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Abstract:

Existing studies explore the hypothesis that nations IQs explain cross-national differences in economic development. However, the conclusions of these findings are also rather limited as GDP per capita, a proxy for economic development, does not account social and external costs associated with economic activities and fails to capture the environmental degradation or resource depletion. In this study, we offer novel evidence on the effect of intelligence on genuine income that addresses the shortcomings of GDP per capita as a better proxy for inclusive development. Moreover, we also provide compelling evidence that intelligence is causal to genuine development processes.

Keywords: IQ; intelligence; genuine income; Cold winters; Savanna IQ hypothesis.

Introduction

There has been contentious debates in the empirical literature on the provocative IQ-development hypothesis. In their celebrated works Lynn & Vanhanen (2002; 2006) have presented novel evidence that 'population IQs are the major determinant of the wealth and poverty of nations in the contemporary world'. A series of follow up studies further documented that national IQs are related to economic growth (Ram, 2007; Jones & Schneider, 2006) and per capita income levels (Hunt & Wittman, 2008).

Intelligence journal has also stressed, addressed or scrutinized that debate with the focus on the correlates of economic growth such as rule of law (Kanyama, 2014), shadow economy (Salahodjaev, 2015), life satisfaction (Salahodjaev, 2015), public spending priorities (Whetzel & McDaniel, 2006), environmental sustainability (Salahodjaev, 2015; Salahodjaev, 2016; Salahodjaev & Yuldashev, 2016), business environment (Salahodjaev, 2016) and financial development (Hafer, 2016). For example, Kodila-Tedika & Asongu (2015), using data for 123 nations over the period 2000-2010, document that intelligence is positively associated with stock market size and supply of credit. Similarly, Rindermann et al. (2015) use path analysis, correlation and econometric models for a sample of 201 countries to show that national cognitive abilities predict economic freedom, innovation and government effectiveness which in turn are instrumental to wealth of nations. While plethora findings published in *Intelligence* suggest that national IQs have direct and indirect effect on economic wealth, the evidence of the positive effect of intelligence on inclusive and sustainable development that takes into long-run consequences of natural resource depletion and environmental degradation has not been explored in this context.

This paper further contributes to the related literature on the consequences of intelligence and addresses the shortcomings of prior studies in a number of ways. **First**, empirical studies look at gross domestic product growth as a proxy for development. However, there has been ample criticism that GDP growth does not take into account the cost of environmental degradation and depreciation of capital. Moreover, Jeniffer Blanke, Chief Economist of World Economic Forum, argues that GDP per capita merely provides a measure of the final goods and services produced in an economy over a given period, without any attention to what is produced, how it's produced or who is producing it. In this study, we explore whether the link between intelligence and development holds for the change in genuine income.

Methodology and Data

Methodology

This section presents the empirical model to explore the effect of intelligence on genuine income. The econometric equation of interest is presented below:

$$GI_i = \beta_0 + \beta_1 IQ_i + \lambda' X_i + \varepsilon_i \quad (1)$$

where subscript *i* represents country. *GENUINE* is a measure of genuine income, *IQ* is a measure of intelligence across countries, *X* is a set of variable that account for other potential determinants of sustainable development, and ε is an error term.

Genuine income (GI)

As a measure of genuine income we use the celebrated Genuine Savings indicator. This indicator was constructed by World Bank to evaluate sustainable economic development. Genuine savings address a number of important shortcomings of GDP per capita. First, genuine savings take into account social and external costs associated with economic activities. Second, GDP per capita and its growth rates overestimate change in welfare and, more importantly, national statistics do not capture informal sector and other activities which take place outside the markets. For example, methodological limitations of national accounts fail to adequately account for illegal clear-cutting or air pollution. Thus, while gross domestic product (GDP) ignores environmental degradation and depletion of natural resources, genuine savings take into account the depletion of natural resources and the air pollution from economic activities. The genuine savings are measured in terms of the following equation:

$$GI = GNS + EE - CFC - DER - DM - NDF - CO \quad (2)$$

where GS - genuine saving; GNS - gross national saving; EE - education expenditure; CFC - consumption of fixed capital; DER - depletion of energy resources; DM - depletion of minerals; NDF - net depletion of forests; CO_2 - CO_2 damages[1].

Intelligence (IQ)

The independent variable of main interest is intelligence measured by national IQs. The data comes from Lynn & Vanhanen (2012). In their first study Lynn & Vanhanen (2002) have compiled country specific studies in which intelligence tests had been administered. Based on the results in these studies they estimated national IQs for 81 countries. In their follow up studies, Lynn & Vanhanen (2006; 2012) estimated national IQs for 111 additional countries, bringing their dataset in which national IQs were measured to 192. For the interpretation purposes Lynn & Vanhanen (2002) rescaled the IQ scores by setting the IQ in Britain at 100 (standard deviation =15) and the IQs for remaining countries adjusted for this scale.

Control variables (X)

To mitigate the potential for omitted variable bias we add a vector of control variables: i.e. GDP per capita, GDP per capita squared, democracy index (on a 1 -7 scale), control of corruption index (on a -3 - (+)3 scale). We add these variable to assess whether intelligence has direct effect climate change. For example, related studies show that

[1] See Bolt et al. (2002) for further discussion

intelligence is associated with better institutions, democracy and GDP per capita (Rindermann, 2008a; Rindermann, 2008b). Moreover, Vanhanen (2003) and Salahodjaev (2015) argue that intelligence is causal to adoption of institutions that support political rights, civil liberties and environmental stringency. Therefore, if national IQs retain significance once we add control variables that means that intelligence has direct effect on climate change policies. We also add a dummy variable for island countries (see e.g. Fors, 2014). The descriptive statistics for main variables are presented in Table 1.

Table 1: Descriptive statistics

Variable	Definition	Mean	Std. dev.	Min	Max
Genuine savings	Change in nation's total capital stock as % of GNI Source: World Bank	7.1488	12.2475	-67.2971	34.6217
Intelligence	Average national IQ Source: Lynn & Vanhanen (2012)	84.1026	10.8475	60.1	107.1
Democracy	Average of civil rights and political liberties Source: Fraser House	4.5106	1.9973	1	7
Corruption	Control of Corruption index Source: World Bank	-0.0252	1.0135	-1.91	2.59
Income	GDP per capita, '000s PPP Source: World Bank	14.3820	18.4384	0.4733	111.582
Island	=1 if island country Source: authors calculations	0.2336	0.4241	0	1

Results

Our baseline results based on ordinary least squares (OLS) method are reported in Table 2. Column 1 shows that there is positive and statistically significant unconditional association between intelligence and genuine savings. A one standard deviation increase in IQ leads to 3.8 percentage points increase in genuine savings rate (slightly less than half a standard deviation).

In columns (2) variables capturing quality of institutions are added in the regression. The first of these variables is democracy index assessing the condition of political rights and civil liberties, while the other one is corruption control index which measures perceptions of the extent to which public power is exercised for private gain, including both petty and grand forms of corruption, as well as 'capture' of the state by elites and private interests. While the correlation between democracy and economic freedom may appear high (0.63) it is evident that these two indices are not measuring exactly the same phenomena. The estimates

suggest that of these two variables only control of corruption has positive and significant effect on genuine savings.

In column (3) we add GDP per capita and its squared term to capture the existence of so-called environment Kuznets curve (EKC). According to EKC hypothesis '[i]n the early stages of economic growth [environmental] degradation ... increases, but beyond some level of income per capita, which will vary for different indicators, the trend reverses, so that at high income levels economic growth leads to environmental improvement' (Stern, 2004 p. 1419). Column (3) indicates that conditioning on environmental Kuznets curve, intelligence retains its effect and significance level. In line with related studies, GDP per capita has non-linear (U-shaped) association with environmental commitment.

Finally, in column (4) we control for dummy variables for island countries. For example, Jagers et al. (2013) shows that island countries are associated with greater provision of environmental goods. In a more recent study, Fors (2014) shows that island nations are associated with better institutions. While this variable is positively, but insignificantly associated with genuine savings, we document that our coefficient for intelligence remain unchanged qualitatively. Therefore, the results in Table 2 indicate that intelligence is directly associated with genuine savings and this effect is not mediated by level of development or quality of institutions.

Table 2: OLS results

	(1)	(2)	(3)	(4)
IQ	0.3515***	0.2275**	0.3625***	0.3824***
	(0.0865)	(0.0926)	(0.1101)	(0.1131)
Democracy		0.2679	0.4459	0.2755
		(0.6228)	(0.6330)	(0.6227)
Corruption		1.9290*	3.2950*	3.4011**
		(1.1099)	(1.6934)	(1.7070)
GDP per capita			-0.5197**	-0.5440**
			(0.2146)	(0.2211)
GDP per capita squared			0.0062***	0.0064***
			(0.0019)	(0.0020)
Island state				3.3471
				(2.2282)
Constant	-22.4683***	-13.2081	-21.1346**	-22.4247**
	(7.8066)	(8.4169)	(8.9346)	(9.1271)
N	161	161	157	157
adj. R^2	0.09	0.10	0.13	0.14

Notes: Standard errors in parentheses; * p<0.1, ** p<0.05, *** p<0.01

Conclusion

The main goal of this study is to test whether the IQ-development hypothesis holds for genuine income as well. This study finds that a 10 points increase in national IQ increases genuine savings by 3.9 percentage points. This effect remains robust when we controlled for a vector of control variables such as per capita GDP and quality of institutions.

Our study also shows that intelligence has a causal impact on genuine income. The instrumental variable estimation was conceptualized based on Lynn's 'cold winters theory' and Kanazawa's 'Savanna-IQ interaction hypothesis'. Indeed, the results from the 2nd stage regression show that intelligence is negatively correlated with temperature and positively correlated with Neolithic transition timing further confirming the evolution of general intelligence as a domain specific adaptation for evolutionary novelty.

Based on our findings we may conclude that intelligence is a robust predictor of sustainable development. Departing from related studies we may argue that there are two reasons explaining positive link between intelligence and genuine income, a change in the rate of income adjusted for depletion and environmental degradation. First, higher-IQ population focuses on long-term rewards rather short-run benefits, thus economic development in these countries is associated with lower pressure on resources and environment. Also, countries with higher general intelligence are associated with patience, have longer time horizons thus build institutions that prevent informal activities and punish rent seeking behavior.

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