the school and "IQ x School" variables in the models with "IQ x School".

In order to test the sensitivity, we follow different robust estimators, by using the same regressors and taking into account two sequences: without "IQ x School" variable, and with "IQ x School" variable (Table 3 and 4 respectively). The estimations are employed based on the M-estimators of Huber (1973), MM-estimator proposed by Yohai (1987), and S-estimator introduced by Rousseeuw and Yohai (1984), with the fast algorithm of Salibian-Barrera and Yohai (2006).

Table 3 - Main regressions taking into account the sensitivity ("without IQ x School")

Variable	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
IQ	**-.365** **(0.014)**	**-.292** **(0.059)**	**-.362** **(0.000)**	**-.323** **(0.003)**	**-.353** **(0.001)**	**-.270** **(0.040)**	**-.220** **(0.001)**	-.102 (0.601)
Agricultureshare	-.140 (0.491)	.057 (0.746)	-.151 (0.550)	-.0515 (0.820)	.101 (0.598)	.142 (0.387)	**.529** **(0.000)**	**.458** **(0.091)**

Import share	-.009 (0.776)	-.009 (0.767)	-.009 (0.805)	.00116 (0.965)	-.048 (0.006)	-.0163 (0.343)	**-.0410** **(0.000)**	-.005 (0.818)
Government effectiveness	**4.608** **(0.024)**	**4.019** **(0.020)**	**4.795** **(0.001)**	**4.289** **(0.002)**	**4.117** **(0.023)**	**3.735** **(0.013)**	.883 (0.130)	2.002 (0.334)
OECD	1.772 (0.520)	-1.502 (0.541)	1.672 (0.338)	-1.079 (0.550)	1.5425 (0.374)	-1.658 (0.369)	2.159 (0.064)	1.394 (0.510)
Shadow economy	.155 (0.117)	.1272 (0.152)	**.159** **(0.026)**	**.114** **(0.037)**	**.14349** **(0.027)**	**.136** **(0.011)**	**.137** **(0.005)**	.154 (0.511)
Log(GDPcap2005)	.713 (0.809)	2.841 (0.255)	.556 (0.876)	1.486803 (0.654)	3.839 (0.164)	3.980 (0.100)	8.628 (0.000)	6.015 (0.138)
School	.234 (0.628)	-.5023 (0.250)	.214 (0.604)	-.450 (0.185)	.37652 (0.219)	-.543 (0.119)	.246 (0.121)	-.531 (0.270)
Dummy continental	No	Yes	No	Yes	No	Yes	No	Yes
Obs.	55	55	55	55	55	55	55	55
Method	Hubert	Hubert	M-estimator	M-estimator	MM-estimators	MM-estimators	S-estimator	S-estimator

All regressions include constant. P-values are in parentheses.

Table 4 - Main regressions taking into account the sensitivity ("with IQ x School")

Variable	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
IQ	.272 (0.534)	.424 (0.310)	**-.243** **(0.068)**	.411 (0.111)	.273 (0.438)	.420 (0.115)	-.201 (0.778)	**.413** **(0.075)**
Agricultureshare	-.112 (0.579)	.052 (0.756)	**.525** **(0.000)**	**.303** **(0.029)**	-.122 (0.416)	-.018 (0.931)	.092 (0.785)	.150 (0.172)
Import share	-.005 (0.885)	-.007 (0.809)	**-.041** **(0.000)**	.002 (0.909)	-.003752 (0.882)	.000 (0.989)	-.042 (0.427)	-.016 (0.327)
Government effectiveness	**5.069** **(0.012)**	4.121 (0.013)	.874 (0.137)	1.935 (0.155)	**5.294** **(0.000)**	**4.359** **(0.000)**	**4.231** **(0.028)**	**3.793** **(0.005)**
OECD	2.747 (0.319)	-.364 (0.879)	**2.215** **(0.048)**	.622 (0.773)	2.656 (0.162)	.031 (0.988)	1.698 (0.382)	-.740 (0.665)
Shadow economy	.155 (0.109)	.106 (0.208)	**.137** **(0.004)**	**.114** **(0.091)**	**.157** **(0.016)**	**.097** **(0.068)**	**.147** **(0.022)**	**.117** **(0.009)**
Log(GDPcap2005)	.049 (0.986)	2.025 (0.395)	**8.591** **(0.000)**	3.946 (0.123)	-.126 (0.960)	1.055 (0.737)	3.581 (0.483)	**3.444** **(0.057)**
School	8.454 (0.123)	**8.269** **(0.084)**	-.124 (0.940)	**6.598** **(0.048)**	**8.368** **(0.044)**	**8.457** **(0.013)**	2.493 (0.808)	**7.750** **(0.004)**
IQ*School	-.090 (0.128)	**-.094** **(0.068)**	.004 (0.820)	**-.077** **(0.025)**	**-.089** **(0.057)**	**-.096** **(0.008)**	-.0231 (0.836)	**-.089** **(0.002)**
Dummy continental	No	Yes	No	Yes	No	Yes	No	Yes
Obs.	55	55	55	55	55	55	55	55
Method	Hubert	Hubert	S-estimator	S-estimator	M-estimators	M-estimators	MM-estimators	MM-estimators

All regressions include constant. P-values are in parentheses.

The outputs reveal that only in the case of models "without IQ x School" the interest variable IQ is significant and negatively correlated with tax revenues ratio, while in the scenario "with IQ x School" the IQ becomes not significant. The same situation is registered for control variables, which are generally not conclusive. This output emphasises the idea that the IQ

variable, as interest determinant of tax ration, is very sensitive under different scenarios, especially when the IQ is “mixed” with the scholastic education.
Thus, based on considered cases, the main results illustrate that the impact of IQ on tax revenues ratio is not conclusive, IQ registering different sign and significance status.

Conclusions

The intelligence represents one of the most significant valences of human capital, with complex implications in the socio-economic area. Even if there are many implications of intelligence on human behaviour, our empirical estimations do not put in evidence very clear some influence of this human dimension on tax area. For all considered scenarios and for all types of estimation methods, the results are contradictory (i.e. reveal opposite signs) or are not significant.
Regarding the policy implications, it is clear that the intelligence cannot be taking into account in tax policy, the IQ not being a good predictor for public authorities’ decision-making related to the tax revenues collections.

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