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National IQ and economic outcomes

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ABSTRACT

One of the most consequential parts of Richard Lynn's work is the establishment of a comprehensive data set of "national IQ" for nearly all countries in the world. The present contribution demonstrates the use of this database for the explanation of two economic outcomes: (1) economic growth and level of attained wealth at the country level; and (2) income distribution in countries as measured by the Gini index. The results show that high IQ is associated not only with high per-capita GDP and fast economic growth, but also with more equal income distribution. These outcomes are not mediated by educational exposure.

1. Introduction

In today's world we find enormous differences between countries in wealth, social and political structures, and many "cultural" traits. Similar differences are observed between ethnic, racial, religious and other groups, even if they live in the same country. According to the "reductionist" approach, many of these differences result from differences in personality traits and cognitive abilities between human groups. Richard Lynn has been the most prominent protagonist of this approach in recent years (Lynn, 2008a).

Lynn's most outstanding contribution to this field is the compilation of a data base of "national IQ" for most countries of the world. Data for an initial set of 81 countries were published in 2001 and 2002 (Lynn & Vanhanen, 2001, 2002), followed by an expanded list of national IQs for 113 countries (Lynn & Vanhanen, 2006). The most recent update expands this set to a total of 136 countries (Lynn, 2010).

National IQs are based on studies with a wide variety of cognitive tests, with different versions of the non-verbal Raven's Progressive Matrices as the most widely used test (data from 95 countries). The computing of results from different cognitive tests into a single score is justified by the high correlations between alternative cognitive tests. All cognitive tests are thought to measure, to various extents, "general" cognitive ability or *g* (Jensen, 1998). Fifty-two of the 136 national IQs are based on a single study. For all other countries the national IQ is calculated from multiple studies, numbering up to 22 for Japan. National IQs range from 60 (Malawi) to 108 (Hong Kong, Singapore). The average is 86.0 for the countries and 90.5 for the totality of individuals living in these countries. The discrepancy is caused by the higher average population size of high-IQ countries.

Lynn and his coworkers showed that national IQ is closely related with the results of international student assessments in mathematics, science, and other curricular subjects (Lynn & Meisenberg, 2010; Lynn, Meisenberg, Mikk, & Williams, 2007; Lynn & Mikk, 2009). The reported correlations of averaged school achievement scores with IQ are as high as $r = 0.919$ ($N = 67$ countries, Lynn et al., 2007) and, with more recent data, $r = 0.917$ ($N = 86$ countries, Lynn & Meisenberg, 2010). These results suggest that IQ and school achievement are alternative indicators for the average intelligence in a country. In economic terms, both are measures of "human capital". School achievement results are currently available for 111 countries. Eighty-seven countries have data for both school achievement and IQ, and 160 countries have either IQ or school achievement or both.

Based on the well established relationship between IQ and earnings at the individual level (reviewed in Strenze, 2007), Lynn and Vanhanen (2002, 2006) proposed national IQ as a cause for differences in per-capita gross domestic product (GDP) and other country-level economic outcomes. The theory is that wealth-producing activities such as running a business, designing buildings, treating diseases and innovating are done more effectively by persons with higher general intelligence.

The most important implication of this postulated causal path is that economic conditions in today's less developed countries can be improved by increasing, within biological limits, the cognitive abilities of the population. Lynn has always been adamant in claiming that IQ is a cause rather than merely a consequence of prosperity, and that genetic race differences explain part but not all of the international IQ differences (Lynn, 2006).

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The Lynn/Vanhanen theory about the causal importance of country-level IQ differences for prosperity and other development indicators has been attacked on theoretical grounds (e.g., Morse, 2008). However, the few empiric studies conducted so far were mainly supportive. The relationship between IQ and national wealth has been confirmed in some studies (Hunt & Wittmann, 2008; Whetzel & McDaniel, 2006). Others found a relationship of IQ with economic growth (Jones & Schneider, 2006; Weede, 2004; Weede & Kämpf, 2002), although one study found no independent relationship between cognitive test results and economic growth, claiming that previously observed effects were due to the inclusion of the "Asian Tigers" (Chen & Luoh, 2010).

There are reasons to expect that high national IQ reduces income inequality in addition to raising the average income level. One reason is that through market forces, the skill premium is expected to be higher in low-IQ countries than in high-IQ countries. In low-IQ countries many low-IQ people compete for unskilled work, but few high-IQ people compete for cognitively demanding work in management, engineering and other professions. This results in high pay for individuals doing cognitively demanding work relative to the pay of unskilled labourers. Another reason to expect less income inequality in high-IQ countries is the existence in these countries of institutions for collective bargaining and for the redistribution of wealth from the rich to the poor. Cognitive sophistication is required to create and maintain such institutions. So far, an inverse relationship of national IQ with income inequality has been reported as an incidental finding in only two empiric studies (Meisenberg, 2007, 2008), with no follow-up and no contradictory findings in the literature.

Economic outcomes are expected to depend not only on intelligence, but also on geographic location, natural resources, political and economic institutions, and history. Studies about the effects of IQ on economic outcomes must take these additional factors into account. Failure to do so can lead to spurious results because many variables used by economists correlate highly with national IQ.

The present paper extends the previous studies on the possible causal effects of intelligence on economic growth and on income inequality, using the most recent data. Based on the near-equivalence of IQ and school achievement (Lynn & Meisenberg, 2010), the IQ data are augmented by school achievement data. This permits a far broader coverage of countries than in any previous study.

2. Methods

IQ is defined by the national IQs reported in Lynn and Vanhanen (2006), with the amendments and extensions reported in Lynn (2010). This data set includes 136 countries with measured IQ. 24 additional countries without measured IQ have results from international school achievement studies as reported in Lynn and Meisenberg (2010). These were extrapolated into the IQ data set, to yield 160 countries with measured "IQ". The correlation between the Lynn & Vanhanen IQs and school achievement is .92 for the 87 countries having both measures.

lgGDP is the logarithm of gross domestic product adjusted for purchasing power, averaged for the years 1975–2005. Data are from the Penn World Tables (Heston, Summers, & Aten, 2009). Missing data were extrapolated into this data set from the World Development Indicators of the World Bank. The logarithmic transformation was used because of the highly skewed nature of GDP worldwide, which approximates to a normal distribution in the logarithmic form.

Education is calculated as the average of the Barro–Lee dataset for the average length of schooling for adults (1990–2000) and school life expectancy in 1999/2000 from the United Nations Statistics Division. Missing data were extrapolated from the combined primary, secondary and tertiary enrolment ratios in 2002, as reported in the 2005 Human Development Report of the United Nations.

Corruption is calculated from the reverse of Transparency International's Corruption Perception Index for the years 1999–2005 (http://www.transparency.org), combined with older data including the Business International corruption score from 1980–1983 (Treisman, 2000), and the "no corruption" domain of the Heritage Foundation's Economic Freedom Index of 1995 (http://www.heritage.org/research/).

Economic Freedom is calculated from the unrotated first factors of maximum-likelihood factor analyses of areas 2–5 of the Fraser Institute's Economic Freedom Index for the periods 1975–2005 (Gwartney et al., 2009), and domains 1, 2, and 5–8 of the Heritage Foundation Index for 1995–2005 (http://www.heritage.org/research/). This measure indexes the extent of business regulation and red tape.

Big Government indexes the government's share of GDP. It is calculated from area 1 of the Fraser Institute's Economic Freedom Index for the periods 1975–2005 (size of government), and domains 3 and 4 of the Heritage Foundation Index for 1995–2005 (fiscal freedom and government spending). These measures are factorially and conceptually different from the other components of the Fraser Institute and Heritage Foundation indices for "economic freedom".

Gini index: The primary data source is the World Income Inequality Database (WIID2a) of the United Nations University, available at www.wider.unu.edu/wiid/wiid.htm, as described in Meisenberg (2007). Missing data points were extrapolated from the World Bank's World Development Indicators of 2005, the Human Development Report 2005 of the United Nations, and the CIA's World Factbook of 2009.

Racial diversity is defined by the racial diversity index described in Meisenberg (2007). Racial distances were quantified as genetic distance according to Cavalli-Sforza and Feldman (2003).

Freedom/Democracy is the average of political freedom defined as the averaged scores of political rights + civil liberties from Freedom House at http://www.freedomhouse.org/research/freeworld, average 1975–2005; and democracy, defined as Vanhanen's democracy index (average 1975–2004), from the Finnish Social Science Data Archive at http://www.fsd.uta.fi/english/data/catalogue/FSD1289/. The correlation between these two measures is $r = .847$, $N = 179$ countries.

3. Results

3.1. Per capita GDP

Table 1 shows that IQ correlates not only with log-transformed GDP, but also with a number of other "development indicators" including exposure to formal schooling, economic freedom, low corruption, and the composite of political freedom and democracy. "Big government" is related only weakly both to IQ and to the other variables. These relationships are seen both in the complete sample of 134 countries with complete data (below the diagonal), and for the subsample of 107 countries that has not experienced a transition from communist rule in the recent past (above the diagonal). Correlations above 0.175 or 0.195 are significant at $p < .05$ for the complete sample and the non-communist countries, respectively. The subsample excluding the ex-communist countries was formed because the economic trajectories of the former communist countries of Eastern Europe and the former Soviet Union have been seriously disrupted by the end of communist rule.

The correlations do not prove a causal effect of IQ on either lgGDP or any other variable in Table 1. It is equally plausible that IQ is a

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Table 1
Correlations of IQ with log-transformed GDP and other country-level variables.

	IQ	lgGDP	Education	Economic freedom	Big government	Corruption	Freedom/Democracy
IQ	1	.785	.806	.661	.120	−.681	.706
lgGDP	.694	1	.857	.745	.143	−.797	.636
Education	.763	.829	1	.760	.205	−.798	.753
Economic freedom	.495	.707	.637	1	.037	−.801	.707
Big government	.217	.166	.248	−.021	1	−.332	.166
Corruption	−.546	−.764	−.686	−.792	−.262	1	−.670
Freedom/Democracy	.559	.633	.669	.724	.121	−.685	1

consequence of prosperity, schooling, or other environmental factors that prevail in highly developed countries. Indeed, the secular rise of IQ in many countries during the 20th century, which had been discovered independently by Flynn (1984, 1987) and by Lynn and Hampson (1986), suggests precisely this causal mechanism.

3.2. Economic growth

Present wealth is the outcome of past economic growth. If IQ causes differences in wealth between countries, we can predict that concurrently measured IQ correlates not only with attained wealth (measured as log-transformed GDP), but also with the rate of economic growth. Table 2 shows the relationship of economic growth from 1975 to 2005 with the usual predictors, plus some others that were hypothesized to affect economic growth. Oil exports were expected to promote economic growth, whereas communist history, overpopulation, and lack of access to the sea were postulated to impede economic growth.

The first data column in Table 2 shows the raw correlations of economic growth between 1975 and 2005 with IQ and the other plausible predictors. Generally, countries with higher levels of economic freedom, education, and per-capita GDP (averaged over the entire period 1975–2005) tended to grow fast, but IQ stands out as the strongest correlate.

Model 1 in Table 2 is a regression model with the same predictor variables, except for the use of lgGDP in 1975, at the beginning of the trend period, rather than the averaged GDP over the entire 30-year period. Model 2 is derived from model 1 by eliminating non-predictors, in an attempt to reduce collinearity. In these models, IQ is the strongest and most significant predictor of economic growth. The models also show that everything else being equal, high GDP in 1975 is associated with slower growth. This "advantage of backwardness" (Weede & Kämpf, 2002) presumably results from the fact that poor countries can adopt the technologies and management practices of the wealthier countries, whereas wealthy countries depend on the slower method of innovation.

Economic freedom favors rapid growth, but democracy and political freedom have, if anything, the opposite effect. The measure of economic freedom used here describes mainly the extent of bureaucracy and red tape faced by businesspeople. Of the other suspects, corruption is ineffective, perhaps because economic freedom is a more accurate indicator for the business climate. A high share of the government in the GDP ("big government") does not impede economic growth, but excessive democracy does; and the economic setback at the end of communist rule is evident from the results as well. The ineffectiveness of population density in slowing economic growth contradicts ecological approaches, which predict flagging growth when the population approaches or exceeds the "carrying capacity" of the land. Education is only a weak predictor of economic growth as long as IQ is in the model. This is understandable because the measure of education describes exposure to formal schooling. The cognitive skills that children acquire in school are indexed by IQ rather than years in school.

3.3. Income inequality

The benefits of economic prosperity depend not only on per-capita GDP, but also on the income distribution. This is so because a fixed increment in income is expected to have a greater marginal benefit for a poor person than a rich person. In theory, equal income distribution leads to the greatest happiness of the greatest number. Table 3 shows the correlations of the Gini index with a number of predictors. The Gini index is a measure for society-wide income inequality, with values ranging from zero (perfect equality) to 1 (one person earns all).

Population density and square root of the land surface area are included. Large countries are expected to be more unequal because of differences in wealth between regions of the country. Also racial diversity is included because high racial (but not ethnic and religious) diversity has previously been shown to be associated

Table 2
Relationship of economic growth from 1975 to 2005 with plausible predictors. $N = 117$ countries. Shown are the raw correlations (Pearson's r), and two regression models (standardized β-coefficients). For the correlations, lgGDP/capita refers to the average of 1975–2005; for the regression models, it is lgGDP in 1975.

	Correlation	Model 1	Model 2
IQ	.481***	.658***	.678***
lgGDP/capita	.232*	−.967***	−.935***
Education	.253**	.363*	.357*
Economic Freedom	.284**	.380**	.414***
Big government	−.027	−.007	
Corruption	−.209*	−.072	
Freedom/Democracy	.145	−.320**	−.320**
Ex-communist	−.044	−.187**	−.191**
lg Population Density	.218*	.109	.110
Oil export/capita	−.114	.185*	.178*
Landlocked	−.087	−.101	−.093
Adjusted R^2		.557	.561

* $p < .05$.
** $p < .01$.
*** $p < .001$.

Table 3
Correlations (Pearson's r) of the Gini index with predictor variables, separately for all countries and for countries without communist history only.

	All countries	Non-communist
IQ	−.580***	−.564***
Education	−.447***	−.437***
lgGDP	−.407***	−.441***
Economic Freedom	−.252**	−.407***
Big government	−.423***	−.332**
Corruption	.358***	.485***
Freedom/Democracy	−.355***	−.501***
Racial diversity	.423***	.369***
Oil exports/capita	−.059	−.092
lg Population Density	−.371***	−.400***
Sqrt. Area	.117	.061
N countries	118	92

* $p < .05$.
** $p < .01$.
*** $p < .001$.

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Table 4
Relationship of the Gini index with predictor variables. Models 1–3 include all countries with complete data, and models 4–6 are for countries without communist history only.

	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
IQ	−.376**	−.338**	−.326**	−.530**	−.457***	−.419***
Education	.096			.158		
lgGDP	.041		−.189	.202		
Economic freedom	.209	.242	.158	.177	.175	.128
Big government	−.163	−.162*	−.171**	−.171	−.180*	−.120
Corruption	.184	.156		.249		
Freedom/Democracy	−.257*	−.225		−.241	−.212	
Racial diversity	.285***	.295***	.206**	.277**	.304***	.205**
Communism	−.164	−.128	−.199**			
Oil exports/capita	−.056			−.061		
lg Population Density	−.285***	−.277***	−.311***	−.329***	−.297***	−.358***
Sqrt. Area	−.002		.067	−.086		
IQ^2			.203**			.186*
Education × lgGDP			−.356***			−.253**
Corruption × Freedom/Democracy			.148			.294**
N countries	118	118	118	92	93	92
Adjusted R^2	.568	.579	.689	.547	.556	.681

* $p < .05$.
** $p < .01$.
*** $p < .001$.

with more unequal income distributions (Meisenberg, 2007, 2008). We see negative correlations of the Gini index with all development indicators. Advanced societies are more equal than less advanced societies. We also see that IQ is more potent than education, GDP, and other development indicators in predicting an egalitarian income distribution. Unexpectedly, high population density is associated with a more egalitarian income distribution.

Table 4 elaborates on this observation with regression models in which IQ is pitted against other predictors. Model 1 includes the linear effects of all predictors.

It shows that IQ, racial diversity and population density are the most significant predictors. Model 2 is derived from model 1 by removing the non-predictors, and model 3 includes quadratic and interaction terms. The significantly positive IQ^2 term, in addition to the main effect of IQ, means that the inequality-reducing effect of IQ is strong when low-IQ countries are compared with countries with IQs of 90–95, but IQs above 95 do not reduce the Gini index any further.

The interaction terms show that imbalances in development tend to raise income inequality. For example, countries in which the educational level of the population is far higher or far lower than expected from GDP tend to have a more unequal income distribution than countries in which these indicators are congruent. Also, countries that are both very democratic and very corrupt, or very dictatorial and non-corrupt, tend to have more income inequality than countries in which the level of corruption is more appropriate to the level of democracy.

4. Discussion

The hypothesis that IQ is a causal influence on prosperity and economic growth was derived from the observation that IQ predicts income at the individual level. Although country-level "ecological" correlations do not always replicate individual-level correlations (Hammond, 1973; Schwartz, 1994), in the case of national IQ and economic growth they apparently do. One caveat about the present findings, as in all country-level comparisons, is the likely presence of spatial and cultural autocorrelation. Autocorrelation refers to the relative non-independence of data points, caused by systematic similarities between neighboring countries or between countries with similar history or culture (Eff, 2004). Autocorrelation can inflate statistical significance levels and cause type 1 errors.

However, inclusion of individual world regions in the regression models, for example East Asia or sub-Saharan Africa, does not eliminate the IQ effect but leaves the significance level for IQ at $p \leqslant .001$ (data not shown). This contrasts with the observation of Chen and Luoh (2010) that scholastic achievement has no major independent relationship with per-capita GDP once the dummy-coded East Asian countries are included in the model. The robustness of the present results for economic growth to the inclusion of world regions shows that the results are not caused by the chance coincidence of high (or low) IQ with high (or low) economic growth in one world region.

The results support the thesis of Lynn and Vanhanen (2002, 2006) that the average IQ in the country is an important determinant of national prosperity. Countries with higher average IQ are not only wealthier, but there has been a trend – at least between 1975 and 2005 – for national wealth to become more congruent with IQ. The latter result is expected only if IQ is a cause for wealth differences between countries, rather than being only a consequence. Because the growth-promoting effect of IQ is stronger than that of education, IQ rather than exposure to formal education is the better measure of human capital. The IQ effect is of moderate magnitude. The correlation between IQ and economic growth in Table 2 suggests that approximately 23% of the between-country variation in economic growth can be attributed to IQ differences.

One task for future research is the extension of the "IQ world map" to countries for which cognitive test data are not yet available, and the generation of more accurate data for both IQ and school achievement. For large countries, we will need data at the regional level. In Pakistan, for example, the IQ difference between the most developed province (Sindh) and the least developed province (Northwest Frontier Province) is approximately 15 points on Raven's Standard Progressive Matrices (Ahmad, Khanum, Riaz, & Lynn, 2008); and in China, members of the Tibetan minority score about 12.6 points below the Han Chinese (Lynn, 2008b). An IQ map of the United States has already been used to correlate state IQ with several outcomes, including the fertility rate (Shatz, 2008).

International scholastic assessments will increasingly complement the IQ data and will help to provide an increasingly accurate picture of intelligence worldwide, both in cross-country comparisons and in the study of temporal trends. Traditionally, IQ has been considered an indicator of genetically inherited ability, whereas school achievement has been attributed to the effectiveness of the school system. The extremely close relationship between these two measures at the country level shows that this dichotomy is false. Another observation is that at the individual level, the heritability of scholastic achievement is between 35% and 75% depending on the kind of test and age at testing (Haworth, Dale,

& Plomin, 2008; Wainwright, Wright, Geffen, Luciano, & Martin, 2005; Walker, Petrill, Spinath, & Plomin, 2004). This is about as high as the heritability of IQ in children and adolescents (Haworth, Wright, Luciano, & Martin, 2010). Even length of schooling has been reported to have a heritability of 57% (Baker, Treloar, Reynolds, Heath, & Martin, 1996).

With his emphasis on the human factor, Richard Lynn has brought the study of country-level economic outcomes back to the psychological basics: the traits of the human actors who create and distribute material value by learning, teaching, working, managing and innovating. What the present results do not show are the mechanisms through which high intelligence promotes economic growth and reduces income inequality. Future studies will have to show whether the IQ effect on economic growth is mediated primarily by management skills, labour productivity, technological innovation, reduced birth rates, or other mechanisms. These mechanisms need not be the same in rich and poor countries. For the apparent effect of IQ on income distribution, future studies need to investigate whether this effect is due to greater income redistribution in high-IQ countries, or to market forces whereby a greater supply of cognitive skill reduces the skill premium in the labour market.

In addition to his work on national IQ, Richard Lynn has pioneered the study of differences in personality traits between nations (Lynn, 1971; Lynn, 2007; Lynn & Hampson, 1975; Lynn & Hampson, 1977), but useful data sets on country-level differences in the Big Five (McCrae et al., 2005; Schmitt, Allik, McCrae, & Benet-Martínez, 2007) and other personality dimensions (Hofstede, 2001; Schwartz & Rubel, 2005) have emerged only recently. It remains to be seen whether personality differences, in addition to IQ differences, are important predictors of economic development and other country-level outcomes. With his "national IQ" data set, Richard Lynn has created a paradigm for the study of country-level differences in personality as well as intelligence.

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