National IQs and Socioeconomic Development

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Abstract

Using 47 indicators of socioeconomic development and various sources of performance on cognitive tests, we constructed the SDI (socioeconomic development index) and a set of national IQs for 197 nations, the latter using no geographic imputations. Combining the various datasets reduced the estimated standard error of national IQs from 5.41 to 2.58, and a strong correlation between socioeconomic development and national IQs was observed (r = .88).

Based on the prior that Flynn Effect gains do not pass measurement invariance, IQ scores should exhibit some non-negligible bias between countries. Empirical assessments of measurement invariance across nations finds that measurement invariance violations are uncommon, and are more prevalent in verbal than nonverbal tests. In most countries, national IQs show high levels of reliability and validity, and we encourage their use in the literature.

1. Introduction

Differences in economic development between countries have traditionally been quantified using GDP (gross domestic product) per capita, introduced in 1937 by Simon Kuznets to capture all economic production (Dickinson, 2011). This measurement was popularized in 1944 after the Bretton Woods conference and has become a commonly used measurement of economic development. This measurement has faced various criticisms: the most notable one being that GDP does not take into account income earned abroad, leading some economists to advocate for using GNI (gross national income) instead. In addition, socioeconomic development (socioeconomic development) extends beyond economic output -- other variables such as mortality, educational attainment, safety, and institutional quality must be taken into consideration. Consequently, researchers developed composite indices such as the HDI (human development index) and the SPI (social progress index) which use multiple indicators to construct a general index.

Both of these indexes, while useful, have their respective issues. The HDI only uses three indicators -- GDP, educational attainment, and life expectancy -- to calculate socioeconomic development, which leads to some non-negligible unreliability ($\omega = .93$, when using GNI per capita, life expectancy, expected years of schooling, and mean years of schooling). The SPI reduces the influence of unreliability by using 50 indicators to calculate socioeconomic development, which is better, but many of these variables may suffer from non-invariance (bias) across cultures, notably indicators of sexual inequality, democracy, corruption, and freedom, which assume that current Western values are the best in a kind of “the end of history” approach (Fukuyama, 2006). While these values may be desirable or lead to higher levels of socioeconomic development, using more objective indicators of socioeconomic development (e.g. internet speed, median income) would be best to avoid the problem of cultural bias. There is also the question of scoring: most indices of socioeconomic development use arbitrary weighting methods, like the HDI, which changed to a geometric mean method in 2011 which shifted the rank order a bit (United Nations, 2011).

Similar to socioeconomic development, there is an issue with measuring human capital. An example of an early adopter of comparing test scores between different nations was Barbara Lerner (1983), who compared the performance of Western Europe, the United States, and Japan in test performance and hypothesized that it was related to economic development. Richard Lynn (1978; 2002) later collected IQ test scores from various countries, and found that national IQs and GDP per capita correlated at .82, though this dataset and other revisions of it have been extensively criticized in the literature. Some economists have made indexes of human capital based on child mortality, test scores, and educational attainment (Angrist et al., 2021), but it could be argued that child mortality and education are a function of both human capital and socioeconomic development, making it an improper measurement.

The purpose of this study is to use state-of-the-art statistical and machine learning techniques to create the most accurate measurements of socioeconomic development and human capital that can be made. Theoretically, socioeconomic development should affect human capital due to the fact that socioeconomic development causes nations to have better nutrition and health, and societies with higher levels of human capital should create societies with higher levels of socioeconomic development. Other researchers reported strong correlations between indicators of socioeconomic development (e.g. GDP per capita) and human capital (r = .6 - .8) (Lynn, 2002; Rindermann, 2018), though these values are based on the national IQ datasets which have been unpopular in the literature.

2. Data

Data on most national development indicators were sourced from the Social Progress Index (*Social Progress Imperative*, 2024). When possible, averages of variables from 2018-2022 were calculated to reduce the unreliability that comes from year-to-year fluctuations. Indicators of national development that are manipulable (e.g. indexes), contain less than 100 observations, or measure a value that is sensitive to national and cultural differences (e.g. gender equality, measurements of freedom) were not considered. An exception was made for the Legatum health index, which was perceived to be of high quality. Other variables were downloaded on the internet from various sources, which have been cited in Table 1.

Table 1. Sources of variables of national differences.

Variable	Number of Countries	Time range	Source
National IQs (unweighted, psychometric)	130	1945-2017	(Becker, 2023)
National IQs (sample weighted, psychometric)	129	1945-2017	(Becker, 2023)
National IQs (quality weighted, psychometric)	130	1945-2017	(Becker, 2023)
National IQs (scholastic)	102	1945-2017	(Becker, 2023)
National IQs (composite)	148	1945-2017	(Becker, 2023)
National IQs (composite)	81	varying	(Lynn & Vanhanen, 2002)
National IQs (composite)	133	varying	(Lynn & Vanhanen, 2012)
National IQs (composite)	170	varying	(Rindermann, 2018)
Recent Test Scores (PISA, TIMSS, PIRLS)	39-81	2019-2022	(Recueil, 2023) and (Wikipedia, 2024b)
Test Scores (Basic Skills Dataset, BSD)	126	varying	(Gust et al., 2022)
Test Scores (World Bank Test Scores, WBTS)	174	varying	(Patrinos & Angrist, 2018)
Average IQs of different countries	7	varying	(Shinwari et al., 2022), (Lynn, 2006), (Kamin, 2006), (Iliescu et al., 2016), (De La Cruz, 2022)
% of population in agriculture ind.	185	2018-2022	(World Bank Open Data,

			2023a)
Caloric intake	168	2018	(Our World in Data, 2023)
Car exports ($)	177	2022	(World Population Review, 2024a)
Circuit exports ($)	132	2022	(World Population Review, 2024b)
DOI Entries per country	131	varying	(DOI Foundation, 2024)
Health index	166	2023	(Legatum Prosperity Index, 2023)
Information technology exports (%)	159	2018-2022	(World Bank Open Data, 2023b)
Internet speed by country (mobile)	137		(World Population Review, 2024c)
Internet speed by country (broadband)	173	2023-2024	(World Population Review, 2024c)
Median income	159	2006-2021	(World Population Review, 2024d)
Median wealth	161	2017-2021	(Wikipedia, 2024a)
Tech exports ($)	163	2018-2022	(World Bank Open Data, 2023c)
Interpersonal Violence	194	2018-2022	(SPI, 2024)
GNI per capita PPP adjusted	196	2018-2022	(IMF, 2024)
GNI per capita PPP adjusted	196	2018-2022	(United Nations, 2024)
Child Stunting	188	2018-2022	(SPI, 2024)
Intimate partner violence	194	2018-2022	(SPI, 2024)
Years lost due to infections	194	2018-2022	(SPI, 2024)
Undernourishment	168	2018-2022	(SPI, 2024)
Child mortality	194	2018-2022	(SPI, 2024)
Maternal Mortality	184	2018-2022	(SPI, 2024)
Mortality due to water quality	188	2018-2022	(SPI, 2024)
Water satisfaction	151	2018-2022	(SPI, 2024)
Water sanitation	192	2018-2022	(SPI, 2024)
Water access (%)	191	2018-2022	(SPI, 2024)
Household pollution	194	2018-2022	(SPI, 2024)
Electricity usage	194	2018-2022	(SPI, 2024)
Clean Fuel Usage	189	2018-2022	(SPI, 2024)
Money stolen (% of pop.)	149	2018-2022	(SPI, 2024)

Percent that say it is safe to walk alone at night	150	2018-2022	(SPI, 2024)
Transportation injuries	188	2018-2022	(SPI, 2024)
Proportion with no education	194	2018-2022	(SPI, 2024)
Primary school enrollment	167	2018-2022	(SPI, 2024)
Proportion with secondary education	176	2018-2022	(SPI, 2024)
Mobile phones per person	194	2018-2022	(SPI, 2024)
Internet access	192	2018-2022	(SPI, 2024)
Mortality from ages 15 to 50	196	2018-2022	(SPI, 2024)
Matter pollution	188	2018-2022	(SPI, 2024)
Air pollution	194	2018-2022	(SPI, 2024)
Particulate matter exposure	194	2018-2022	(SPI, 2024)
Percent that are NEETS	180	2018-2022	(SPI, 2024)
Citable documents per capita	195	2018-2022	(SPI, 2024)
University rankings (population controlled)	130	2018-2022	(SPI, 2024)
Percent satisfied with health care	150	2018-2022	(SPI, 2024)
Percent who say they have friends and family to count on	151	2018-2022	(SPI, 2024)
Life Expectancy	193	2018-2022	(SPI, 2024)
Expected years of tertiary schooling	142	2018-2022	(HDI, 2023)
GNI per capita	191	2018-2022	(HDI, 2023)
GDP per capita (composite)	195	2018-2022	(CIA, 2023), (IMF, 2024), (World Bank Open Data, 2023b), (SPI, 2024)

3. Methodology

3.1. Estimating socioeconomic development

Missing values from the socioeconomic development indicators were imputed with multiple imputation by chained equations (m = 100), with a prediction threshold of r = 0.4, as many indicators are highly correlated with each other. This was reduced to 0.3 in the untransformed data, as the untransformed data was less intercorrelated than the transformed data. Countries that had more than 45% of their data missing in socioeconomic indicators (Bahamas, Palestine, Kosovo, Liechtenstein, Monaco, Greenland, Nauru, Tuvalu, Palau, Saint Kitts and Kevis, San Marino, Macao, Puerto Rico, Palau, and Hong Kong) had their social development index (SDI) calculated using a different method. For these countries, factor scores based on the variables that were not missing were calculated and then their rank relative to the sample was calculated. That rank was then regressed to the mean depending on the omega reliability of the estimate, which was lowest for Greenland at .90 and highest for Saint Kitts and Kevis at .98. Due to its implausibility, the estimate for North Korea (SDI = .98, which would make it the 47th most developed country in the world), was removed from the dataset, as it's inconsistent with its very low GDP per capita ($1,500).

Variables were grouped into various categories depending on what they were measuring conceptually to compute specific scores, as displayed in Table 2. Principal component analysis was used to extract factor scores in all cases, so if a variable needed to be reverse coded, the algorithm would apply this correction automatically.

Table 2. Method used to calculate specific scores.

Indicator name	Indicators	Cronbach's alpha	Omega total
Economic Development Index	GNI per capita, GDP per capita, median income, median wealth	0.970	0.977
Technological Development Index	broadband speed, mobile internet speed, agriculture (%), mobiles per capita, internet (%), tech exports per capita ($), car exports per capita ($), circuit exports per capita ($), ICT share of GDP (%), electricity (%)	0.865	0.910
Educational Attainment Index	NEETs (%), no education (%), primary enrollment (%), secondary degree att. (%), expected yrs. of teritary ed., uni rank controlled for pop., citable docs per cap.,	0.917	0.939

	DOI res. per cap.		
Index of Mortality	child mortality, maternal mortality, mortality yrs. 15-50	0.937	0.938
Infrastructure Development Index	Infections daily, satisfaction with healthcare, health index, life expectancy, water satisfaction, water sanitation, mortality due to water qual., water use (%), child stunting, undernourishment, caloric intake.	0.961	0.973
Index of Pollution	air pollution, household pollution, use of clean fuels, lead exposure	0.762	0.895
Safety Index	% who say they had money stolen, % who say it's safe to walk alone at night, intimate partner violence, whether friends/family can be counted on, transport quality, years lost due to interpersonal violence	0.860	0.904
First Principal Component	composite of subindicators	0.961	0.972

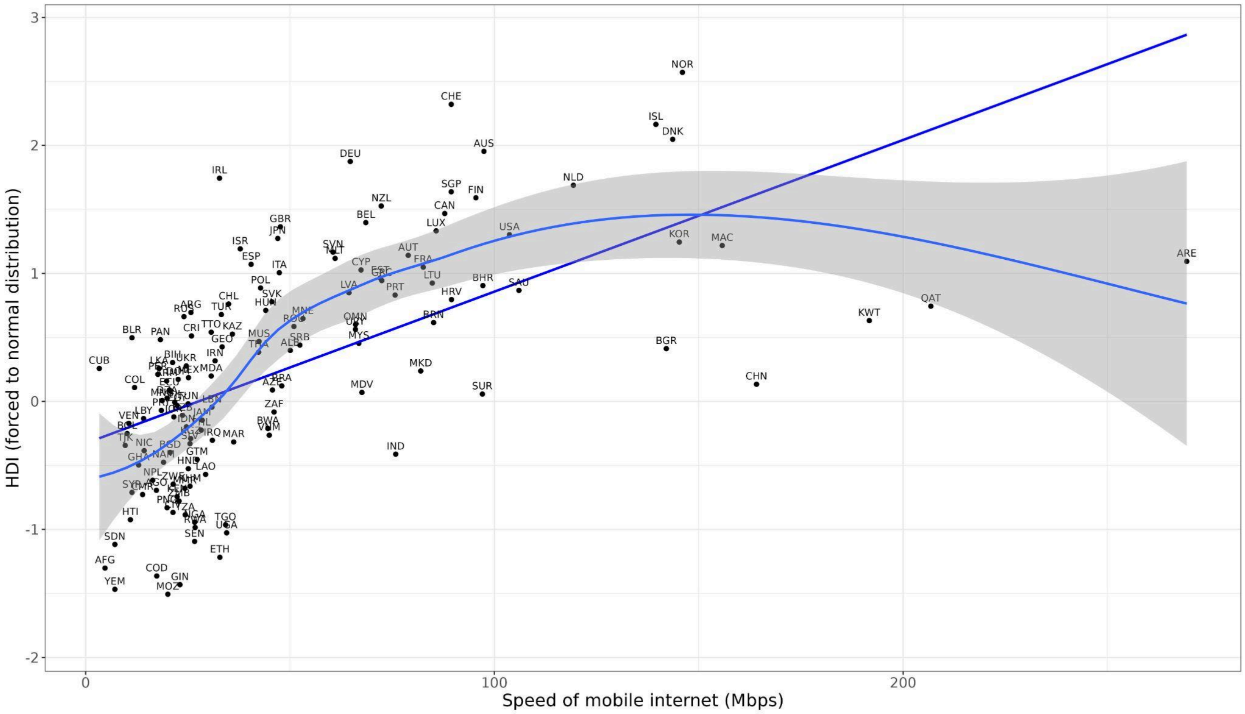
After this, general scores of socioeconomic development were computed in different ways which involved combining several different methodological variations. This was done to produce results that are less sensitive to changes in methodology. These methodological variations include:

1. Computing general development scores by iterating through each of the 48 variables and randomly selecting four independent variables that predict another random variable using restricted cubic splines. This process is repeated 5000 times per variable. Then, these predictions are averaged and the first principal component of those averages is taken. This admittedly is a very unusual method (which will be called “spline iteration” from now on), but this avoids non-linear biases and maximizes the influence of the most reliable and valid variables.
2. The above method is repeated, but using a support vector machine that uses regression and a radial kernel to predict the dependent variable from four randomly selected independent variables. This method will be called the “SVM iteration” method.
3. The first principal component of the indicators is extracted. This will be called the “simple component” method.
4. Four components from the data are extracted,obliquely rotated, and the first principal component is extracted. This will be called the “complex component” method.
5. Both of the above can be calculated by extracting the first principal component of the 47 indicators or the 7 subindicators.
6. Applying the transformations (logarithmic, square root, reciprocal, or squared) that maximize the correlation between the variable and socioeconomic development.

16 different combinations of these methodological decisions were calculated and averaged to form the Socioeconomic Development Index (SDI). Eight possible combinations of these methods are missing, as making estimates based on the 7 subindicators vs 47 indicators for the machine learning derived estimates was judged as superfluous. On average, scores from these 16 methods correlated at .99, with intercorrelations ranging from .94 to .9999. This index of socioeconomic development was consistent with other measurements of development ($r = .97$ with the Social Progress Index, $r = .98$ with HDI).

If a variable exhibited a strongly nonlinear relationship with HDI, where variance at extremes no longer predicted HDI, then values in the unpredictive range were winsorized. This was also done when one variable had large outliers (e.g. some countries produce orders of magnitude more semiconductors than others). In the case of mobile internet speed, the maximum speed was set to 100 Mbps, as the relationship was nonlinear and the variable contained several outliers, as shown in Figure 1. This avoids specific variance from biasing the estimates of the general socioeconomic development, as if a country is an outlier in general development, that status should theoretically be reflected in all of its development indicators.

Figure 1. Relationship between the speed of mobile internet and HDI (forced to a normal distribution)



3.2. Criticisms of National IQs

Sear has criticized the use of national IQs (2022), primarily the Lynn and Becker datasets for several reasons. Among these criticisms is the use of children to estimate the average IQs of nations, as IQ scores depend on age. However, the scores on these tests are standardized by age, which makes this concern irrelevant. This can be a concern if the magnitude of group differences varies by age, but the best evidence available suggests that is usually not the case, at least not between American Blacks and Whites (Rushton & Jensen, 2005). The same is true for Asians and Whites, where Asians score above Whites as children (Rushton, 1997; Weiss et al., 2019) and adults (Weiss et al., 2010). There are exceptions, such as the Arab ~ European IQ difference, where the difference increases with age (Bakhiet et al., 2018).

Sear (2022) also questions whether the figures that are estimated for the African countries are believable, as many of them fall in the 65 to 75 range, which is close to the conventional cutoff for intellectual disability (70). This ignores that not all causes and types of mental disability are the same (Jensen, 1970; Reichenberg et al., 2015): some of them are mild and typically caused by additive genetic variance, these intellectually disabled people generally can live normal lives (Boat & Wu, 2015); others are caused by severe mutations or deletions, which cause deficits in other areas of biological functioning. Arthur Jensen was initially drawn to IQ research because he noticed that Black and White children in the classes for the mentally disabled behaved quite differently in the playground, the Black children behaving normally, but the White being socially dysfunctional. The explanation for this pattern was that a large fraction of the White children suffered from major genetic disorders such as Down's syndrome, or perinatal environmental damage (syndromic disability), while the Black children were merely on the left side of their normal distribution, thus had mostly ordinary causes (familial disability). Since the syndromic causes of mental disability usually cause other deficits beyond low intelligence, this explains the large difference in the social skills of the two groups of children.

A more intuitive comparison would be differences in height between African Pygmies and those from the Dinaric Alps. On average, Pygmy men are about 153 cm tall (Travaglino et al., 2011), and Dinaric men are about 186cm tall (Pineau et al., 2005); a difference of roughly five entire standard deviations relative to the standard deviation of Dinaric male height (6.5 cm). The conventional cutoff for dwarfism in Western nations is 150cm; within the Pygmies, roughly half of their men would fall below this cutoff, in the Dinaric Alps, only men who suffer from a genetic disorder such as achondroplasia, metatropic dysplasia, or growth hormone deficiency could be this short. The fact that Dinarics who are under 150cm tall tend to suffer from additional complications that are not observed in Pygmies is not evidence that height measurements are biased against the latter group; merely that height differences must be understood as originating from a variety of genetic and environmental causes, which can have effects on various phenotypes.

It is doubtful that an IQ score of 70 for an African and a European means the same thing in terms of biological functioning, though these scores accurately reflect their ability to take cognitive tests, as Africans tend to score the equivalent of an IQ of 70 on scholastic tests administered by the TIMSS (Lynn & Meisenberg, 2010). Whether these test scores function as biased estimates of intelligence is debatable. Theoretically, some biases will deflate the African IQ relative to what would be expected from their true average levels of intelligence (low effort test takers, Flynn Effect related measurement variance, illiterates), and others will inflate it (use of primary/secondary school students which are less nationally representative in more uneducated countries, use of the standard deviation between groups instead of within groups, use of subtest differences instead of full scale differences).

Flynn Effect related measurement invariance is concerning, as the literature overwhelmingly converges towards Flynn effects being partially caused by test bias in favour of newer cohorts (Recueil, 2024; Wicherts et al., 2004; Beaujean & Osterlind, 2008; Beaujean & Sheng, 2010; Pietschnig et al., 2013). As nations differ in the rate at which they undergo Flynn Effects (Pietschnig & Voracek, 2015; Rindermann & Becker, 2018), this may cause the test scores to be biased in favour of certain countries. Some of the Flynn Effect gains are still plausibly real: brain sizes increased by about 0.7 SD (DeCarli et al., 2024) between the 1930s and 70s, if this effect occurred between 1900 and 1970, then the expected increase in brain size would be 1.2 SD. Given that brain size and IQ correlate at roughly .28 (Cox et al., 2019), and this correlation is causal from brain size to intelligence (Lee et al., 2019), intelligence would have been expected to increase by 5 points due to this increase; assuming it is absolute and not relative brain size that is linked to IQ.

There have been some studies on whether international scholastic tests satisfy measurement invariance. There are traditionally four steps taken to test measurement invariance: configural invariance (whether the items load on the same factors between groups), metric invariance (whether the magnitude of the factor loadings on the constructs differs between groups), scalar invariance (whether the magnitude of the intercepts of the items differs between groups), and residual invariance (whether the residual variance of the items is the same between groups) (Putnick & Bornstein, 2016). For comparing national means, scalar invariance is the most important test of measurement invariance that needs to be satisfied.

Contrary to priors, scores on cognitive tests do not exhibit large violations of measurement invariance, especially if the test involved is nonverbal. Strict measurement invariance was held within Anglo and East Asian cultural groups on the 1999 TIMSS tests, though only weak (metric, but not scalar) measurement invariance was held between the cultural groups (Wu et al., 2007), as shown in Figure 2. Their methodology is limited by the fact measurement invariance was assessed at the factor level, as groups are likely to differ in general and specific ability -- it would be better to assess measurement invariance at the item level.

The vast majority of the items on the 2015 PISA math and science tests passed measurement invariance (Odell et al., 2021), in both the factor loadings and intercepts, suggesting test bias was not an issue in administration. Another study of international test bias of the PISA item data on the reading subtest found that scalar invariance was violated in most nations, with the magnitude of invariance ranging from 0.041 in Canada to 0.93 in Kyrgyzstan (Asil & Brown, 2015). The presence of biased items, however, does not imply that the means are biased between groups, as the direction of the effects tends to vary at the item level (Cardoza, 2006; Kirkegaard, 2021).

Figure 2. Results of measurement invariance testing from Wu et al. 2007.

Table 5. Summary Results of MI for 21 Planned Comparisons

	AUS	NZL	CAN	USA	TWN	KOR
NZL	**Strict**					
CAN	**Strict**	**Strict**				
USA	**Weak**	**Strict**	**Strict**			
TWN	Weak	Weak	Weak	Weak		
KOR	Weak	Weak	Weak	Weak	**Strict**	
JPN	Weak	Configure	Weak	Configure	**Weak**	**Strict**

The most exhaustive and recent assessment of measurement invariance between nations is an assessment that is available in the PISA 2022 technical report. They concluded that measurement invariance is a major issue for the financial literacy test, somewhat of an issue for the science and reading tests, and a minor issue for the mathematics test. Figures 3 and 4 show the distribution of variant (orange/red/light green) and invariant (dark green) items by country and test.

Figure 3. Results of the measurement invariance testing at the item level for the science and financial literacy test by country (taken from PISA, 2022).

Figure 14.3. Frequency of invariant, variant, and dropped items for science, by country/economy

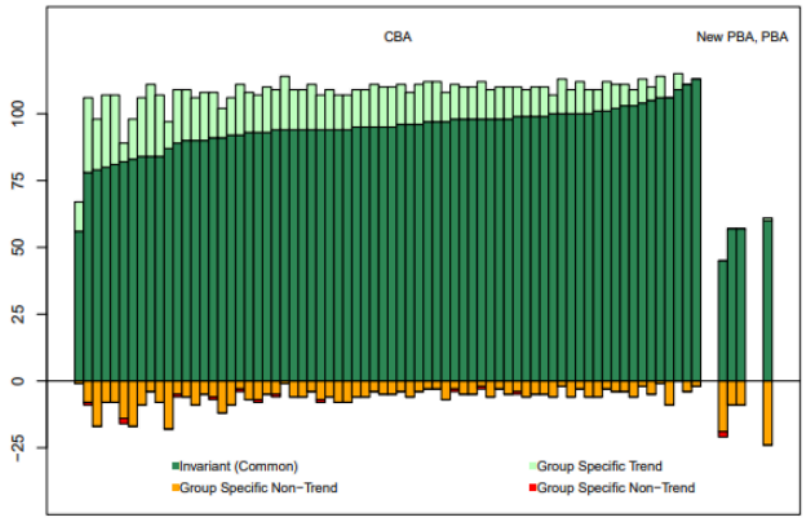


Figure 14.4. Frequency of invariant, variant, and dropped items for financial literacy, by country/economy

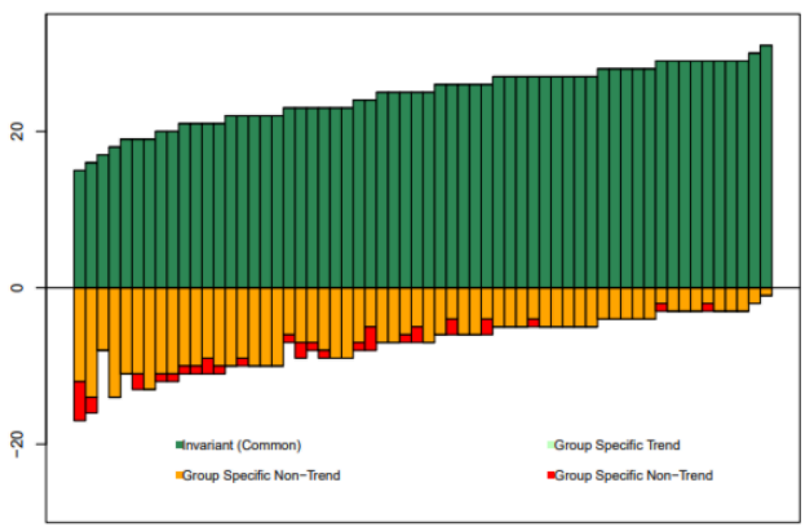


Figure 4. Results of the measurement invariance testing at the item level for the mathematics and reading test by country (taken from PISA, 2022).

Figure 14.1. Frequency of invariant, variant, and dropped items for mathematics, by country/economy

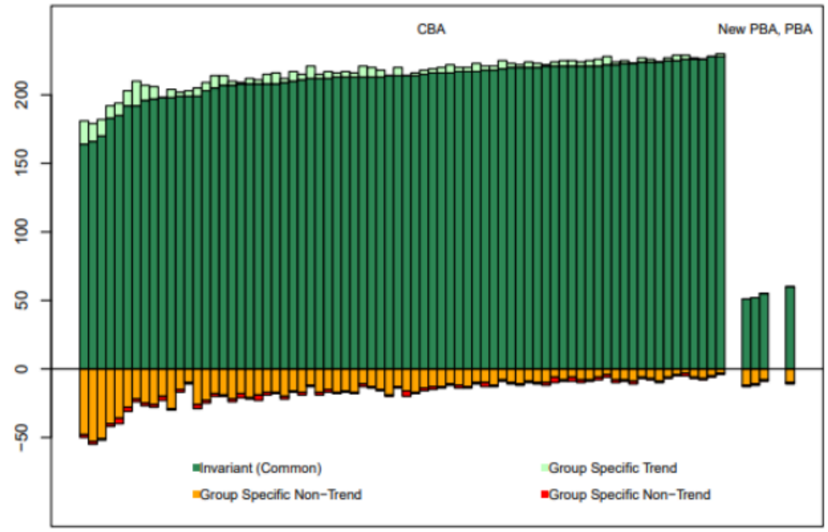
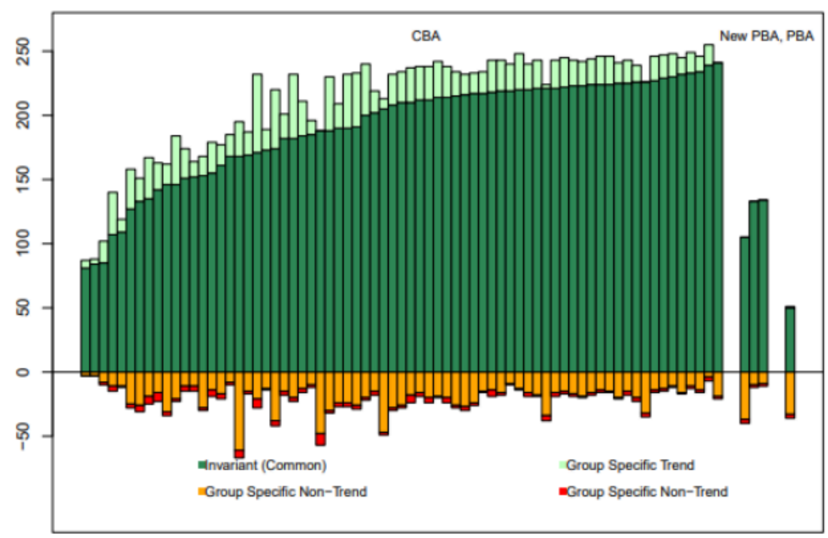


Figure 14.2. Frequency of invariant, variant, and dropped items for reading, by country/economy



In practice, the differences between countries on PISA scores are extremely highly correlated and of roughly equal magnitude, as shown in Table 3. Therefore, it must be concluded that minor violations of measurement invariance on the PISA exams, and likely all scholastic tests, do not have a practically significant impact.

Table 3. Average score on the PISA (2022) exam by country and subtest. Taken from Recueil (2023) and Wikipedia (2024b).

Country	Maths	Country	Science	Country	Reading
Singapore	575	Singapore	561	Singapore	543
Macau	552	Japan	547	Ireland	516
Chinese Taipei	547	Macau	543	Japan	516
Hong Kong	540	Chinese Taipei	537	South Korea	515
Japan	536	South Korea	528	Chinese Taipei	515
South Korea	527	Estonia	526	Estonia	511
Estonia	510	Hong Kong	520	Macau	510
Switzerland	508	Canada	515	Canada	507
Canada	497	Finland	511	United States	504
Netherlands	493	Australia	507	New Zealand	501
Ireland	492	Ireland	504	Hong Kong	500
Belgium	489	New Zealand	504	Australia	498
Denmark	489	Switzerland	503	United Kingdom	494
United Kingdom	489	Slovenia	500	Finland	490
Poland	489	United Kingdom	500	Denmark	489
Australia	487	United States	499	Poland	489
Austria	487	Poland	499	Czech Republic	489
Czech Republic	487	Czech Republic	498	Sweden	487
Slovenia	485	Denmark	494	Switzerland	483
Finland	484	Latvia	494	Italy	482
Latvia	483	Sweden	494	Germany	480
Sweden	482	Germany	492	Austria	480
New Zealand	479	Austria	491	Belgium	479
Germany	475	Belgium	491	Norway	477
Lithuania	475	Netherlands	488	Portugal	477
France	474	France	487	Croatia	475
Spain	473	Hungary	486	Latvia	475
Hungary	473	Spain	485	Spain	474
Portugal	472	Lithuania	484	France	474
Italy	471	Portugal	484	Israel	474
Vietnam	469	Croatia	483	Hungary	473
Norway	468	Norway	478	Lithuania	472
Malta	466	Italy	477	Slovenia	469
United States	465	Turkey	476	Vietnam	462
Slovakia	464	Vietnam	472	Netherlands	459
Croatia	463	Malta	466	Turkey	456

Iceland	459	Israel	465	Chile	448
Israel	458	Slovakia	462	Slovakia	447
Turkey	453	Ukraine	450	Malta	445
Brunei	442	Iceland	447	Serbia	440
Ukraine	441	Serbia	447	Greece	438
Serbia	440	Brunei	446	Iceland	436
UAE	431	Chile	444	Uruguay	430
Greece	430	Greece	441	Brunei	429
Romania	428	Uruguay	435	Romania	428
Kazakhstan	425	UAE	432	Ukraine	428
Mongolia	425	Qatar	432	Qatar	419
Cyprus	418	Romania	428	UAE	417
Bulgaria	417	Kazakhstan	423	Costa Rica	415
Moldova	417	Bulgaria	421	Mexico	415
Qatar	414	Moldova	417	Moldova	411
Chile	412	Malaysia	416	Brazil	410
Uruguay	409	Mongolia	412	Jamaica	410
Malaysia	409	Cyprus	411	Colombia	409
Montenegro	406	Colombia	411	Peru	408
Azerbaijan	397	Costa Rica	411	Montenegro	405
Mexico	395	Mexico	410	Bulgaria	404
Thailand	394	Thailand	409	Argentina	401
Peru	391	Peru	408	Panama	392
Georgia	390	Argentina	406	Malaysia	388
North Macedonia	389	Brazil	403	Kazakhstan	386
Saudi Arabia	389	Jamaica	403	Saudi Arabia	383
Costa Rica	385	Montenegro	403	Cyprus	381
Colombia	383	Saudi Arabia	390	Thailand	379
Brazil	379	Panama	388	Mongolia	378
Argentina	378	Georgia	384	Georgia	374
Jamaica	377	Indonesia	383	Guatemala	374
Albania	368	Azerbaijan	380	Paraguay	373
Indonesia	366	North Macedonia	380	Azerbaijan	365
Palestine	366	Albania	376	El Salvador	365
Morocco	365	Jordan	375	Indonesia	359
Uzbekistan	364	El Salvador	374	North Macedonia	359
Jordan	361	Guatemala	373	Albania	358
Panama	357	Palestine	369	Dominican Republic	351
Kosovo	355	Paraguay	368	Palestine	349

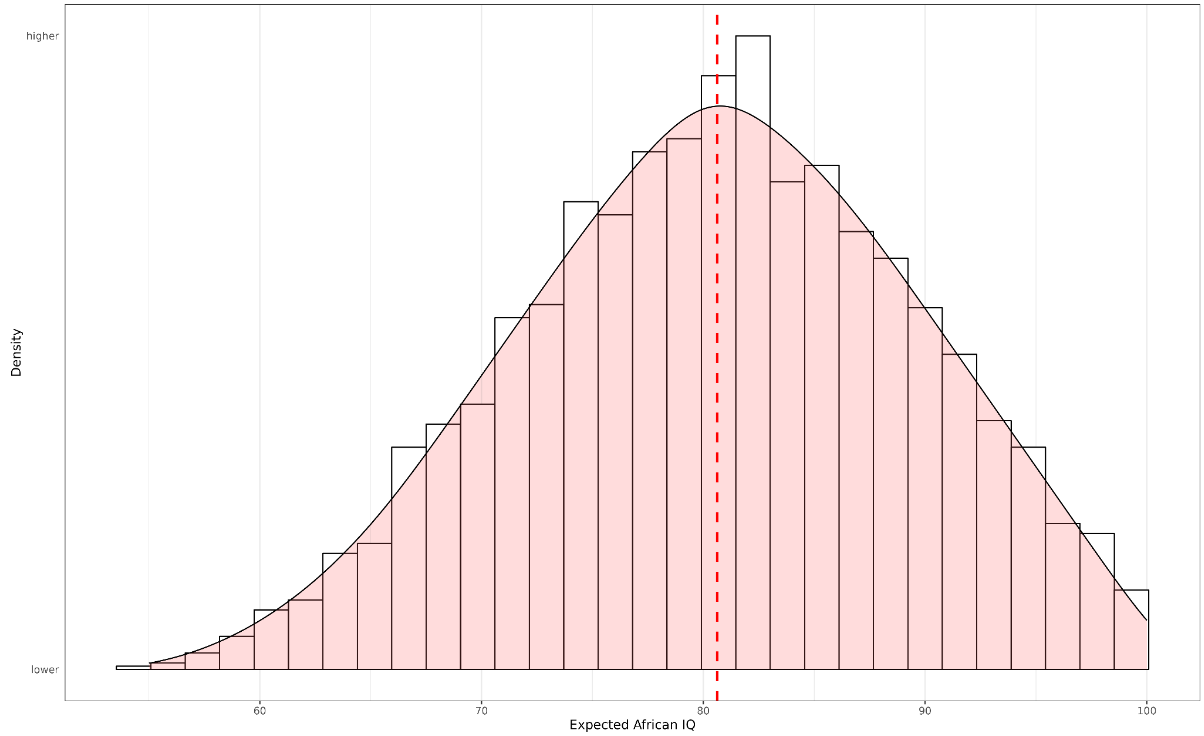
Philippines	355	Morocco	365	Philippines	347
Guatemala	344	Dominican Republic	360	Jordan	342
El Salvador	343	Kosovo	357	Kosovo	342
Dominican Republic	339	Philippines	356	Morocco	339
Paraguay	338	Uzbekistan	355	Uzbekistan	336
Cambodia	336	Cambodia	347	Cambodia	329

Some researchers have argued that the samples of Africans who took the Raven's test collected by Lynn have low levels of convergent validity and are taken from unrepresentative samples (Wicherts et al., 2010). The low scores of Africans (70) on these tests cannot be blamed on selective sampling or reporting, as the average African IQ converges to an average of roughly 70 regardless of the source (Warne, 2022), including sources that rely solely on results from scholastic assessments. The evidence Wicherts et al. presented regarding IQ scores of Africans having lower levels of validity than Europeans was convincing, but not necessarily indicative of an upward or downward bias.

The expected African IQ can be estimated based on several parameters, including the average IQ of Blacks, the percentage of the difference between Blacks and Whites that is due to additive genetics, the percentage of admixture in Blacks that is European (20%), and the extent to which the environment of Sub-Saharan Africa depresses IQ scores. For example, if the between-group heritability of IQ between African Americans and White Americans is 100%, and the difference between them is 18 points, and the environment of Africa depresses IQ scores by 10 points, then the expected Sub-Saharan African IQ is 67.5 (67.5 = (82-.2*100)/.8 - 10).

If the expected African IQ differs greatly from the observed one, then this difference is likely to be due to test bias or incorrect assumptions. To test whether this was the case, the expected Sub-Saharan African IQ was estimated based on a range of possible parameters. The range of the American Black IQ was assumed to be between 80-90, for the between-group heritability it was assumed to be 0-100%, and the extent to which the environment of Africa depresses Black IQs was assumed to be between 0 to 20 points. Using these parameter ranges, the expected IQ of Sub-Saharan Africa could be anywhere from 55 to 100, as shown in Figure 5.

Figure 5. Density plot of possible Sub-Saharan African IQs according to the possible range of parameters that was chosen.



There is fairly robust evidence, from military-based randomization studies (Carlsson et al., 2012) and latent modeling (Karwowski & Milerski, 2021; Lasker & Kirkegaard, 2022; Ritchie et al., 2015) that education improves IQ scores, though this improvement does not translate to greater general intelligence (e.g. increases in accumulated knowledge, but not reaction time). If this conclusion is accepted, then it must be the case that differences in IQ between nations that are due to differences in educational attainment must lead to bias in favour of the more educated countries. Besides this, there is quantitative evidence summarized by Warne (2023) which indicates that unschooled populations in Central Asia do not reason about problems on IQ tests the same way Westerners do: when asked which of a set of four objects do not fit together (e.g. an axe, saw, hammer, and log), they will typically choose one of the tools, as not much can be done without three tools and no object to operate with (Lurija, 1978).

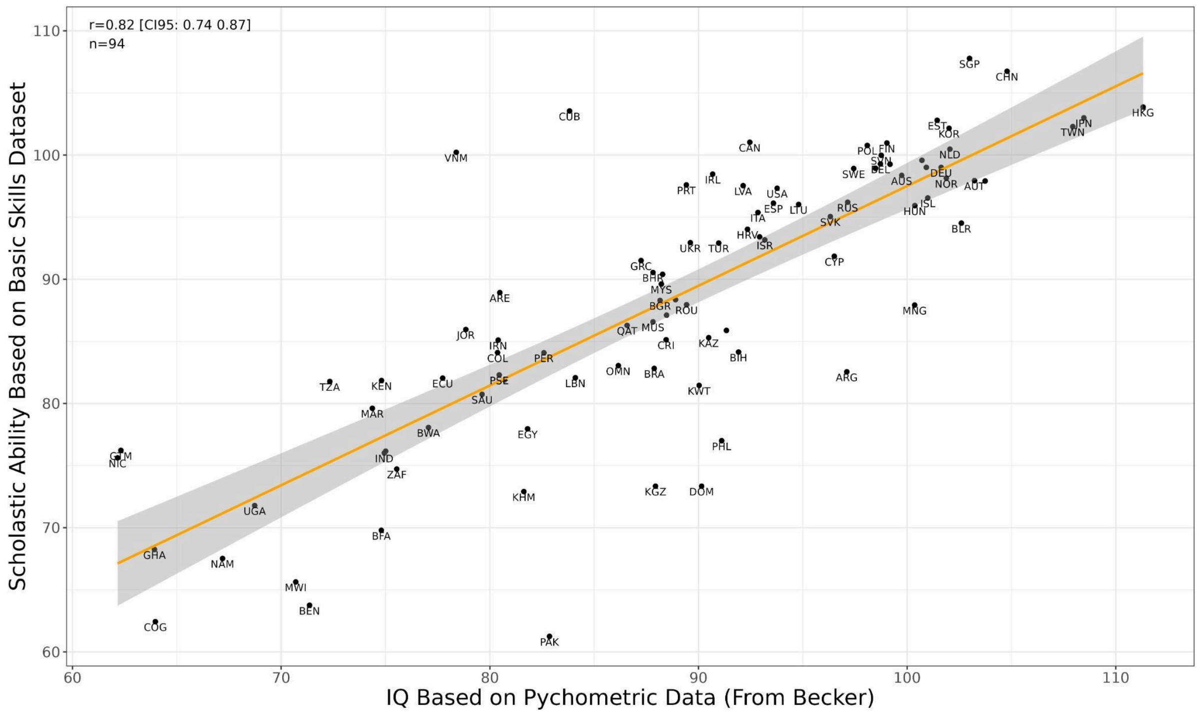
This bias in testing that occurs due to some populations being uneducated can be tested by comparing results from psychometric testing (IQ tests) and those based on scholastic tests (e.g. PIRLS, PISA, TIMSS tests). While the quality of education varies by country, students who take scholastic tests are active in educational institutions, which should reduce the bias that results from unschooling. In terms of regional differences, scores on psychometric and scholastic tests are highly correlated regionally (r = .97); the only prominent outliers being the East Asians and Central Asians who score about 4 to 5 points higher on psychometric tests in comparison to scholastic tests, as shown in Table 4. This indicates that differences in educational attainment between countries are not a practically significant source of bias when estimating the average levels of intelligence between regions, as matching populations for years of schooling does not change the average differences. Given that most scholastic tests do not show large violations of measurement invariance, it would be appropriate to conclude that the IQ tests do not show large biases against undeveloped nations.

Table 4. Estimated regional IQ by dataset. BSD - basic skills dataset, WBTS - world bank test scores, RSAS - Rindermann's scholastic estimates, BSAS - Becker's scholastic estimates, BQNW - Becker's quality weighted psychometric estimates, BNW - Becker's sample size weighted estimates, BUW - Becker's unweighted estimates, SCH - average of the scholastic estimates (BSD, WBTS, RSAS, BSAS), PSY - average of the psychometric estimates (BNW, BUW, BQNW).

Region	BSD	WBTS	RSAS	BSAS	BQNW	BNW	BUW	SCH	PSY
Eastern Asia	101.76	98.89	97.51	100.63	103.37	103.27	105.81	99.70	104.15
Northern America	99.18	100.75	98.76	99.23	95.55	95.62	93.84	99.48	95.00
Western Europe	99.16	99.16	98.12	98.68	100.23	99.83	101.68	98.78	100.58
Northern Europe	98.76	99.80	97.86	98.33	96.98	96.72	97.61	98.69	97.10
Australia and New Zealand	98.68	100.25	98.26	97.71	100.07	100.03	100.33	98.72	100.14
Eastern Europe	93.76	94.95	93.26	94.98	93.24	93.18	95.22	94.24	93.88
Southern Europe	90.80	91.55	90.01	90.66	91.60	91.52	91.93	90.75	91.68
South-eastern Asia	88.11	87.42	85.76	88.61	89.10	88.98	87.24	87.47	88.44
Western Asia	86.31	85.03	79.32	79.69	83.28	83.15	84.97	82.59	83.80
Latin America / Caribbean	82.48	82.01	75.41	78.18	81.29	80.99	81.51	79.52	81.26
Central Asia	79.32	88.93	78.76	81.52	86.98	86.98	89.29	82.13	87.75
Northern Africa	79.19	78.21	75.51	72.09	78.21	78.17	78.27	76.25	78.22
Southern Asia	74.12	78.54	74.26	76.62	76.44	76.33	78.22	75.88	76.99
Sub-Saharan Africa	70.32	77.71	65.93	66.54	69.60	69.51	70.30	70.12	69.80

It's worth mentioning that most researchers, including Becker and Rindermann, used scholastic estimates of ability derived from international tests to estimate the intelligence of nations. These data sources are immune to many of the biases that plague the estimates that are based on convenience samples: they tend to test about a thousand students per country, the samples are roughly representative of the student body of the country, and the same test is administered to all countries at roughly the same time. Within individuals, scores on IQ tests and scholastic ability tests correlate positively (Saß et al., 2017; Flores-Mendoza et al., 2018) and differences in IQ between nations correlate highly with scholastic estimates, such as those from the Basic Skills Dataset (r = .82), as shown in Figure 6. If it is the case that these scholastic estimates correspond closely with the psychometric ones between nations, then that suggests that the psychometric data is not of low quality.

Figure 6. Relationship between measured IQ and scholastic ability by country.



The relationship between IQ based on psychometric data and scholastic estimates also holds within regions, although the relationship attenuated (r = .41, weighted by sample size), as shown in Table 5. This indicates that this correlation is not a function of regions being assigned systematically lower or higher values by the data sources, rather that nations differ in ability, and these differences are reflected in test performance.

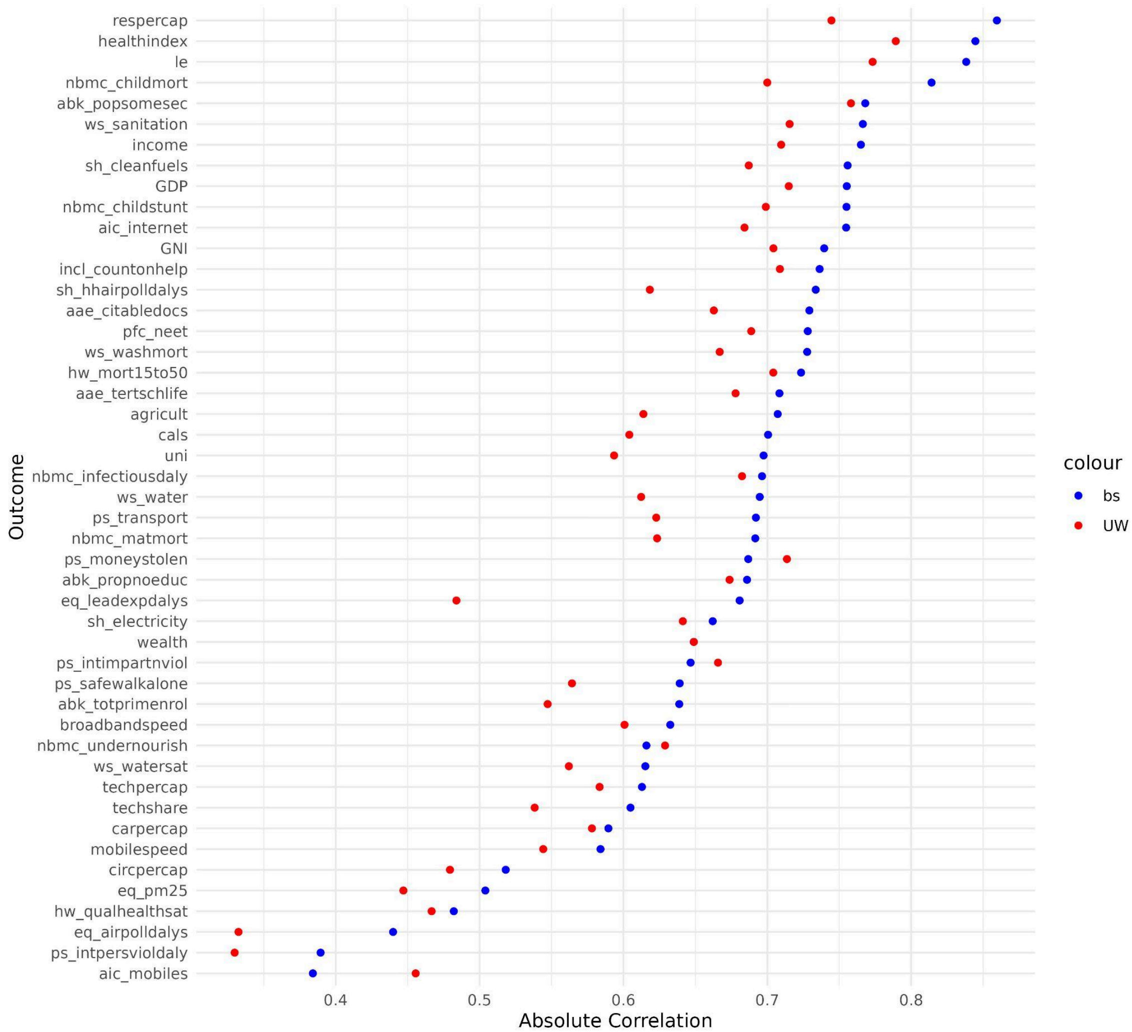
Table 5. Correlation between Becker's unweighted estimates of IQ and the world bank test score results by region. World bank test scores were used over the basic skills dataset because the world bank dataset measured more nations.

Region	Correlation	Sample Size
Central Asia	0.97	4
Sub-Saharan Africa	0.70	22
Eastern Europe	0.66	8
Eastern Asia	0.60	5
Western Asia	0.58	14
Southern Europe	0.44	9
South-eastern Asia	0.39	8
Latin America / Caribbean	0.29	15
Southern Asia	0.23	6
Northern Europe	0.07	10
Northern Africa	-0.41	3

Western Europe	-0.49	6

When correlations between indicators of development between the psychometric and scholastic estimates are contrasted, they are typically similar in magnitude, as shown in Figure 7. The correlation between the correlations derived from both variables is .91, further evidencing that scholastic and psychometric tests are measuring a similar construct across countries.

Figure 7. Absolute correlations between indicators of development and average IQs based on Becker's unweighted estimates (red) and estimates of average ability from the basic skills dataset (blue). National variables were transformed and their missing data was imputed.



Sear (2022) also noted that there was no formal search strategy or exclusion strategy carried out by Becker and Lynn - this is a fair criticism, but keep in mind that search strategies are easy to falsify and that flexibility is necessary to estimate national intelligence. In some cases, unweighted means are more accurate than sample size weighted means when the sample sizes of the studies are large, when the sample sizes are small, it would be better to weigh by the sample size. For countries that have a large amount of data (e.g. South Africa) adding psychiatric, foreign, or rural samples to the dataset would be unnecessary. In other countries that have no data available, low quality samples would be better than none. In most nations, the scholastic data is of higher quality than the psychometric data, but if the psychometric data is of high quality, then it may be wise to weigh it more highly for that specific nation.

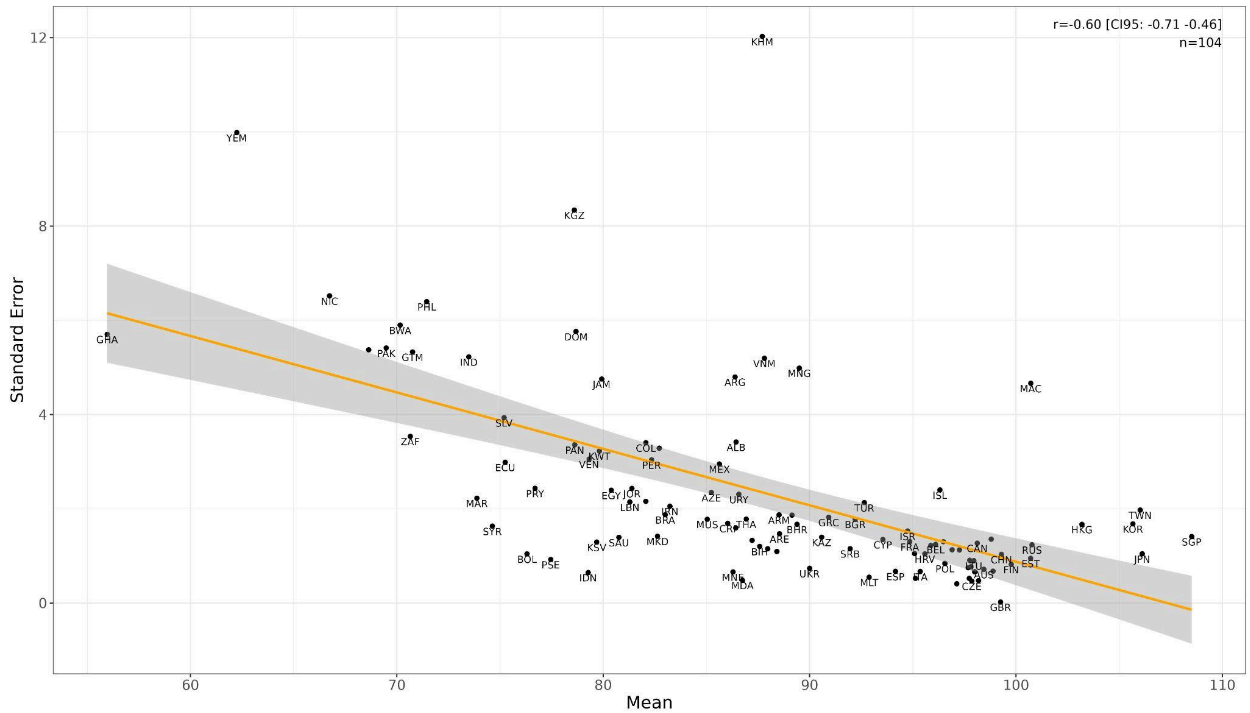
3.3. National IQ standard errors

Sear's focal criticism of the national IQ datasets, particularly Lynn's and Becker's, was that the quality of data is not equally distributed across regions. This is an inevitability, given less developed countries have lower data quality, thus the criticism is not specific to intelligence measurements (World Economics, 2023). Many countries in Becker's dataset were estimated using small samples -- this is true, but a small sample is still better than none, and even a sample of 20 can provide a reasonably precise estimate of a population mean, as the standard error will be only 3.4 IQ points. The true standard error of national IQ estimates is even higher than this, as the various proxies for national intelligence that were collected only correlated at .87 on average, implying an average standard error of 5.41 (5.41 = sqrt(1 - 0.87) x 15). This large standard error indicates that the error variance is due to heterogeneity between samples, not random sampling error. Restricting to the earlier set of datasets that had no overlapping data (recent TIMSS/PIRLS/PISA results, Rindermann's SAS estimates, and Becker's quality weighted psychometric estimates) resulted in the same average correlation (.87). In any case, many other national datasets were based on small samples, when nothing else was available, and they were not excessively criticized for this reason (Kirkegaard & Karlin, 2020).

Warne (2022) argued in a reply to Sear that the quality of Becker's data does not vary by regional group or average level of national IQ, based on the fact that Becker's quality assessments of the data do not vary by the average IQ of the sample. This is incorrect, as high levels of sample quality in certain regions may be indicative of fraud. Empirically, Becker's quality weighted estimates of intelligence have roughly the same correlation with SDI (.81) as his unweighted estimates (.83). Based on priors, it should be the case that higher quality samples should result in more accurate estimates of intelligence; because they don't, the alternative hypothesis that the higher quality samples are more likely to be fraudulent must be considered.

The hypothesis that lower IQ nations have more imprecisely estimated means by collecting estimates of national intelligence that were based on different data (recent TIMSS/PIRLS/PISA assessments, Becker's psychometric estimates weighted by quality, Rindermann's estimates of scholastic ability) and estimating the means and the standard errors, where the standard deviation of the sample averages divided by the square root of the number of samples. Standard errors and means are correlated negatively between countries ($r = -0.60$, $p < .001$), meaning that estimates made of lower IQ countries were less accurate, as shown in Figure 8. On average, a country's estimated IQ has a standard error of 2.33, though this figure varies substantially by country: from 0.41 in Denmark to 12 in Cambodia.

Figure 8. Plot of standard errors and means of national IQ estimates.



This is not due to intelligent countries having data from more samples; the negative relationship between the mean and the standard error holds after controlling for the number of samples used to estimate intelligence, as shown in Table 6.

Table 6. Regression models that predict the standard errors of the estimates. * -> p < .05, ** -> p < .01, *** -> p < .001.

Parameter	Model 1	Model 2	Model 3
Estimated mean IQ	-0.12 (0.016)***		-0.089 (0.018)***
Number of samples		-0.49 (0.079)***	-0.26 (0.086)**
R^2	0.36	0.28	0.41

3.4. Estimating national intelligence averages

To compute the intelligence of nations, measured IQ and achievement test results are used. While these are not perfect measurements of intelligence, IQ scores are predictive of socially important outcomes and show low levels of bias between groups (Jensen, 1980), in contrast to personality measurements which are confounded by reference group effects (Credé et al., 2010).

Multiple sources of data were consulted, including psychometric estimates (Becker unweighted, Becker sample-weighted, Becker quality-weighted), scholastic estimates (World Bank test scores, basic skills dataset, PISA 2022 results, Becker scholastic estimates, Rindermann scholastic estimates), and composite estimates (Lynn 2012, Lynn 2002, Becker composite, Rindermann composite). If a dataset included geographic imputations, the imputations were removed.

Rindermann included estimates that were based on performance in the mathematics olympiad for North Korea, Belarus, Brunei, Cambodia, Mauritania, Tajikistan, and Turkmenistan; these were kept, though this was most relevant for Turkmenistan, which has no measured data. Samples were normed in a fashion that placed the UK at a mean of 99.26, which is roughly what the UK's average psychometric IQ is compared to British Whites. In one case where a UK sample was not available, the average of Americans was used as an anchor instead.

It was tested whether some samples were of higher quality than others, and statistical analysis suggested that this was the case (which is available in the supplement), though subjective indicators of quality (e.g. how new the data is, how much data the indicators are based on) was also taken into consideration. Concretely speaking, Lynn's and Becker's composite estimates were given lower weights due to the fact that they are based on older data and provide little incremental validity. An overall average was computed using nested means:

- Nest 1: Lynn's estimates, Becker's composite estimates, Becker's scholastic estimates, and recent TIMSS math results.
- Nest 2: average of nest 1, recent TIMSS science results, average of Becker's psychometric estimates, recent PIRLS results, World Bank test scores
- Nest 3: average of nest 2, recent PISA results, and Rindermann's scholastic estimates
- Nest 4: average of nest 3, basic skills dataset, Rindermann's IQ estimates

Another method was tested where random effects meta-analytic means were calculated for each country. Sample sizes were assigned based on the perceived quality of each dataset:

N = 10 → TIMSS math, Becker psychometric averages
N = 20 → Becker composite, TIMSS science, Lynn estimates, Becker's scholastic estimates
N = 40 → PIRLS results, PISA results, WB test scores, Rindermann SAS estimates
N = 80 → Rindermann IQ estimates and Basic Skills dataset

Samples that displayed unusual heterogeneity or extreme means in either direction were manually reviewed, where the sources were consulted and a subjective best estimate was given. Most countries that had suspiciously large amounts of variance in estimates were undeveloped countries, though there were notable exceptions like Vietnam and China. In the case of Vietnam, Becker included estimates of the IQ of rural Vietnamese who scored an IQ of 78 in his dataset; their performance on the PISA tests suggests that the true national IQ is somewhere between 95 and 100. In China, the differences in estimates between datasets is due to a debate over how the PISA samples should be weighted relative to the rest of China. The World Bank estimated its human capital to be the IQ equivalent of 90, while the Basic Skills Dataset estimated its human capital to be the IQ equivalent of 107 -- both agreed that the PISA results were not representative, but differed in the extent to which this biased the overall average. Using the China Family Panel Study (CFPS, 2020), regional differences in cognitive ability were calculated, and it was determined that China's recent PISA results are biased because they come from more intelligent provinces like Shanghai (IQ = 107) and Beijing (IQ = 108), and that if the results were weighted relative to the whole population, they are indicative of an IQ of roughly 99. The scores from the IQ samples are also inflated by the fact that they come from educated and Eastern samples, when this bias is corrected for, the results imply an average of roughly 102 for the whole country.

In total, 42 countries had their national IQs estimated based on a manual review, and the estimates correlated at .97 with the estimates that would have been made otherwise and were 1.9 IQ points higher ($p < .001$, two-sided paired t-test) on average. In most cases, the manual revisions were unnecessary, as shown in Table 7.

Table 7. Average IQ by country, by method.

Country	Mathematical estimate	Manual (final) estimate
Afghanistan	74.80	75.70
Cambodia	83.09	84.10
Canada	100.22	100.88
China	101.03	100.20
Cuba	90.64	87.90
Dominica	68.96	75.84
Dominican Republic	77.07	82.41
Ecuador	80.50	82.04
Egypt	79.56	81.26
El Salvador	77.14	79.87
Equatorial Guinea	61.56	69.67
Estonia	101.14	101.86
Finland	100.62	100.86
Gambia	62.83	63.70
Guatemala	75.46	78.78
Haiti	71.89	72.74
Honduras	74.57	79.30
Hong Kong SAR China	103.54	106.02
Iraq	84.62	82.27
Ireland	98.02	99.10
Jamaica	77.18	79.82
Japan	103.96	105.90
North Korea		87.90
South Korea	104.00	103.84
Kuwait	79.51	84.26
Kyrgyzstan	77.29	80.51

Laos	84.23	84.77
Macao SAR China	102.62	103.90
Marshall Islands	80.45	86.50
Mongolia	89.66	93.37
Nepal	73.01	76.98
Netherlands	99.58	100.08
Nicaragua	74.39	77.95
Pakistan	73.42	70.86
Papua New Guinea	79.37	71.77
Romania	89.14	87.34
Samoa	81.91	88.00
Singapore	106.37	108.70
Taiwan	103.34	105.23
Uzbekistan	83.88	83.95
Vietnam	93.63	98.52
Zambia	70.52	77.00

4. Results

Measurements of national intelligence and socioeconomic development correlated at .88 between countries (n = 197). Average IQs and SDI have been plotted in Figures 9 and 10. The average IQ of the world is 85.3 when weighted by population size.

Figure 9. IQ by country.

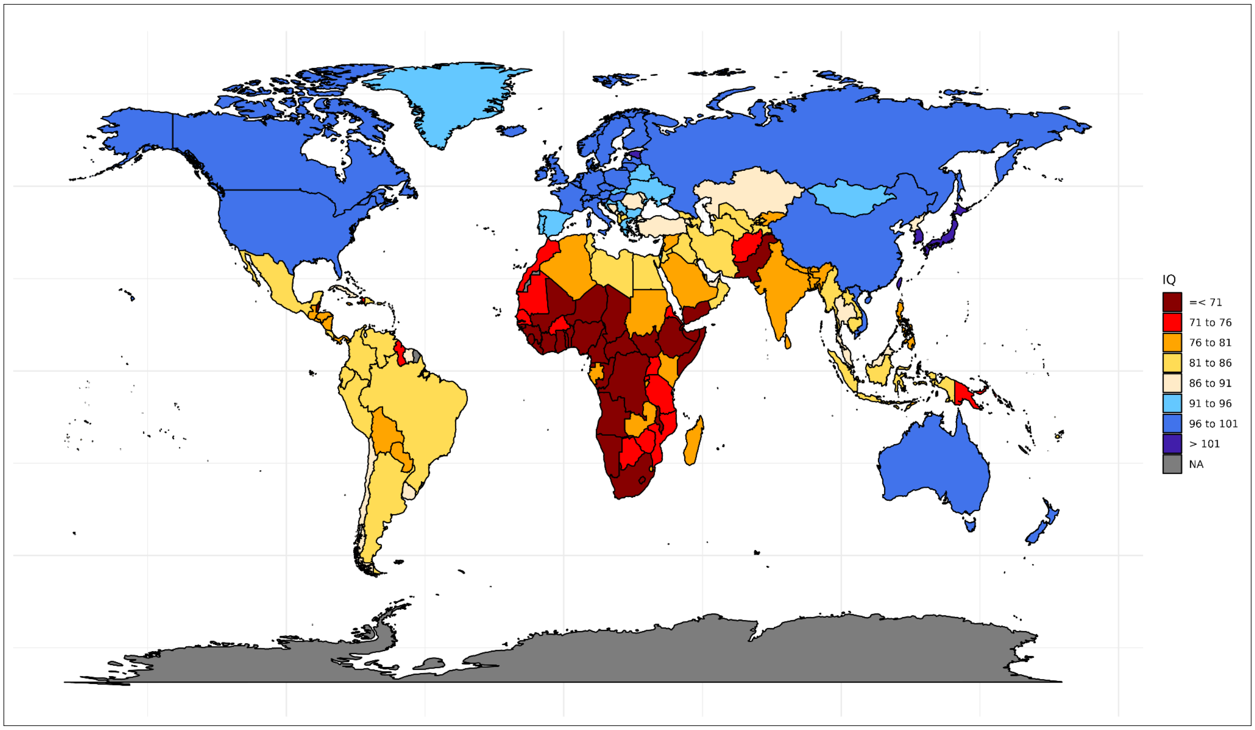
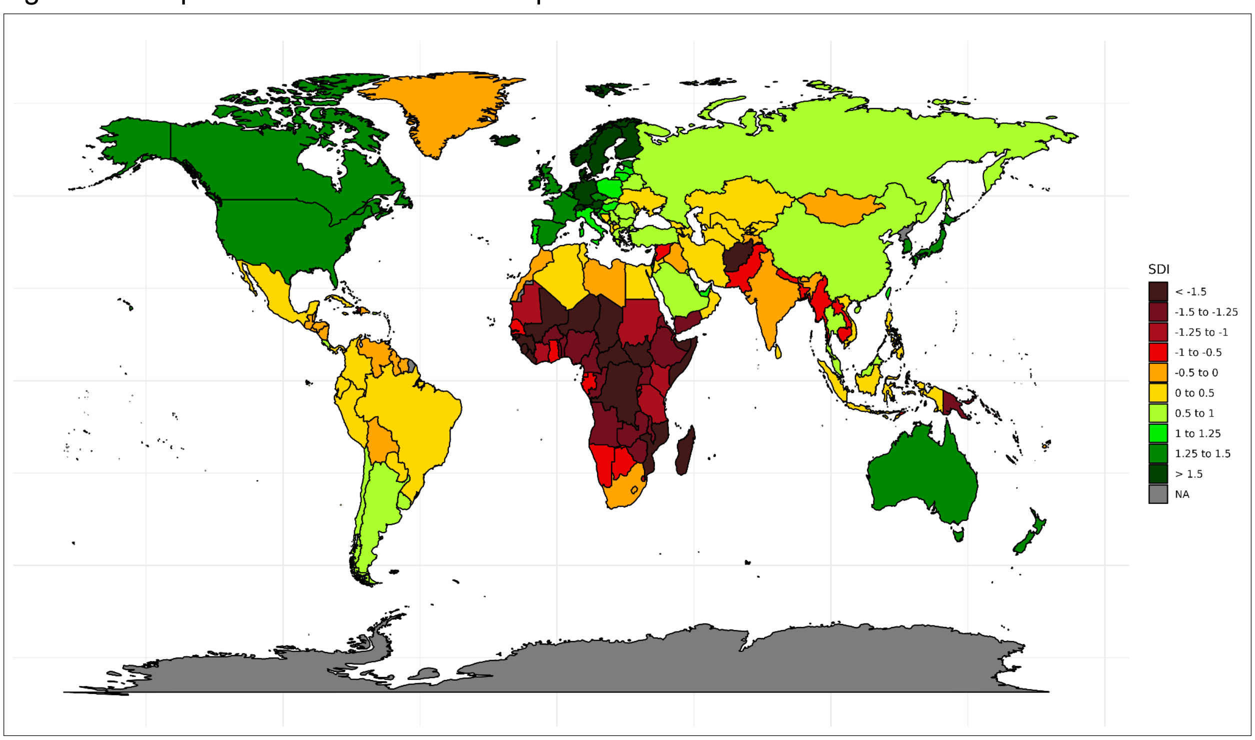
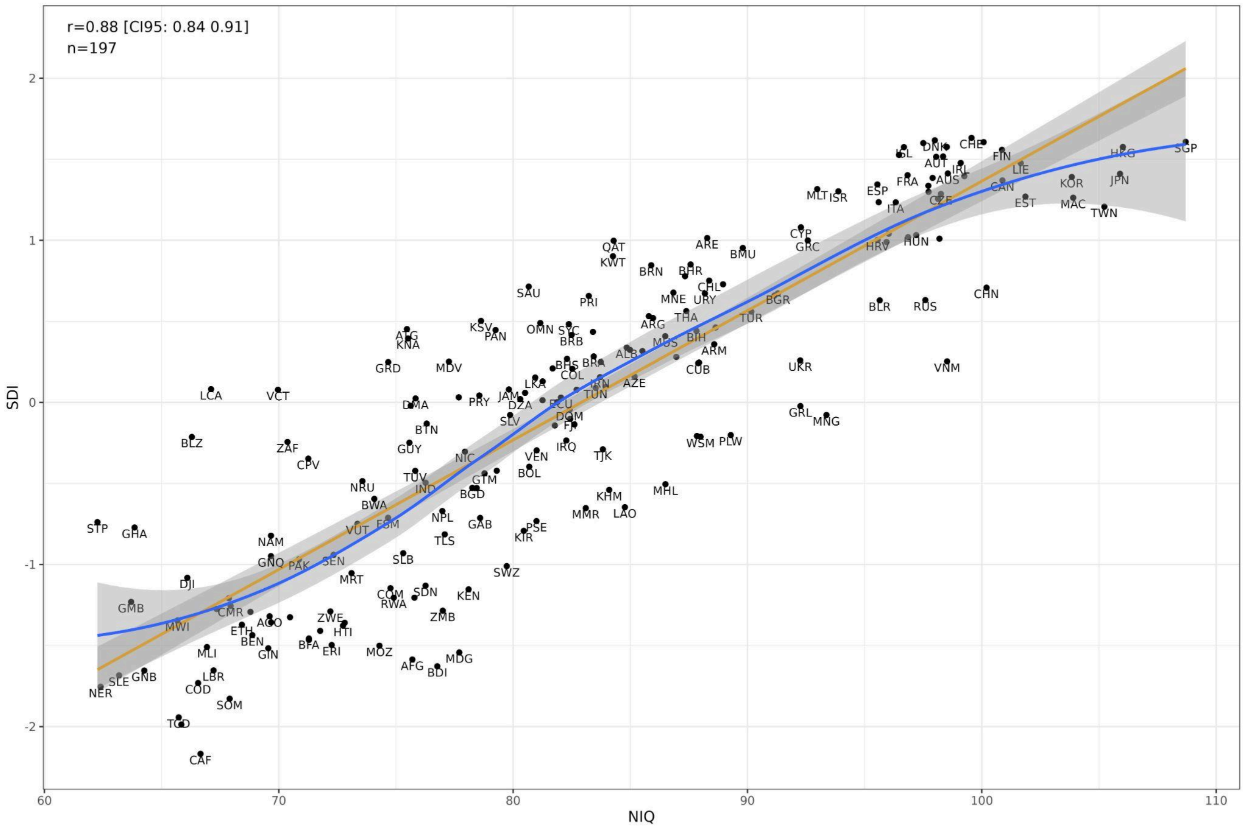


Figure 10. Map of Socioeconomic Development Around the World.



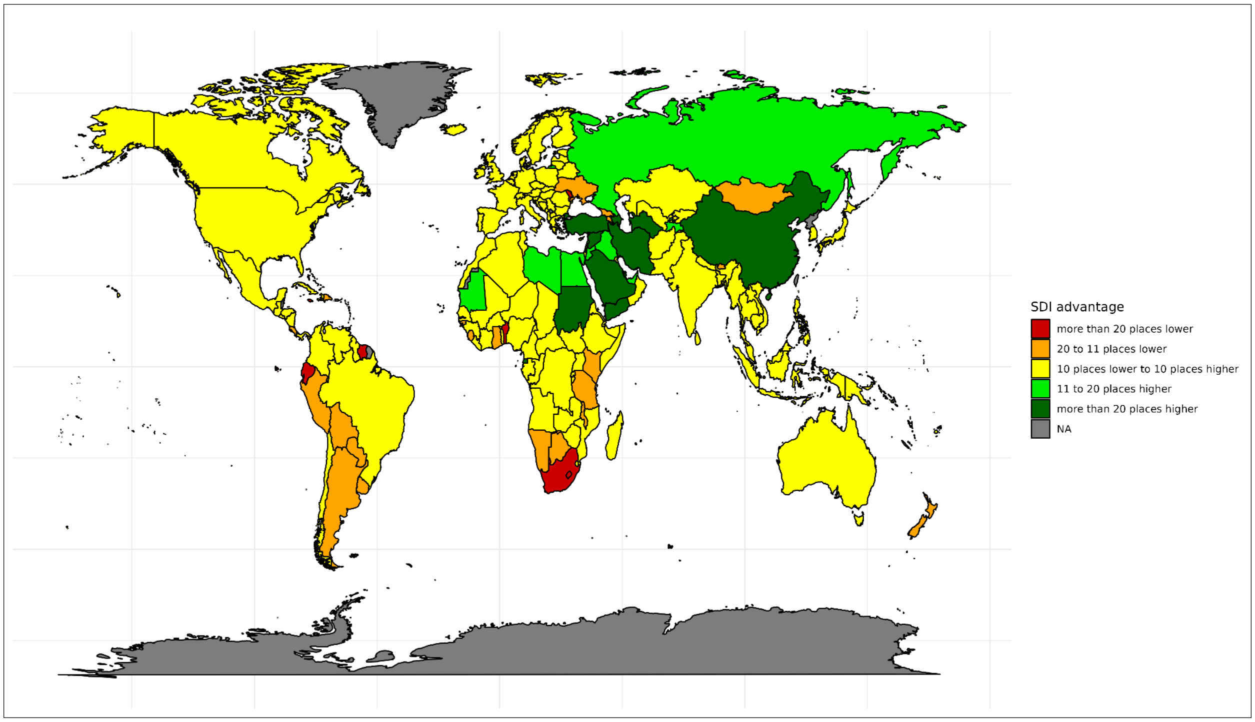
Heterogeneity was observed in the correlation between SDI and national IQ according to the Breusch-Pagan test ($p = .0012$), with lower IQ nations showing more variance in the relationship between intelligence and socioeconomic development. The non-linear relationship between the two variables marginally passed significance testing ($F = 2.54$, $p = .04$). The relationship between SDI and average IQ has been plotted in Figure 11.

Figure 11. Relationship between National IQs and the Socioeconomic Development Index.



Despite the strong levels of agreement between the measurements of socioeconomic development, there were still some large outliers in the relationship. Many Middle Eastern countries, China, and Turkey all rose over 20 ranks in our measurement of socioeconomic development relative to the Social Progress Index, as shown in Figure 12.

Figure 12. Difference in ranks between Social Development Index (SDI) and Social Progress Index (SPI). Green colour corresponds to higher relative rank, redder colour to lower.



Average IQs and SDIs have been displayed in Table 8, with average IQs ranging from 70.8 in Sub-Saharan Africa to 100.8 in Eastern Asia. Regional differences in intelligence and socioeconomic development highly correlate (r = .96), as shown in Figures 13 and 14.

Table 8. Average IQ and SDI by region.

Region	Average IQ	Average SDI
Eastern Asia	100.79	1.07
Western Europe	98.61	1.51
Northern Europe	98.46	1.41
Australia and New Zealand	98.34	1.33
Northern America	95.17	0.90
Eastern Europe	94.16	0.75
Southern Europe	90.69	0.94
South-eastern Asia	87.10	0.13
Western Asia	84.21	0.36
Polynesia	83.90	-0.26
Central Asia	83.64	0.09
Micronesia	80.94	-0.54
Latin America / Caribbean	80.18	0.09
Northern Africa	79.79	-0.19

Southern Asia	77.37	-0.42
Melanesia	75.72	-0.80
Sub-Saharan Africa	70.76	-1.22

Figure 13. Plot of average IQs and SDIs by region.

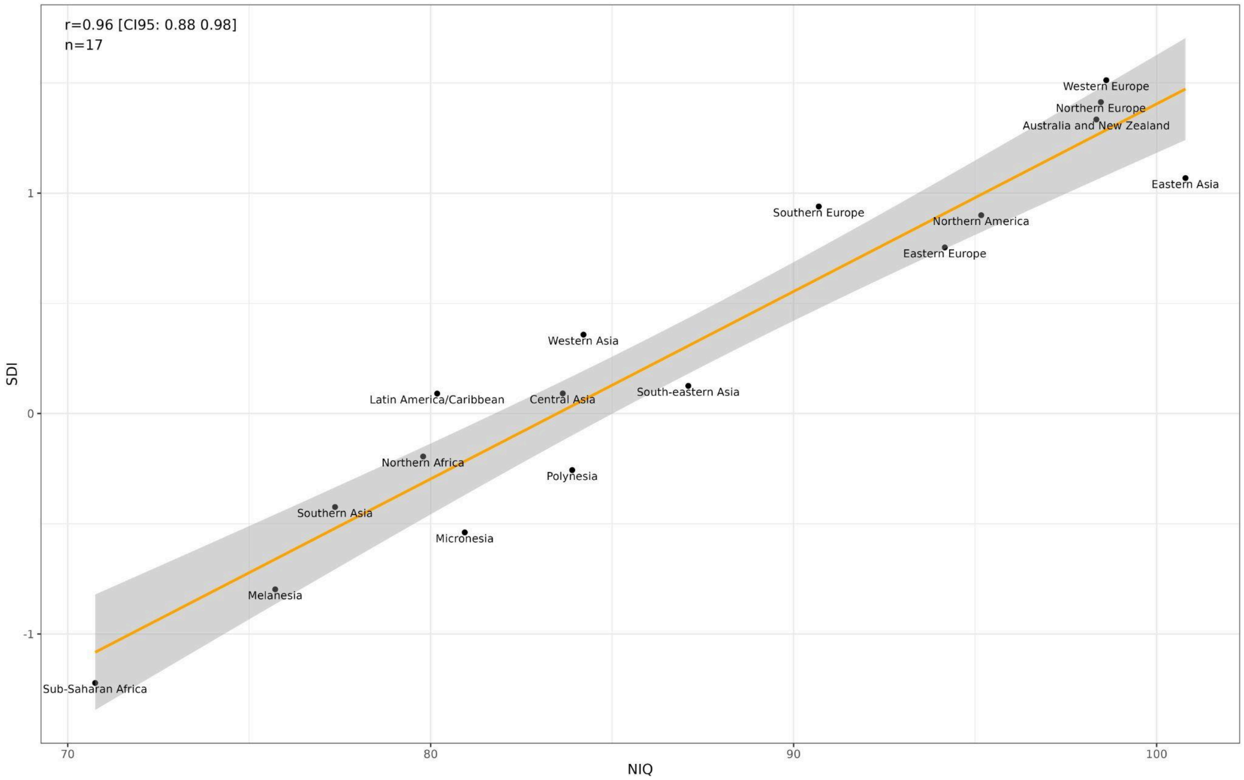
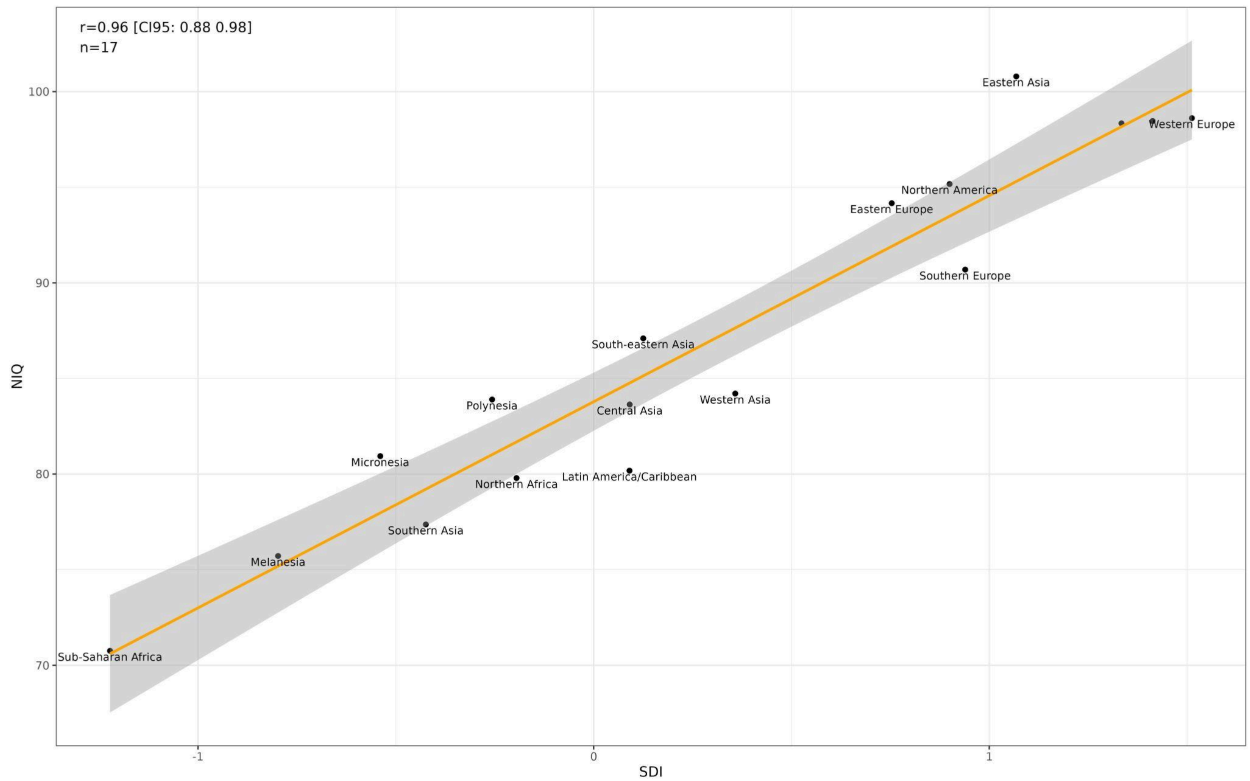
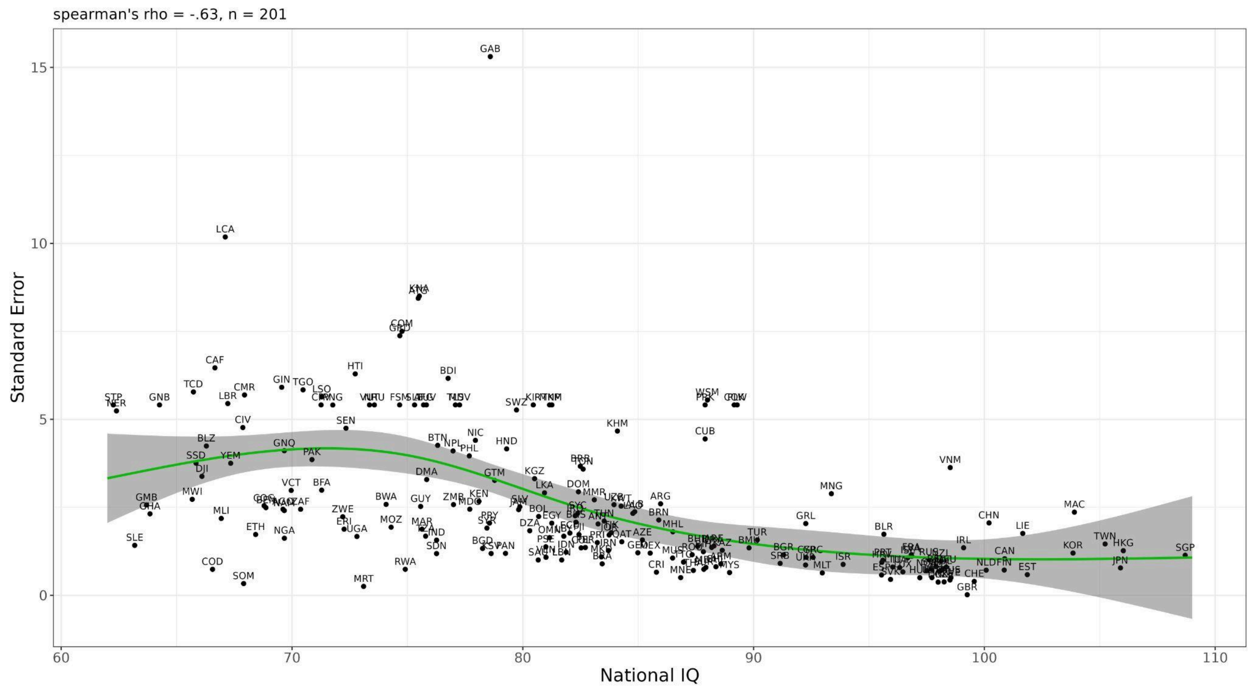


Figure 14. Plot of average IQs and SDIs by region (axes inverted).



The analysis that related the standard errors and the means of national IQs was repeated for the dataset that included all national IQ datasets. We found a negative correlation between standard errors and means (spearman's rho = -.63, p < .001), meaning that countries with higher IQs had their estimates more precisely taken, as shown in Figure 15. This negative correlation also held for socioeconomic development, where more developed countries had lower standard errors (rho = -.65, p < .001).

Figure 15. Relationship between standard errors of national IQs and estimated national IQ.



5. Discussion

We were able to replicate prior literature that found that measurements of socioeconomic development are correlated with measurements of human capital, though our correlation is higher than the ones found prior (r = .88). This is probably because our measurements of human capital and socioeconomic development are of higher quality than the ones that preceded it - the measurement of socioeconomic development is based on 47 variables and advanced statistical techniques were used to calculate the averages; the national IQ measurement is a composite of other datasets, which causes the error to decrease.

The large magnitude of the correlation is a function of the relationship being bidirectional: increases in intelligence have been observed as countries have become more economically developed, and the deficiency in IQ of certain undeveloped nations (e.g. Africa) clearly cannot be attributed to genetic causes, therefore it would be reasonable to conclude that socioeconomic development causes intelligence. On the other hand, intelligence is the most robust and strong predictor of economic growth (Francis & Kirkegaard, 2022), and causality from intelligence to socioeconomic development can be proven with the use of historical variables such as age heaping and cranial capacity.

Our measurement of socioeconomic development, the SDI, correlates highly with the HDI and the SPI (r = .98 and .97, respectively), indicating that it has high levels of external validity. The SDI estimates the development of authoritarian countries such as Iran, Saudi Arabia, Singapore, Turkey, Turkmenistan, and Russia to be higher than the SPI, probably because it does not base its estimates of socioeconomic development on cultural values or political indexes.

The national IQ estimates were shown to have non-negligible inaccuracy -- a standard error of roughly 5.41 IQ points. We have estimated that the composite measurement (SE of 2.6) has 50% less error than the average dataset that measures proxies for national intelligence. Most of the estimates made of individual countries are accurate, though a few have very high standard errors (Gabon, Cambodia, Cuba, Saint Lucia, and Haiti) or are based on dubious estimation methods (Turkmenistan was estimated using mathematical olympiad performance, North Korea was estimated using North Korean refugees and it was difficult to judge how to correct for Flynn Effects). We also found that more intelligent and developed countries tended to have more precisely estimated national IQs, even after controlling for the fact that intelligent and developed countries are more likely to be represented in these datasets.

The research on whether scholastic test scores between nations pass measurement invariance suggests that measurement invariance between countries is usually tenable, with nonverbal tests (e.g. mathematics) showing more invariance than verbal (e.g. reading) ones. As these nonverbal and verbal tests have differences of roughly the same magnitude across countries, the violations of measurement invariance are not likely to be a practically significant source of bias when assessing differences in IQ between countries. Some studies have suggested that matrix reasoning does not test intelligence equally between Europeans and Sub-Saharan Africans -- the research is not definitive enough to make inferences, unfortunately.

Some groups that are genetically highly similar still differ greatly in IQ: South Koreans score 16 points higher than North Korean refugees on cognitive tests, and African Americans score 11-14 points higher than Africans. This sets a rough upper limit on how much Flynn Effects can bias estimates of intelligence between nations. The magnitude of the observed differences between nations is much larger than this, with scores ranging from 108.7 in Singapore to 62.26 in Sao Tome. Because of that, it would be rational to conclude that the disparities in test scores between countries are largely due to true differences in ability instead of test bias.

6. Acknowledgement

We thank @notcomplex_ for handling the DOI data.

7. Appendix

Table A1. Estimated mean and standard error of IQ by country

Rank	Country	IQ	Standard Error
1	Singapore	108.70	1.14
2	Hong Kong SAR China	106.02	1.27
3	Japan	105.90	0.78
4	Taiwan	105.23	1.46
5	Macao SAR China	103.90	2.36
6	South Korea	103.84	1.20
7	Estonia	101.86	0.59
8	Liechtenstein	101.66	1.76
9	Canada	100.88	1.04
10	Finland	100.86	0.72
11	China	100.20	2.06
12	Netherlands	100.08	0.71
13	Switzerland	99.56	0.40
14	United Kingdom	99.26	0.02
15	Ireland	99.10	1.35
16	Australia	98.55	0.50
17	Vietnam	98.52	3.63
18	Sweden	98.51	0.44
19	Germany	98.35	0.80
20	Czechia	98.25	0.38
21	Poland	98.19	0.76
22	New Zealand	98.13	0.98
23	Austria	98.05	0.68
24	Denmark	98.00	0.37
25	Belgium	97.90	0.82
26	United States	97.73	0.50
27	Slovenia	97.72	0.73
28	Russia	97.59	1.01
29	Norway	97.50	0.70
30	Hungary	97.20	0.50
31	Latvia	96.85	1.11
32	France	96.83	1.15

33	Iceland	96.68	1.06
34	Luxembourg	96.47	0.67
35	Italy	96.33	0.79
36	Lithuania	96.03	0.80
37	Slovakia	95.93	0.45
38	Belarus	95.64	1.74
39	Portugal	95.60	1.00
40	Croatia	95.55	0.94
41	Spain	95.54	0.58
42	Israel	93.88	0.88
43	Mongolia	93.37	2.89
44	Malta	92.98	0.64
45	Greece	92.57	1.08
46	Cyprus	92.28	1.08
47	Greenland	92.26	2.04
48	Ukraine	92.25	0.86
49	Bulgaria	91.30	1.15
50	Serbia	91.15	0.91
51	Turkey	90.16	1.57
52	Bermuda	89.80	1.35
53	Palau	89.29	5.41
54	Cook Islands	89.16	5.41
55	Malaysia	88.96	0.65
56	Kazakhstan	88.64	1.28
57	Armenia	88.58	0.89
58	Chile	88.37	0.81
59	United Arab Emirates	88.28	1.40
60	Uruguay	88.18	1.36
61	Samoa	88.00	5.55
62	Moldova	87.93	0.79
63	Cuba	87.90	4.44
64	North Korea	87.90	5.41
65	Suriname	87.84	0.74
66	Bosnia & Herzegovina	87.82	1.24
67	Bahrain	87.57	1.39
68	Thailand	87.39	0.71
69	Romania	87.34	1.15
70	Trinidad & Tobago	86.96	0.94
71	Montenegro	86.84	0.50

72	Marshall Islands	86.50	1.81
73	Mauritius	86.49	1.06
74	Argentina	85.97	2.60
75	Brunei	85.89	2.14
76	Costa Rica	85.79	0.66
77	Mexico	85.52	1.20
78	Azerbaijan	85.18	1.57
79	Georgia	84.99	1.21
80	Albania	84.85	2.38
81	Laos	84.77	2.33
82	Qatar	84.29	1.52
83	Kuwait	84.26	2.53
84	Cambodia	84.10	4.67
85	Uzbekistan	83.95	2.58
86	Tajikistan	83.83	1.78
87	Jordan	83.74	1.71
88	Iran	83.71	1.27
89	Tunisia	83.52	2.11
90	Brazil	83.44	0.89
91	North Macedonia	83.41	1.09
92	Puerto Rico	83.23	1.50
93	Myanmar (Burma)	83.10	2.71
94	Peru	82.71	1.36
95	Tonga	82.61	3.59
96	Colombia	82.53	1.35
97	Barbados	82.49	3.67
98	Fiji	82.43	1.73
99	Dominican Republic	82.41	2.94
100	Seychelles	82.38	2.33
101	Bahamas	82.30	2.08
102	Iraq	82.27	2.26
103	Ecuador	82.04	1.77
104	Indonesia	81.88	1.22
105	Libya	81.78	1.68
106	Lebanon	81.69	1.00
107	Turkmenistan	81.26	5.41
108	Egypt	81.26	2.05
109	Northern Mariana Islands	81.16	5.41
110	Oman	81.16	1.64

111	Venezuela	81.00	1.08
112	Palestinian Territories	81.00	1.38
113	Sri Lanka	80.94	2.91
114	Bolivia	80.69	2.24
115	Saudi Arabia	80.67	1.00
116	Kyrgyzstan	80.51	3.31
117	Kiribati	80.45	5.41
118	Algeria	80.30	1.83
119	El Salvador	79.87	2.51
120	Jamaica	79.82	2.44
121	Eswatini	79.73	5.27
122	Honduras	79.30	4.16
123	Panama	79.25	1.19
124	Guatemala	78.78	3.27
125	Kosovo	78.63	1.19
126	Gabon	78.59	15.31
127	Paraguay	78.56	2.05
128	Syria	78.45	1.91
129	Bangladesh	78.26	1.33
130	Kenya	78.10	2.67
131	Nicaragua	77.95	4.40
132	Madagascar	77.70	2.45
133	Philippines	77.68	3.96
134	Maldives	77.26	5.41
135	Timor-Leste	77.08	5.41
136	Zambia	77.00	2.58
137	Nepal	76.98	4.10
138	Burundi	76.76	6.17
139	Bhutan	76.31	4.26
140	India	76.27	1.57
141	Sudan	76.26	1.19
142	Dominica	75.84	3.29
143	Tanzania	75.79	1.68
144	Afghanistan	75.70	5.41
145	Morocco	75.63	1.88
146	Guyana	75.57	2.52
147	St. Kitts & Nevis	75.52	8.50
148	Antigua & Barbuda	75.47	8.44
149	Solomon Islands	75.31	5.41

150	Rwanda	74.91	0.74
151	Comoros	74.77	7.50
152	Grenada	74.67	7.38
153	Mozambique	74.30	1.94
154	Botswana	74.08	2.58
155	Nauru	73.57	5.41
156	Vanuatu	73.36	5.41
157	Mauritania	73.10	0.25
158	Uganda	72.81	1.67
159	Haiti	72.74	6.29
160	Senegal	72.34	4.75
161	Eritrea	72.26	1.88
162	Zimbabwe	72.20	2.23
163	Papua New Guinea	71.77	5.41
164	Burkina Faso	71.29	2.99
165	Lesotho	71.29	5.64
166	Cape Verde	71.26	5.41
167	Pakistan	70.86	3.86
168	Togo	70.48	5.84
169	South Africa	70.37	2.45
170	St. Vincent & Grenadines	69.97	2.98
171	Nigeria	69.67	1.62
172	Equatorial Guinea	69.67	4.11
173	Namibia	69.67	2.41
174	Angola	69.61	2.45
175	Guinea	69.55	5.91
176	Benin	68.87	2.49
177	Congo - Brazzaville	68.79	2.54
178	Ethiopia	68.42	1.73
179	Cameroon	67.94	5.69
180	Somalia	67.90	0.33
181	Côte d’Ivoire	67.87	4.77
182	Yemen	67.34	3.75
183	Liberia	67.22	5.45
184	St. Lucia	67.11	10.18
185	Mali	66.93	2.18
186	Central African Republic	66.66	6.46
187	Congo - Kinshasa	66.56	0.74
188	Belize	66.29	4.24

189	Djibouti	66.10	3.38
190	South Sudan	65.84	3.75
191	Chad	65.73	5.78
192	Malawi	65.68	2.73
193	Guinea-Bissau	64.26	5.41
194	Ghana	63.85	2.32
195	Gambia	63.70	2.57
196	Sierra Leone	63.18	1.42
197	Niger	62.40	5.24
198	São Tomé & Príncipe	62.26	5.41

Table A2. Average SDI, HDI, and SPI index score by country.

Rank	Country	SDI	SPI	HDI
1	Switzerland	1.632	89.280	0.960
2	Denmark	1.617	90.480	0.946
3	Singapore	1.607	84.170	0.940
4	Netherlands	1.606	87.720	0.941
5	Norway	1.600	90.780	0.961
6	Sweden	1.576	89.350	0.945
7	Hong Kong SAR China	1.576		
8	Iceland	1.575	89.550	0.959
9	Finland	1.558	90.130	0.938
10	Monaco	1.549		
11	Luxembourg	1.527	87.480	0.926
12	Germany	1.517	87.730	0.945
13	Austria	1.515	87.500	0.916
14	Ireland	1.477	86.870	0.942
15	Liechtenstein	1.476		0.934
16	Australia	1.412	87.310	0.945
17	Japan	1.410	85.430	0.924
18	France	1.402	84.230	0.902
19	United Kingdom	1.396	84.530	0.929
20	South Korea	1.391	85.680	0.922
21	Belgium	1.385	85.980	0.934
22	Canada	1.370	86.940	0.934
23	Spain	1.345	84.360	0.903
24	San Marino	1.338		0.855
25	Slovenia	1.337	83.810	0.917
26	Malta	1.316	82.850	0.914

27	Israel	1.302	81.780	0.919
28	United States	1.299	82.070	0.925
29	Czechia	1.286	84.920	0.893
30	Estonia	1.269	85.440	0.892
31	Macao SAR China	1.263		0.922
32	New Zealand	1.256	86.000	0.937
33	Portugal	1.235	84.400	0.864
34	Italy	1.234	83.400	0.894
35	Andorra	1.227		0.863
36	Taiwan	1.207		
37	Cyprus	1.080	81.670	0.895
38	Lithuania	1.041	82.120	0.880
39	Hungary	1.032	77.620	0.849
40	Latvia	1.019	80.840	0.868
41	United Arab Emirates	1.014	72.780	0.913
42	Poland	1.010	79.740	0.878
43	Croatia	1.003	80.660	0.858
44	Greece	0.999	80.120	0.887
45	Qatar	0.997	69.470	0.855
46	Slovakia	0.990	80.020	0.857
47	Bermuda	0.953		
48	Kuwait	0.902	73.680	0.832
49	Bahrain	0.851	66.460	0.878
50	Brunei	0.846		0.830
51	Romania	0.779	75.500	0.826
52	Chile	0.751	78.280	0.856
53	Malaysia	0.729	73.400	0.807
54	Saudi Arabia	0.714	65.420	0.871
55	China	0.708	67.570	0.762
56	Montenegro	0.677	74.790	0.832
57	Bulgaria	0.673	75.870	0.804
58	Uruguay	0.672	79.600	0.818
59	Serbia	0.659	74.620	0.806
60	Puerto Rico	0.657		
61	Russia	0.631	69.600	0.835
62	Belarus	0.630	70.520	0.813
63	Thailand	0.563	69.660	0.800
64	Turkey	0.560	66.710	0.838

65	Costa Rica	0.532	78.200	0.814
66	Argentina	0.520	77.770	0.846
67	Kosovo	0.503		
68	Oman	0.490	69.530	0.829
69	Seychelles	0.483		0.795
70	Kazakhstan	0.462	69.930	0.815
71	Antigua & Barbuda	0.452		0.794
72	Panama	0.447	71.970	0.809
73	Bosnia & Herzegovina	0.441	70.070	0.780
74	North Macedonia	0.435	70.270	0.777
75	Barbados	0.416	76.760	0.794
76	Mauritius	0.408	72.910	0.809
77	St. Kitts & Nevis	0.395		0.780
78	Armenia	0.359	73.320	0.766
79	Albania	0.339	71.660	0.802
80	Georgia	0.324	72.160	0.805
81	Mexico	0.317	68.370	0.768
82	Brazil	0.284	68.940	0.761
83	Trinidad & Tobago	0.281	72.670	0.816
84	Bahamas	0.269		0.818
85	Ukraine	0.259	71.510	0.779
86	Vietnam	0.253	68.650	0.703
87	Maldives	0.251	67.940	0.747
88	Jordan	0.249	66.380	0.723
89	Grenada	0.249		0.796
90	Moldova	0.246	73.300	0.769
91	Cuba	0.242	68.910	0.779
92	Lebanon	0.210	64.460	0.732
93	Colombia	0.207	67.450	0.760
94	Azerbaijan	0.159	63.060	0.748
95	Iran	0.156	61.050	0.780
96	Sri Lanka	0.153	67.650	0.779
97	Turkmenistan	0.130	60.410	0.744
98	Uzbekistan	0.095	66.680	0.724
99	Tunisia	0.089	66.500	0.739
100	St. Lucia	0.082		0.730
101	Jamaica	0.080	72.830	0.714
102	Peru	0.079	68.170	0.770

103	St. Vincent & Grenadines	0.078		0.765
104	Kyrgyzstan	0.059	66.760	0.694
105	Paraguay	0.043	67.750	0.727
106	Philippines	0.032	66.410	0.709
107	Ecuador	0.030	69.310	0.748
108	Dominica	0.024		0.724
109	Algeria	0.020	64.020	0.744
110	Egypt	0.013	58.380	0.732
111	Indonesia	0.001	66.500	0.710
112	Morocco	-0.020	62.020	0.680
113	Greenland	-0.023		
114	Dominican Republic	-0.046	67.910	0.767
115	Mongolia	-0.078	66.780	0.743
116	El Salvador	-0.078	63.510	0.678
117	Fiji	-0.102	65.550	0.740
118	Bhutan	-0.131	66.520	0.666
119	Tonga	-0.136		0.744
120	Libya	-0.142	55.970	0.716
121	Palau	-0.202		0.774
122	Suriname	-0.207	67.970	0.746
123	Samoa	-0.212		0.713
124	Belize	-0.213		0.696
125	Iraq	-0.235	56.860	0.688
126	South Africa	-0.244	67.330	0.726
127	Guyana	-0.249	65.340	0.711
128	Tajikistan	-0.290	56.880	0.674
129	Venezuela	-0.296	57.010	0.711
130	Nicaragua	-0.304	57.800	0.662
131	Cape Verde	-0.347	67.870	0.668
132	Bolivia	-0.397	63.960	0.704
133	Honduras	-0.421	58.550	0.623
134	Guatemala	-0.438	57.920	0.636
135	Nauru	-0.486		
136	India	-0.495	58.980	0.641
137	Marshall Islands	-0.505		0.639
138	Bangladesh	-0.527	53.840	0.649
139	Syria	-0.528	48.290	0.580
140	Cambodia	-0.540	55.500	0.595

141	Botswana	-0.595	62.090	0.710
142	Laos	-0.646	52.540	0.608
143	Myanmar (Burma)	-0.652	51.900	0.593
144	Nepal	-0.670	58.050	0.605
145	Gabon	-0.713	56.820	0.708
146	Palestinian Territories	-0.732		
147	São Tomé & Príncipe	-0.738	59.970	0.619
148	Vanuatu	-0.749		0.607
149	Ghana	-0.772	60.460	0.629
150	Kiribati	-0.793		0.625
151	Timor-Leste	-0.814	57.520	0.610
152	Namibia	-0.822	58.530	0.631
153	Solomon Islands	-0.930	51.190	0.566
154	Senegal	-0.940	54.630	0.512
155	Equatorial Guinea	-0.948	44.520	0.600
156	Pakistan	-0.968	49.520	0.545
157	Eswatini	-1.010	49.010	0.607
158	Mauritania	-1.053	44.600	0.558
159	Djibouti	-1.082	47.510	0.509
160	Sudan	-1.131	43.430	0.512
161	Comoros	-1.146	49.460	0.559
162	Kenya	-1.153	53.360	0.578
163	Rwanda	-1.205	48.570	0.532
164	Tanzania	-1.205	52.140	0.546
165	Côte d’Ivoire	-1.208	49.490	0.548
166	Gambia	-1.231	49.960	0.500
167	Cameroon	-1.256	45.950	0.579
168	Yemen	-1.274	39.730	0.459
169	Zambia	-1.285	48.480	0.571
170	Zimbabwe	-1.289	48.360	0.599
171	Congo - Brazzaville	-1.292	44.370	0.573
172	Angola	-1.319	44.010	0.592
173	Togo	-1.325	47.680	0.534
174	Malawi	-1.345	49.810	0.514
175	Nigeria	-1.357	46.370	0.535
176	Uganda	-1.359	45.180	0.524
177	Ethiopia	-1.371	43.910	0.496
178	Haiti	-1.377	42.240	0.540

179	Papua New Guinea	-1.409	44.060	0.558
180	Benin	-1.436	49.660	0.527
181	Burkina Faso	-1.456	45.830	0.450
182	Lesotho	-1.465	49.260	0.520
183	Eritrea	-1.497	36.250	0.494
184	Mozambique	-1.501	45.120	0.452
185	Mali	-1.509	42.780	0.430
186	Guinea	-1.517	40.360	0.465
187	Madagascar	-1.543	43.910	0.505
188	Afghanistan	-1.586	34.490	0.483
189	Burundi	-1.628	39.680	0.428
190	Liberia	-1.653	43.820	0.482
191	Guinea-Bissau	-1.654	44.020	0.485
192	Sierra Leone	-1.684	45.120	0.476
193	Congo - Kinshasa	-1.731	37.750	0.480
194	Niger	-1.754	39.980	0.402
195	Somalia	-1.828	34.070	
196	Chad	-1.943	30.010	0.398
197	South Sudan	-1.987	25.430	0.390
198	Central African Republic	-2.168	27.770	0.407

Figure A1. IQ by country, Europe only.

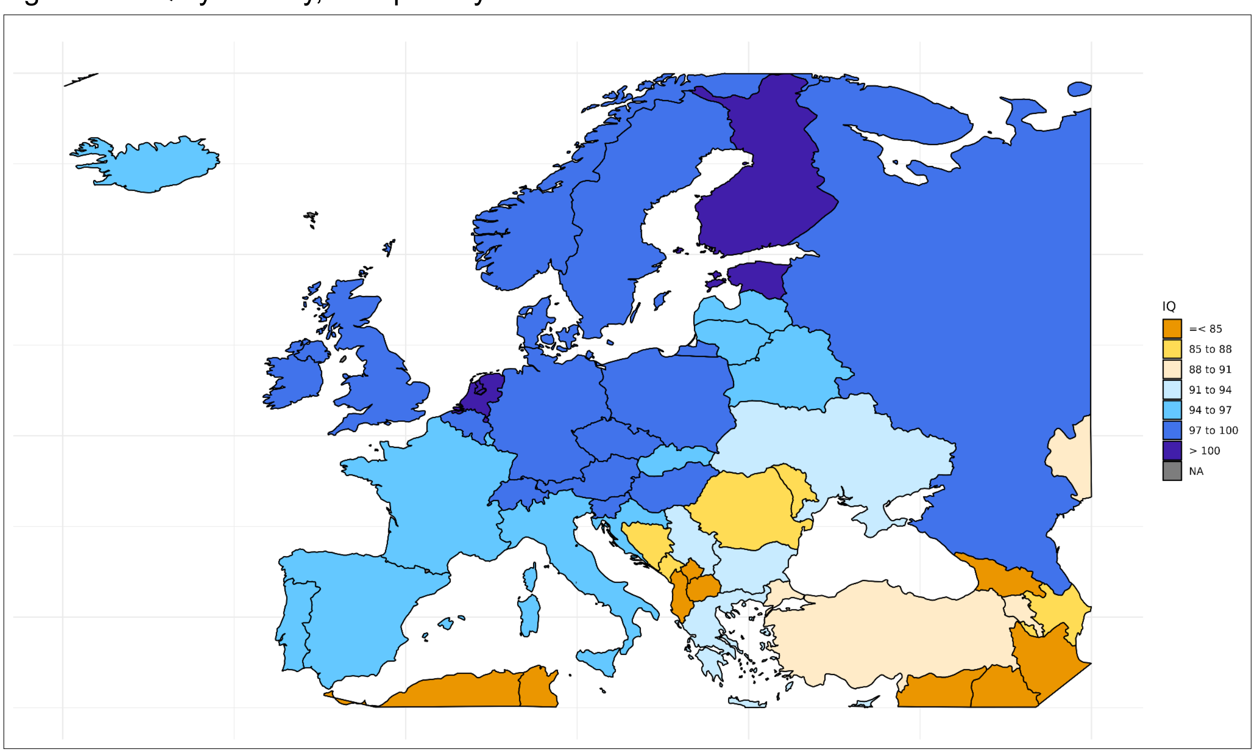


Figure A2. Relationship between national IQ (estimated in 2002 by Lynn) and national IQ (estimated in 2024).

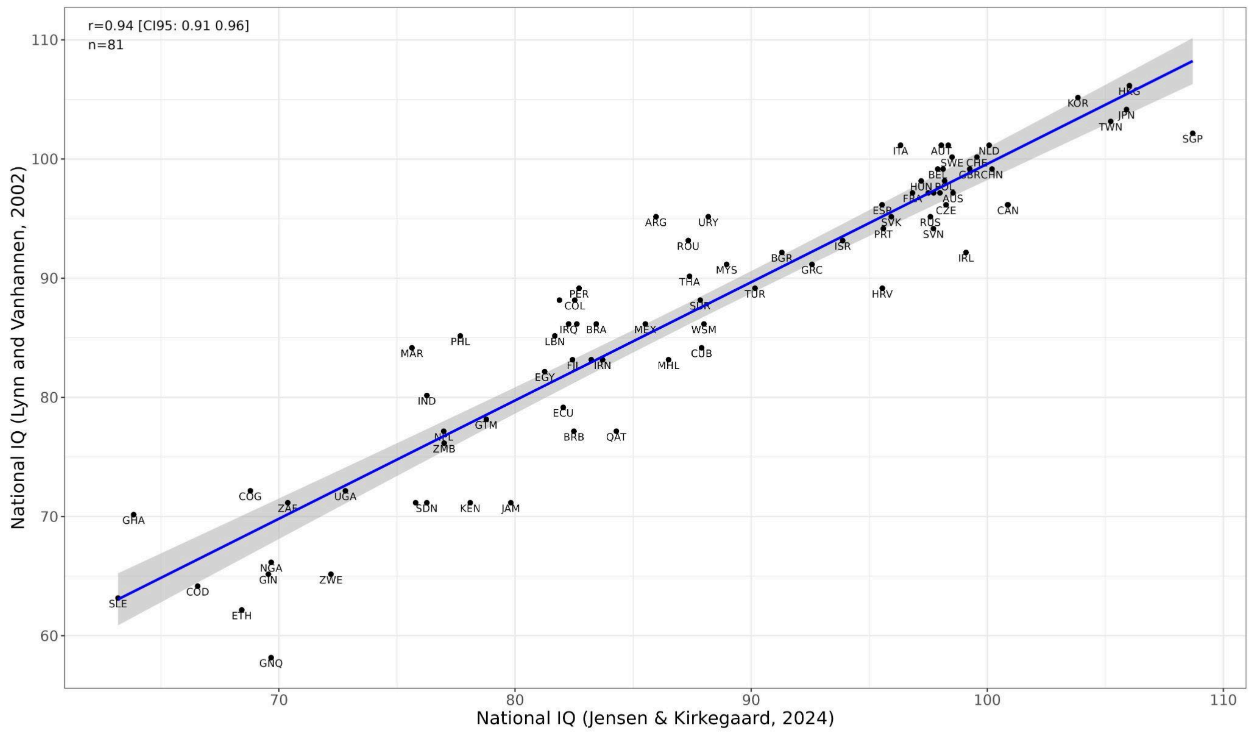


Figure A3. Relationship between national IQ (estimated in 2002 by Lynn) and world bank harmonized test scores (estimated in 2010-2020, converted to IQ units).

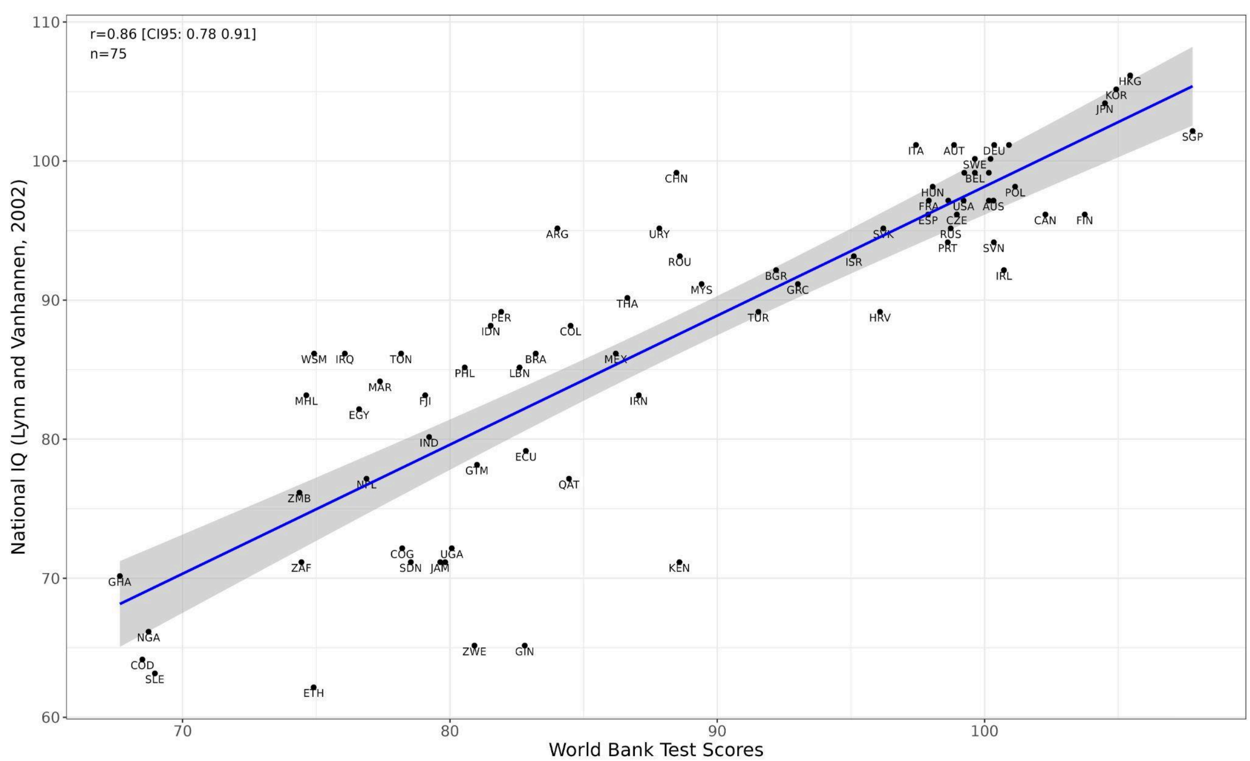


Table A3. Comparison of the average absolute correlation between cognitive variables and socioeconomic development by type. National variables were winsorized, as they where when SDI was calculated.

Predictor	Average correlation (non-transformed)	Average correlation (transformed)
Average IQ	0.64	0.71
Predicted % above 125	0.46	0.55

Figure A4. Relationship between average IQ and GDP per capita. Yellow line - linear fit, blue line - Locally estimated scatterplot smoothing.

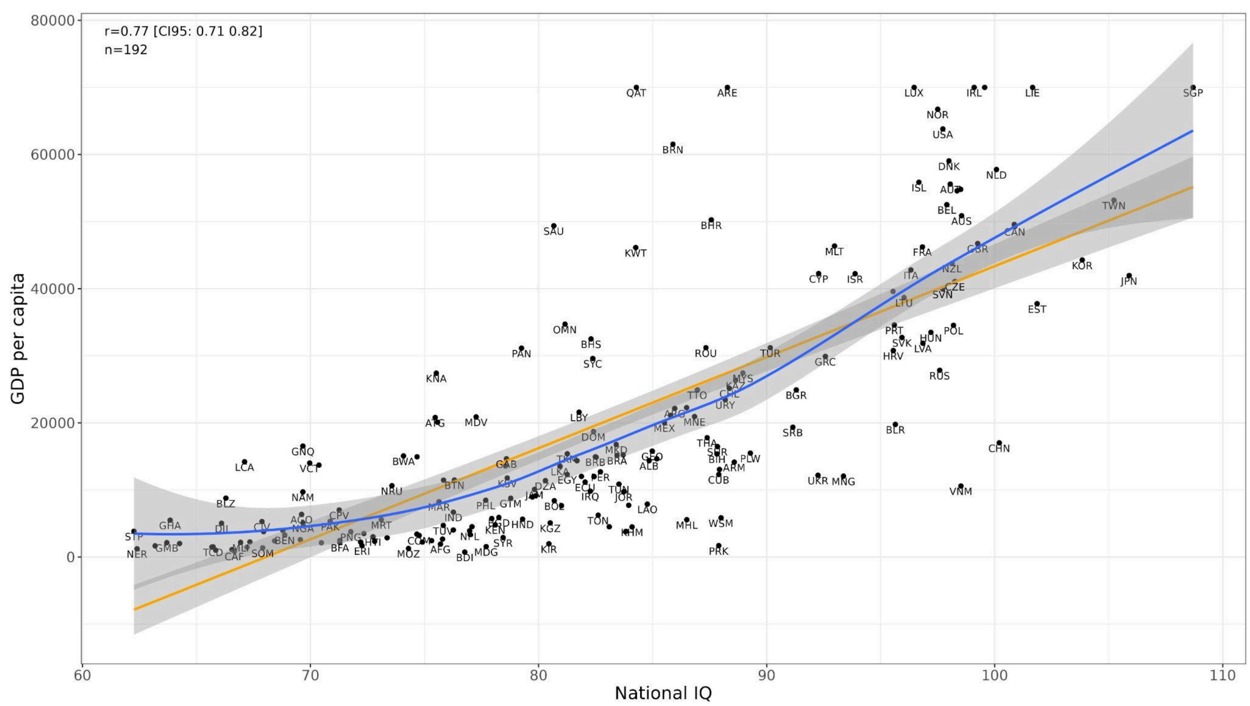


Figure A5. Relationship between predicted % who score above 125 and GDP per capita. Yellow line - linear fit, blue line - Locally estimated scatterplot smoothing.

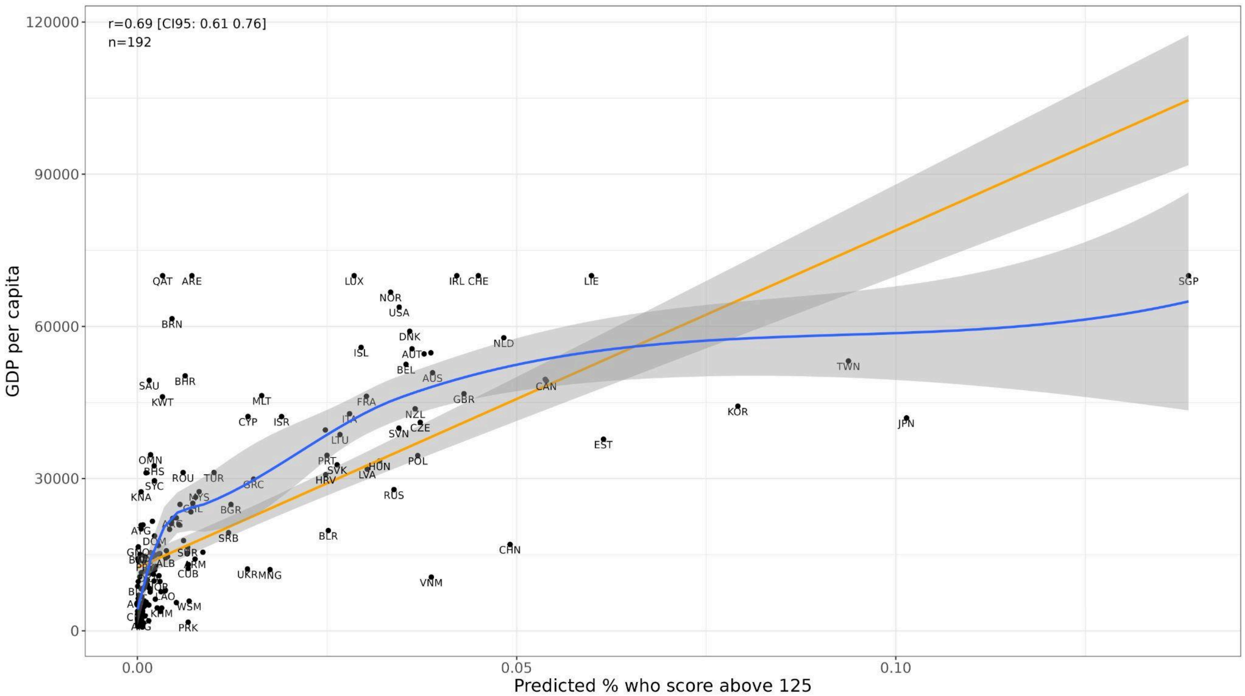


Figure A6. Hierarchical cluster analysis of the Gower distance of nations based on the 47 socioeconomic development variables.

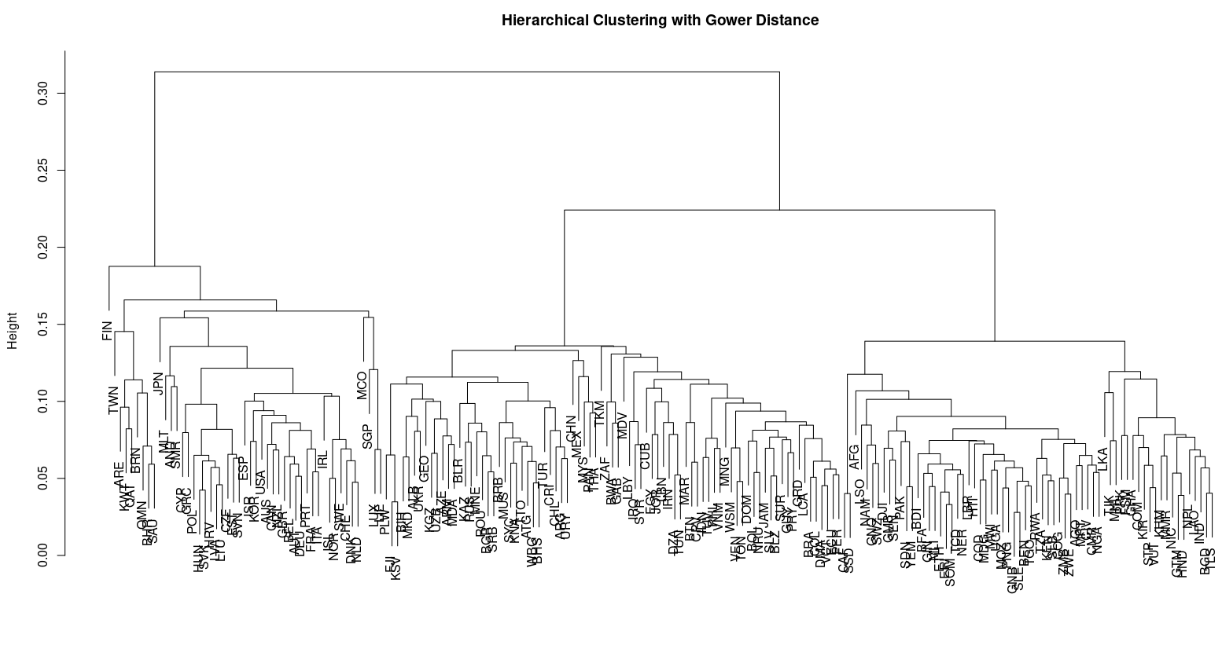


Figure A7. Correlation between absolute factor loadings on the general socioeconomic factor and absolute correlations between national IQs within the indicators. Analysis was made using the transformed data with MICE imputations, principal components analysis was used to extract factor loadings.

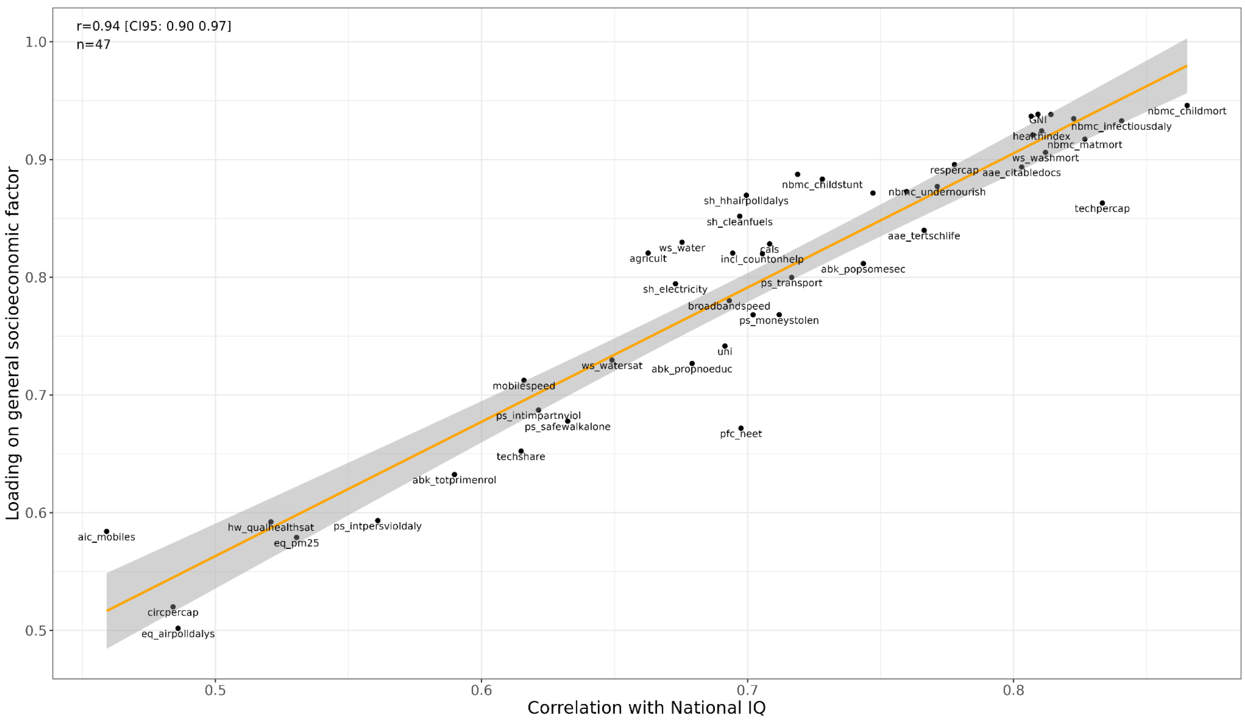


Table A4. correlations with national IQ and factor loadings on the general socioeconomic factor by indicator of development. Analysis was made using the transformed data with MICE imputations, principal components analysis was used to extract factor loadings.

Correlation with IQ	Loading on general socioeconomic factor	variable
0.865	0.946	Child mortality rate
0.841	0.933	Years lost to disease
0.833	0.863	Tech exports per capita
0.827	0.917	Maternal mortality
0.823	0.935	Life expectancy
0.814	0.938	Mean wealth
0.812	0.906	Deaths due to unsafe water
0.811	0.924	Legatum health index
0.809	0.938	GNI per capita
0.807	0.921	Mean income
0.807	0.937	GDP per capita
0.803	0.894	Citable documents per 1000 people
0.778	0.896	DOI resolutions per capita
0.771	0.877	Undernourishments rates
0.766	0.840	Expected years of teritary schooling

0.760	0.873	Access to basic sanitation
0.747	0.872	Mortality in 15-50
0.744	0.812	% with secondary schooling
0.728	0.883	Child stunting rates
0.719	0.887	% with internet access
0.717	0.800	Transportation related injuries
0.712	0.768	% Who had money stolen
0.708	0.828	Calorie intake per capita
0.706	0.820	% who say they have friends/family to count on
0.702	0.768	Years lost to lead exposure
0.700	0.870	Years lost due to household pollution
0.698	0.672	% of youth who are NEETs
0.697	0.852	% using clean fuel
0.694	0.821	Car production per capita
0.693	0.780	Speed of broadband internet
0.691	0.742	Rank of national universities
0.679	0.727	% of population that is uneducated
0.675	0.830	% with access to water
0.673	0.795	% with access to electricity
0.663	0.821	% of population in agriculture
0.649	0.730	% satisfied with water
0.632	0.678	% who say it is safe to walk alone at night
0.621	0.687	% of adult women who have been abused
0.616	0.712	Speed of mobile internet
0.615	0.652	Share of economy that is tech
0.590	0.632	% of children enrolled in primary school
0.561	0.593	Years lost due to interpersonal violence
0.531	0.579	Exposure to particulate matter
0.521	0.592	% satisfied with healthcare
0.486	0.502	Years lost to air pollution
0.484	0.520	Semiconductor manufacturing per capita
0.459	0.584	Mobiles per 100 people

Table A5. Subindicator values by country (standardized at mean = 0 and SD = 1). EDI - economic development index, TDI - technological development index, EAI - educational attainment index, IoM - index of mortality, IDI - infrastructure development index, IoP - index of pollution, SI - safety index

Country	EDI	TDI	EAI	IoM	IDI	IoP	SI
AFG	-0.951	-1.569	-1.640	-1.528	-1.344	2.789	-2.176

ALB	-0.174	-0.271	0.307	0.807	0.494	-0.286	0.614
DZA	-0.452	-0.587	-0.033	0.251	0.400	0.069	-0.015
AND	1.484	1.614	0.039	1.084	1.104	-1.530	1.431
AGO	-0.817	-1.299	-1.179	-1.203	-1.641	0.647	-0.983
ATG	-0.012	0.414	0.296	0.814	0.431	-0.702	0.240
ARG	0.057	0.188	0.821	0.550	0.625	-0.979	0.099
ARM	-0.258	-0.177	0.283	0.434	0.521	-0.124	1.030
AUS	1.957	0.815	1.846	1.288	1.263	-1.542	0.983
AUT	1.705	1.466	1.602	1.158	1.343	-1.343	1.409
AZE	-0.238	-0.195	0.128	-0.067	0.400	0.018	0.621
BHS	0.453	0.288	0.059	0.036	0.300	-0.790	-0.203
BHR	1.030	1.043	0.336	0.935	1.037	0.241	0.580
BGD	-0.729	-0.662	-0.615	-0.070	-0.215	1.490	-0.155
BRB	-0.093	0.492	0.189	0.438	0.564	-0.710	0.002
BLR	0.120	0.077	0.795	0.865	0.682	-0.573	0.676
BEL	2.010	1.442	1.526	1.097	1.262	-1.095	0.856
BLZ	-0.587	-0.626	-0.385	0.029	0.140	-0.271	-0.527
BEN	-0.993	-1.194	-1.243	-1.738	-1.383	1.243	-1.335
BTN	-0.382	0.009	-0.643	0.053	0.175	0.338	0.138
BOL	-0.388	-0.761	-0.149	-0.495	-0.262	-0.087	-0.670
BIH	-0.032	-0.182	0.151	1.008	0.680	0.385	1.003
BWA	-0.377	-0.087	-0.515	-0.609	-0.815	0.504	-1.064
BRA	-0.219	0.368	0.305	0.180	0.465	-0.805	-0.232
BRN	1.503	0.652	0.605	0.405	0.755	-1.363	0.891
BGR	0.339	0.902	0.753	0.638	0.461	-0.252	0.819
BFA	-1.102	-1.073	-1.846	-1.462	-1.451	1.446	-0.633
BDI	-1.319	-1.625	-1.474	-1.443	-1.699	1.164	-1.165
CPV	-0.576	-0.524	-0.969	0.340	-0.155	0.130	-0.438
KHM	-0.797	-0.526	-0.651	-0.362	-0.179	0.745	0.051
CMR	-0.925	-1.153	-0.680	-1.562	-1.265	1.547	-1.292
CAN	1.761	1.234	1.475	0.990	1.189	-1.801	0.927
CAF	-1.302	-1.469	-1.354	-2.685	-3.041	2.017	-2.558
TCD	-1.152	-1.419	-1.846	-2.933	-2.308	1.797	-1.096
CHL	0.258	0.760	0.970	0.790	0.679	-1.060	0.155
CHN	0.040	1.285	0.574	0.738	0.903	0.495	1.024
COL	-0.297	0.032	0.239	0.248	0.530	-0.671	-0.537
COM	-0.912	-1.135	-1.425	-0.847	-1.147	0.588	-0.591
COD	-1.264	-1.511	-1.325	-1.770	-2.242	1.212	-1.613
COG	-1.053	-0.995	-1.060	-1.035	-1.518	0.957	-1.661

CRI	0.129	0.280	0.195	0.719	0.904	-0.726	0.064
CIV	-0.836	-0.676	-1.125	-1.819	-1.187	0.915	-1.070
HRV	0.615	0.718	1.092	1.034	0.847	-0.842	1.335
CUB	-0.375	-0.698	0.348	0.657	0.666	-0.495	0.158
CYP	1.096	0.805	1.180	0.978	0.931	-0.939	0.906
CZE	0.895	1.555	1.462	1.108	1.107	-0.935	1.223
DNK	2.148	1.840	1.734	1.150	1.271	-1.556	1.631
DJI	-0.826	-0.613	-1.514	-1.105	-0.901	1.013	-1.182
DMA	-0.285	-0.023	0.086	-0.031	0.114	-0.404	-0.283
DOM	-0.098	-0.080	-0.206	-0.145	0.277	-0.139	-0.677
ECU	-0.326	-0.272	0.336	0.179	0.075	-0.721	-0.705
EGY	-0.434	-0.211	0.048	0.345	0.227	1.452	0.242
SLV	-0.341	-0.124	-0.644	0.024	0.234	-0.172	0.047
GNQ	-0.273	-0.654	-0.822	-1.310	-1.181	0.984	-1.074
ERI	-1.015	-1.211	-1.700	-0.816	-1.659	1.317	-1.462
EST	0.919	1.421	1.352	1.017	0.939	-1.688	1.353
ETH	-0.956	-1.395	-1.443	-0.938	-1.662	1.008	-0.411
FJI	-0.392	-0.196	0.176	-0.086	0.042	-0.197	-0.896
FIN	1.548	1.336	1.867	1.125	1.318	-2.011	1.522
FRA	1.621	1.651	1.325	1.046	1.166	-1.349	1.127
GAB	-0.319	-0.121	-0.792	-0.724	-1.008	0.207	-1.711
GMB	-1.022	-1.227	-1.214	-1.327	-1.030	1.170	-1.022
DEU	1.658	1.636	1.624	1.145	1.321	-1.320	1.302
GEO	-0.261	0.135	0.548	0.389	0.371	-0.156	0.748
GHA	-0.724	-0.732	-0.681	-0.965	-0.490	0.812	-0.804
GRC	0.646	0.577	1.450	1.082	0.871	-0.942	0.752
GRD	-0.040	0.166	0.664	0.442	0.024	-0.170	0.144
GTM	-0.504	-0.380	-0.881	-0.136	-0.357	0.477	-0.104
GIN	-0.953	-1.226	-1.647	-1.911	-1.434	1.327	-1.138
GNB	-1.064	-1.047	-1.560	-1.908	-1.848	1.467	-1.433
GUY	-0.159	-0.375	-0.604	-0.361	-0.033	0.374	-0.394
HTI	-1.074	-1.174	-1.003	-1.100	-1.665	1.368	-1.300
HND	-0.647	-0.748	-0.978	0.135	-0.019	0.591	-0.115
HUN	0.626	1.372	1.058	0.801	0.847	-0.744	1.155
ISL	2.172	1.069	1.727	1.293	1.368	-1.841	1.760
IND	-0.624	-0.125	-0.613	-0.215	-0.370	1.676	-0.339
IDN	-0.404	-0.042	0.177	-0.238	0.098	0.102	0.708
IRN	-0.114	-0.400	0.310	0.429	0.408	0.215	-0.139
IRQ	-0.471	-0.269	-0.753	-0.050	-0.086	0.671	0.145

IRL	2.019	1.360	1.695	1.201	1.140	-1.537	1.410
ISR	1.143	1.366	1.140	1.262	1.172	-1.085	1.214
ITA	1.365	0.821	1.112	1.251	1.144	-1.111	1.094
JAM	-0.415	-0.235	-0.132	0.115	0.268	-0.461	0.482
JPN	1.345	1.593	1.360	1.313	1.033	-1.526	1.684
JOR	-0.335	0.089	-0.012	0.480	0.444	-0.205	0.464
KAZ	0.187	0.103	0.736	0.264	0.519	-0.380	0.527
KEN	-0.783	-1.016	-0.564	-1.492	-1.372	0.573	-1.178
KIR	-0.798	-0.918	-0.242	-0.499	-0.676	0.791	-0.997
PRK	-0.895	-0.897	-0.654	0.022	-0.441	1.025	-0.155
KOR	1.291	2.035	1.349	1.204	1.195	-0.950	1.178
KWT	1.374	1.161	0.118	0.919	1.121	0.041	0.888
KGZ	-0.719	-0.161	0.215	0.028	0.385	0.149	0.534
LAO	-0.737	-0.340	-1.082	-0.412	-0.206	1.010	-0.437
LVA	0.726	1.221	1.295	0.644	0.773	-1.018	0.989
LBN	-0.068	-0.236	0.437	0.786	0.138	-0.085	-0.313
LSO	-1.094	-0.477	-1.105	-2.385	-2.013	1.284	-1.335
LBR	-1.043	-1.715	-1.420	-1.770	-1.846	0.792	-1.830
LBY	-0.183	-0.513	-0.584	0.196	0.120	0.235	-0.367
LIE	2.193	1.816	0.841	1.052	0.776	-0.033	0.489
LTU	0.869	1.243	1.268	0.694	0.769	-1.169	0.843
LUX	2.737	1.433	1.299	1.222	1.259	-1.507	1.482
MKD	-0.056	0.129	0.024	0.983	0.589	0.201	0.807
MDG	-1.187	-1.444	-0.774	-1.198	-2.132	1.008	-1.253
MWI	-1.172	-1.496	-0.720	-1.245	-1.283	0.833	-1.575
MYS	0.338	1.494	0.844	0.633	0.632	-0.633	0.219
MDV	-0.038	0.065	-0.509	0.824	0.150	-1.017	0.468
MLI	-1.063	-1.232	-2.001	-1.789	-1.165	1.361	-1.079
MLT	1.413	1.489	0.950	1.247	1.137	-0.885	1.523
MHL	-0.675	-0.829	0.192	-0.636	-0.337	-0.007	-1.069
MRT	-0.797	-0.811	-1.537	-0.884	-0.969	0.718	-0.831
MUS	0.176	0.175	0.058	0.176	0.622	-0.743	0.651
MEX	0.001	0.714	0.372	0.008	0.514	-0.268	-0.098
FSM	-0.724	-1.149	-0.866	-0.039	-0.391	0.476	-1.276
MDA	-0.261	-0.075	0.447	0.300	0.231	-0.597	0.424
MNG	-0.441	-0.304	0.358	0.154	-0.177	0.975	0.254
MNE	0.243	0.366	0.624	1.025	0.732	-0.127	1.036
MAR	-0.546	0.295	-0.312	0.291	0.197	0.341	-0.367
MOZ	-1.194	-1.633	-1.175	-1.164	-1.657	1.101	-0.907

MMR	-0.732	-0.824	-0.523	-0.644	-0.220	0.962	-0.291
NAM	-0.512	-0.760	-0.476	-1.157	-1.006	0.504	-0.917
NPL	-0.870	-0.773	-0.991	-0.290	-0.236	1.900	-0.014
NLD	1.897	2.039	1.861	1.178	1.263	-1.379	1.482
NZL	1.712	0.814	1.389	1.038	1.088	-1.710	0.800
NIC	-0.601	-0.755	-0.740	0.123	-0.006	0.104	0.233
NER	-1.164	-1.704	-2.255	-1.699	-1.710	2.043	-0.928
NGA	-0.858	-1.014	-1.243	-3.006	-1.330	1.436	-0.514
NOR	2.278	1.055	1.785	1.343	1.337	-1.792	1.754
OMN	0.493	0.734	0.236	0.690	0.574	0.301	0.095
PAK	-0.784	-1.143	-1.092	-0.685	-0.783	1.658	-0.516
PAN	0.386	0.598	0.373	0.317	0.298	-0.910	0.392
PNG	-0.885	-1.346	-1.253	-0.708	-1.698	0.662	-2.134
PRY	-0.263	-0.257	-0.380	0.086	0.468	-0.437	-0.130
PER	-0.309	-0.246	0.501	0.223	0.087	-0.469	-0.455
PHL	-0.552	0.477	0.173	0.036	0.107	0.262	0.462
POL	0.671	1.157	1.118	0.946	0.787	-0.643	1.200
PRT	0.888	1.207	1.329	1.047	1.080	-1.338	1.263
QAT	2.216	1.145	0.575	1.076	1.002	0.482	0.494
ROU	0.476	1.107	0.621	0.768	0.706	-0.611	0.798
RUS	0.368	0.363	1.279	0.346	0.424	-0.648	0.504
RWA	-1.011	-1.082	-1.181	-0.789	-1.141	0.981	-1.119
LCA	-0.155	0.539	-0.598	0.090	0.220	-0.398	-0.086
VCT	-0.281	0.105	-0.241	0.174	0.278	-0.125	-0.029
WSM	-0.627	-0.708	-0.346	0.170	0.377	0.023	-0.919
STP	-0.885	-0.831	-0.541	-0.328	-0.540	0.827	-0.931
SAU	1.195	0.718	0.506	0.725	0.892	0.835	0.432
SEN	-0.921	-0.747	-1.486	-0.575	-0.703	0.908	-0.535
SRB	0.068	0.623	0.837	0.835	0.523	-0.076	0.991
SYC	0.466	0.266	0.023	0.429	0.602	-0.688	0.566
SLE	-1.195	-1.718	-1.202	-1.678	-1.979	1.126	-1.852
SGP	2.161	2.290	1.663	1.299	1.248	-1.042	2.036
SVK	0.655	1.219	0.914	0.861	0.776	-0.799	1.093
SVN	1.171	1.078	1.421	1.248	1.112	-1.128	1.659
SLB	-0.895	-1.192	-0.501	-0.089	-0.751	1.487	-1.121
SOM	-1.187	-1.447	-1.704	-2.249	-2.024	1.509	-1.588
ZAF	-0.398	0.463	0.123	-0.789	-0.380	-0.109	-0.738
SSD	-1.150	-1.631	-1.684	-2.871	-2.372	1.240	-1.960
ESP	1.273	1.092	1.269	1.268	1.098	-1.303	1.680

LKA	-0.326	-0.573	0.024	0.594	0.506	-0.265	0.465
SDN	-0.842	-1.351	-1.382	-0.958	-1.015	1.702	-0.530
SUR	-0.430	-0.094	-0.606	-0.010	-0.122	-0.133	-0.183
SWZ	-0.612	-0.351	-0.963	-1.545	-1.239	0.495	-1.246
SWE	1.648	1.563	1.734	1.251	1.273	-1.911	1.470
CHE	2.389	1.608	1.635	1.191	1.376	-1.547	1.715
SYR	-0.903	-1.336	-1.011	0.146	-0.295	0.556	0.312
TWN	1.517	1.671	1.254	0.935	0.880	-0.753	1.177
TJK	-0.801	-1.062	-0.187	0.039	-0.026	1.205	0.967
TZA	-0.961	-1.140	-0.922	-0.792	-1.363	0.817	-0.812
THA	-0.084	1.421	0.453	0.532	0.599	-0.511	0.229
TLS	-0.821	-0.677	-0.833	-0.584	-0.684	0.739	-0.654
TGO	-1.125	-1.057	-0.929	-1.459	-1.497	1.049	-0.814
TON	-0.430	-0.575	-0.115	-0.069	0.225	-0.702	-0.816
TTO	0.128	0.038	0.125	0.255	0.362	-0.669	-0.028
TUN	-0.362	-0.026	-0.117	0.394	0.319	0.031	-0.342
TUR	0.238	0.258	0.805	0.712	0.714	-0.192	0.348
TKM	-0.321	-0.528	-0.241	0.003	0.414	-0.061	1.516
UGA	-1.053	-1.304	-0.654	-1.098	-1.627	1.139	-1.397
UKR	-0.214	-0.041	0.461	0.396	0.187	-0.530	0.176
ARE	2.000	1.635	0.747	0.959	0.986	0.024	0.300
GBR	1.637	1.182	1.656	0.975	1.078	-1.435	1.288
USA	2.115	1.724	1.508	0.595	1.138	-1.424	0.585
URY	0.324	0.592	0.499	0.640	0.814	-1.133	0.239
UZB	-0.591	-0.523	-0.096	0.233	0.572	0.808	1.076
VUT	-0.803	-0.873	-0.683	-0.086	-0.412	0.800	-1.462
VEN	-0.461	-0.524	-0.079	-0.359	-0.375	-0.435	-0.644
VNM	-0.442	0.736	0.152	0.032	0.541	-0.075	0.419
YEM	-1.008	-1.467	-1.655	-0.857	-1.335	1.896	-0.337
ZMB	-1.025	-0.894	-0.874	-1.002	-1.718	0.863	-1.355
ZWE	-1.019	-1.012	-0.509	-1.520	-1.707	0.898	-1.211
KNA	0.435	0.630	0.924	0.183	0.193	-0.956	0.073
KSV	-0.244	0.300	0.173	0.759	0.584	-0.460	0.742
NRU	-0.188	0.225	-0.387	-1.053	-0.091	-0.732	-1.197
PLW	-0.023	0.170	0.562	-0.577	0.106	-0.837	-1.283
TUV	-0.635	-0.294	-0.195	-0.810	-0.033	-0.564	-1.314
WBG	-0.080	0.141	-0.182	0.518	0.572	0.183	0.406
MCO	2.466	1.644	1.371	1.323	0.970	-1.258	1.265
SMR	1.716	1.181	1.091	1.291	1.026	-1.477	1.432

Figure A8. IQ by country (alternative version).

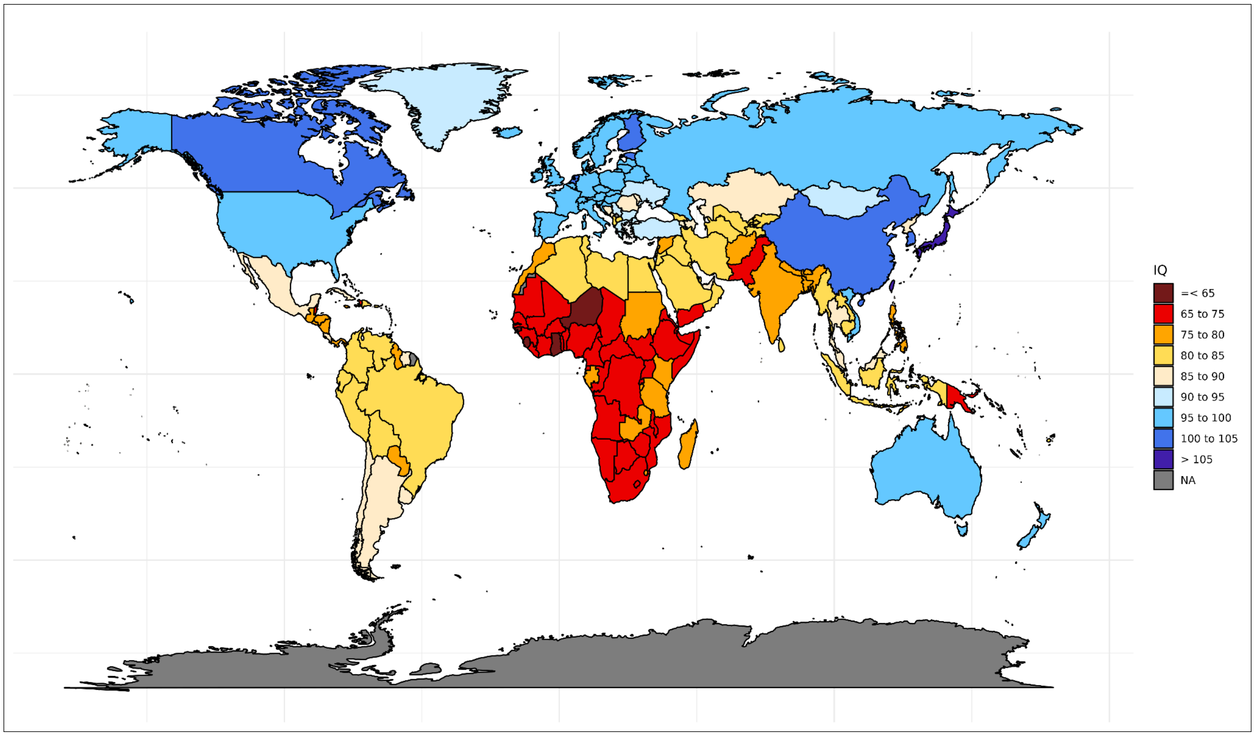


Table A6. Regression model predicting SDI. Standard error in parenthesis. * -> p < .05, ** -> p < > .01, *** -> p < .001. 'Communist history' and 'Oil producer' variables are binary variables.

Parameter	Dependent Variable: SDI
Intercept	-6.81 (0.25)***
National IQ	0.082 (0.003)***
Communist History	-0.28 (2.6)**
Oil producer	0.33 (0.13)**
R^2	79%

List of countries labeled as ever Communist: "ALB", "BLR", "BGR", "CHN", "CUB", "CZE", "EST", "HUN", "KAZ", "KGZ", "LAO", "LVA", "LTU", "MDA", "MNG", "POL", "PRK", "ROU", "RUS", "SRB", "SVK", "SVN", "UKR", "VNM", "YUG", "KHM", "AFG", "YEM"

List of countries labeled as Oil producing: "BHR", "BRN", "GNQ", "GAB", "IRN", "IRQ" "KWT", "LBY", "NOR", "OMN", "QAT", "SAU", "ARE". Countries were labeled as "oil producing" if over 2,000$ of their gross domestic product per capita was due to oil exports. Russia, Azerbaijan, and Kazakhstan were excluded due to their Communist history.

Figure A9. Effect of oil production and Communist history (Africa excluded) on socioeconomic development independent of national IQ.

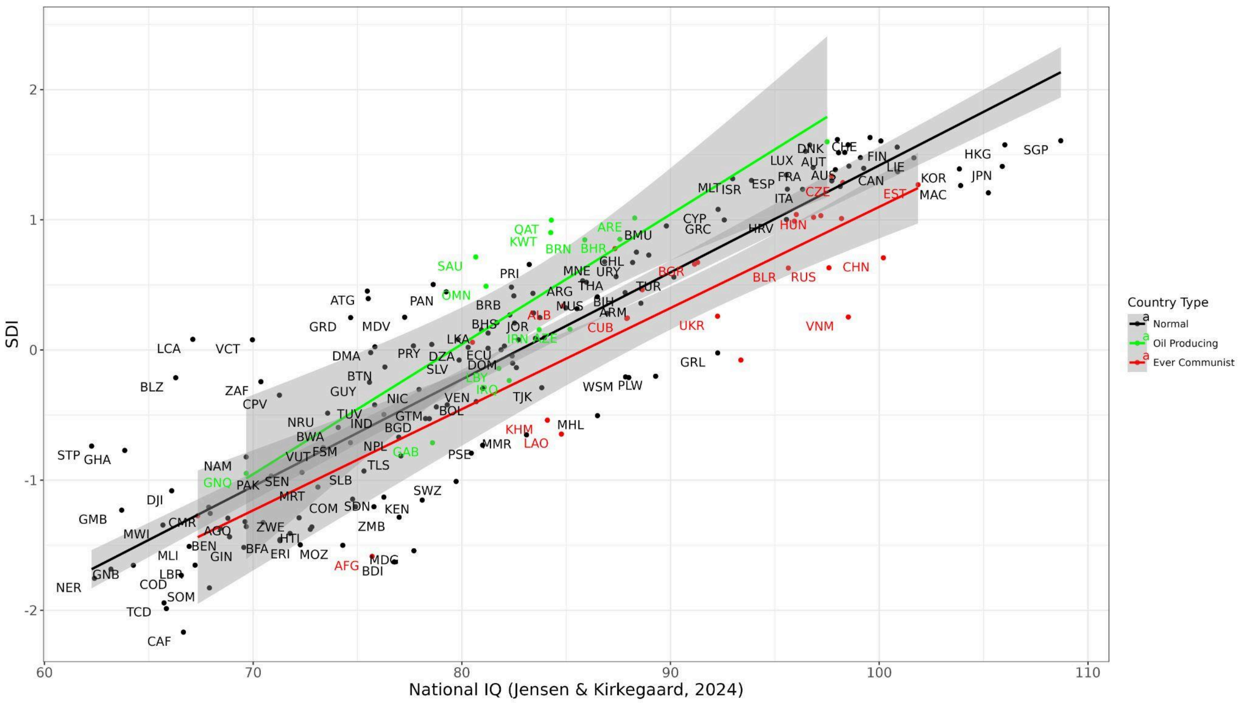
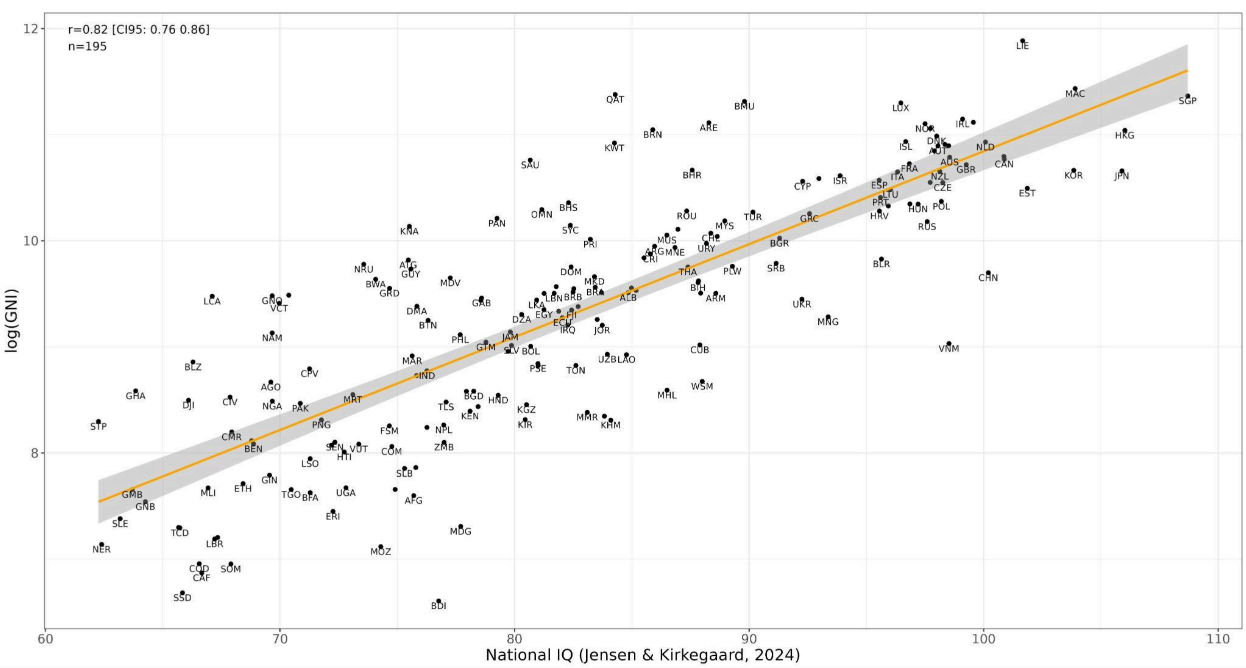


Figure A10. Relationship between log(GNI) and national IQ. log(GNI) = 0.0876*NIQ + 2.09. An increase in IQ of one unit corresponds to an increase in GNI per capita of 9.2%.



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