

# Collaboration Trumps Intelligence as a Predictor of Standard of Living

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## Abstract

Human beings are intelligent. More importantly, they are a social species capable of cooperation. Other animals in the kingdom can cooperate. But human beings further distinguish themselves by their innate ability to collaborate. They not only take care of their children they also take care of each other. The purpose of this paper is to compare the relative impacts of collaboration and intelligence on economic growth and development. We illustrate by data and analysis, that collaboration is superior to intelligence as a predictor of per capita real gross domestic product adjusted for purchasing power parity. Collaboration is found to be a statistically significant predictor and intelligence quotient (IQ) is not.

**JEL: E02, P16**

**Keywords:** collaboration, innovation, intelligence, entrepreneurship, economic growth and development

## 1. Introduction

The terms collaboration and cooperation are sometimes confused. So are economic growth and economic development. In this research we are interested in collaboration and economic growth and development based on epistemological, metaphysical, and axiological insights (Randrup, Druckemiller and Briggs, 2016), so for clarity of purpose we begin with the following definitions.

*Definition.* Intelligence is the ability to acquire and apply knowledge and skills.

*Definition.* Cooperation is a plan and execution thereof by participants, each with their own personal self-interest and economic gain in mind yet yielding unintended mutual benefits.

*Definition.* Collaboration is the plan and execution thereof by participants for their intentional mutual benefit of shared goals, objectives, and rewards.

*Definition.* Economic growth is the improvement in per capita real gross domestic product adjusted for purchasing power parity.

*Significance.* Society is concerned with intelligence and efforts to raise it. But collaboration trumps intelligence as a predictor of per capita real gross domestic product adjusted for purchasing power parity and measure of potential for standard of living. Nations interested in fighting poverty and raising economic growth and development must focus even more on developing and practicing collaboration.

### 1.1 Economic Growth and Development

A desired objective of all modern societies is economic development. Economic development is concerned with improving the social wellbeing of mankind. Economic growth is the improvement in per capita real gross domestic product (GDP) adjusted for purchasing power parity (GDP<sub>PPP</sub>). The pursuit of GDP<sub>PPP</sub> is concerned with total material wellbeing, without regard to social wellbeing. And its distribution is not necessarily uniform. But GDP<sub>PPP</sub> is the source for financing economic development. So, while economic development might be the end goal, it is first necessary to generate wealth by means of GDP<sub>PPP</sub>. We know from Ridley (2020a,b) that the way to raise GDP<sub>PPP</sub> of a country is by raising its CDR index (capitalism, democracy, rule of law). We also know from Ridley and Korovyakovskaya (2021) and Ridley (2021) that collaboration is required to raise the CDR index and promote economic growth and development. Ridley, Korovyakovskaya and Llaugel (2021) revealed that there is very little intracountry collaboration in many countries. It seems reasonable that society concerns itself with the intelligence of its citizens. Measures of intelligence such as IQ have been developed and published. It is difficult to imagine economic progress without intelligence. But what might easily be overlooked is the need for cooperation, moreover collaboration.

### 1.2 Cooperation and Collaboration

All animals are observed to cooperate to various degrees. Cooperation occurs when people work together for their individual benefit. Chimpanzees hunt together (Tomasello, 2001, 2009; Tomasello, et al., 2005, 2012). They cooperate. But unless they are family, they do not share.

If the prey is the little red monkey (a meal for one), the first chimpanzee to catch the prey takes off with it. That is, they do not collaborate. Their behavior is antithetical to a lasting human relationship. Lions hunt together in prides. They cooperate. Their sharing gives the appearance of collaboration. But by definition a lion pride is a family comprised of mother and daughters and their children. So naturally they share. Furthermore, the typical prey is large, so sharing is easy. Male lions (fathers and sons) leave the family while females remain with the pride. Lions who are strangers to each other do not collaborate. Collaboration is a phenomenon associated with and only with human beings and humanity. Consider the Adam Smith (1776, 2010) analogy of the butcher, the baker, and the brewer who divide their labor, each with their own self-interest in mind. Their pursuit is of their own advantage, yet it leads to action that is most advantageous to society. This is cooperation. Contrast that with their intentional creation of a road that they can intentionally share for the transportation of their produce. Or the creation of beer flavored meat pie. These are examples of collaboration. John Heywood (1497-1580) might have said “many hands make light work” with regards to cooperation. Maxwell (2002) might have said “teamwork makes the dream work” with respect to collaboration.

To paraphrase Charles Darwin (1809-1882) “It is not the strongest of the species that survive, nor the most intelligent, but the one most responsive to change.” this might account for human dominance of all species. It is obvious that cooperating people can lift and move heavier weights and larger objects to greater heights. The field of economics speaks to cooperation for the satisfaction of self-interest, but little consideration is given to collaboration. Collaboration demands a certain faith in fellow collaborators. At the time of innovation, there is no guarantee that the outcome will be a product that anybody will purchase. The economic advantage is purely speculative. The primary driving force of entrepreneurs to collaborate might be a tendency toward altruistic contribution to society. The absence of cooperation rules out collaboration. But cooperation does not guarantee collaboration. The purpose of this paper is to compare the relative impacts of collaboration and intelligence, where intelligence is measured by IQ.

### *1.3 Ordinary and Extraordinary Economic Growth*

Cooperation is required for ordinary economic growth and development. Collaboration occurs when people work together for their intentional mutual benefit of shared goals, objectives and rewards. Whereas cooperation can result in the unintended consequences of mutual benefit, collaboration is planned intentionally by participants to provide for their mutual benefit (Tomasello, 2001, 2009). See also Hinde (1989), McCune-Nicholich and Fenson (1984) and Searle (1995). Collaboration is required for extraordinary economic growth and development. That occurs when discoveries are expressed and developed through exogenous new ideas of human imagination and creativity. These ideas must be converted into capital stock of knowledge and machines which in turn produce products and services. Rule of law is required to attract capital and democracy is required to create additional pathways for the deployment of capital. Intelligence is required to recognize this and act on it. But little if any will be accomplished in the absence of cooperation, much less collaboration.

### *1.4 Organization*

The remainder of the paper is organized as follows. The next section reviews some related literature. That is followed by a study of the data by graphical analysis and regression analysis. That is followed by a discussion on how intelligence can be ineffective unless it is organized by collaboration. The final section summarizes conclusions and suggestions for future research.

## **2. Related Literature**

### *2.1 Intelligence*

There are numerous definitions of human intelligence given by notable experts. So much so that the matter can hardly be considered settled. But there are some common elements within the various definitions. Binet (1857-1911), inventor of the Binet-Simon IQ test, suggested that intelligence is the faculty of adapting oneself to circumstances. This implies self-interest. While it may be useful for cooperation, it is a detractor from collaboration. Wechsler (1857-1911) suggested intelligence is the aggregate or global capacity of the individual to act purposefully, to think rationally, and to deal effectively with his environment. This also implies self-interest not collaboration. Humphreys (1913-2003) suggests that intelligence is the resultant of the process of acquiring, storing in memory, retrieving, combining, comparing, and using in new contexts information and conceptual skills. No mention of collaboration. Gardner (2011) a proponent of multiple intelligences, suggest that human intellectual competence must entail a set of skills of problem solving - enabling the individual to resolve genuine problems or difficulties that he or she encounters and, when appropriate, to create an effective product - and must also entail the potential for finding or creating problems - and thereby laying the groundwork for the acquisition of new knowledge. No mention of collaboration. Gottfredson (1998) suggested that intelligence is the ability to deal with cognitive complexity. No mention of collaboration. Sternberg and Salter (1982) suggest that intelligence is goal-directed adaptive behavior. Goals may be individualistic not necessarily shared as in collaboration. Feuerstein (1921-2014) suggests that intelligence is the unique propensity of human beings to change or modify the structure of their cognitive functioning to adapt to the changing demands of a life situation. This implies self-interest, a detractor from collaboration. [Wissner-Gross \(2016\)](#) suggested that intelligence is a force that acts so as to maximize future freedom of action or keep options open, for the diversity of possible accessible options up to some future time horizon. That is, intelligence doesn't like to get trapped. This is a detractor from team collaboration that has a relatively short-term goal that tends to lead the group to converge in one direction. None of these particular experts identify intelligence as a facility of collaboration. Quite the opposite. They suggest that intelligence is a facility of self-interest which is entirely compatible with cooperation.

There are other capacious considerations in the intellectual space such as emotional intelligence and artificial intelligence. But this research is concerned with human intelligence and the data studied are IQ scores for human beings. Emotional intelligence may have certain benefits but a method for its measurement has not yet been devised. Artificial intelligence is void of

humanity altogether and does not capture the nuances thereof that are indeed apropos. Needless to say, intelligence is very difficult to measure. Rather than defer to psychometrics, people are inclined to judge as intelligent anybody who agrees with them and to judge as unintelligent anybody who does not. Given such tenuous circumstances, United States Supreme Court Justice Potter Stewart (1964) might have said “I know it when I see it.”

## 2.2 Collaboration

Entrepreneurship has created massive wealth through collaboration (Ridley, 2020a,b; de Silva, Ridley and Green, 2020; Llaugel and Ridley, 2018; Ngnepieba, et al., 2018). See Schumpeter (1911, 1928, 1954) for more on entrepreneurship. As an example of collaboration, Hayek (1945) depicts a market economy as a mechanism that allows people to take advantage of the knowledge others have without having to acquire the knowledge themselves. Ridley, Ngnepieba and de Silva (2021) show how university calculus test scores and their distribution improve when collaborative learning is implemented. The individual effort of a science or engineering inventor, while brilliant, requiring superior intelligence rarely succeeds without managerial collaboration with several other individuals of less illustrious intelligence. We tend to give disproportionately more credit to inventors as compared to innovators who refine and improve inventions to make them valuable to users (Ridley, 2020a, b).

## 3. Data and Analysis

**Table 1.** Per capita real GDPppp by country (2014), Global innovation index (GII) and Intelligence Quotient (IQ)

Country	Per capita real GDPppp	Global Innovation Index (GII)	Intelligence Quotient (IQ)	Country	Per capita real GDPppp	Global Innovation Index (GII)	Intelligence Quotient (IQ)
Argentina	22,302	35.1	93	Latvia	23,793	44.8	97
Armenia	8,164	36.1	94	Lebanon	18,052	33.6	83
Australia	46,550	55	99	Lithuania	27,259	41	93
Austria	46,640	53.4	100	Macedonia	13,398	25.5	91
Bangladesh	3,391	24.4	77	Malawi	1,112	27.6	63
Belgium	43,139	51.7	100	Malaysia	25,145	45.6	93
Bolivia	6,224	27.8	99	Mauritius	18,689	40.9	71
Botswana	17,050	30.9	72	Mexico	17,950	36	86
Brazil	16,155	36.3	83	Mongolia	11,919	37.5	98
Bulgaria	17,926	40.7	93	Morocco	7,813	32.2	82
Canada	44,967	56.1	101	Namibia	10,656	28.5	69
Chile	23,057	40.6	89	Netherlands	47,960	60.6	102
China	13,224	46.6	104	Nigeria	6,054	27.8	84
Colombia	13,480	35.5	82	Norway	67,166	55.6	99
Cote d'Ivoire	3,101	27	69	Oman	43,847	33.9	82
Croatia	20,947	40.7	90	Panama	19,546	38.3	84

Denmark	44,625	57.5	99	Peru	11,860	34.7	85
Dominican Republic	14,014	32.3	98	Philippines	6,974	29.9	86
Egypt	10,918	30	83	Poland	25,247	40.6	97
El Salvador	8,060	29.1	80	Portugal	27,069	45.6	95
Estonia	27,880	51.5	99	Romania	19,744	38.1	90
Finland	40,661	60.7	101	Russia	24,449	39.1	96
France	40,538	52.2	98	Saudi Arabia	52,311	41.6	81
Germany	46,216	56	100	Serbia	13,378	35.9	89
Ghana	4,137	30.3	73	Singapore	83,066	59.2	108
Greece	25,954	38.9	92	Slovakia	28,279	41.9	97
Hungary	25,019	44.6	98	Slovenia	29,867	47.2	96
India	5,808	33.7	81	South Africa	13,094	38.2	77
Indonesia	10,651	31.8	87	Spain	33,835	49.3	97
Iran	17,443	26.1	84	Sweden	46,219	62.3	99
Ireland	51,284	56.7	94	Switzerland	58,149	64.8	102
Israel	33,136	55.5	95	Thailand	15,579	39.3	89
Italy	35,131	45.7	97	Trinidad and Tobago	32,170	31.6	85
Jamaica	8,610	32.4	71	Turkey	19,698	38.2	90
Japan	37,519	52.4	105	Uganda	1,939	31.1	72
Jordan	11,971	36.2	84	Ukraine	8,681	36.3	97
Kazakstan	24,108	32.8	92	United Kingdom	39,826	62.4	100
Kenya	3,099	31.9	80	United States	54,370	60.1	98
Korea, South	34,355	55.3	106	Vietnam	5,656	34.9	94
Kyrgyzstan	3,262	27.8	84				

G (PPP, constant international\$ for 2014, reported by the IMF) <http://www.imf.org/external/data.htm>

GII - World intellectual property organization (WIPO) ([Indicator Rankings & Analysis | Global Innovation Index](#))

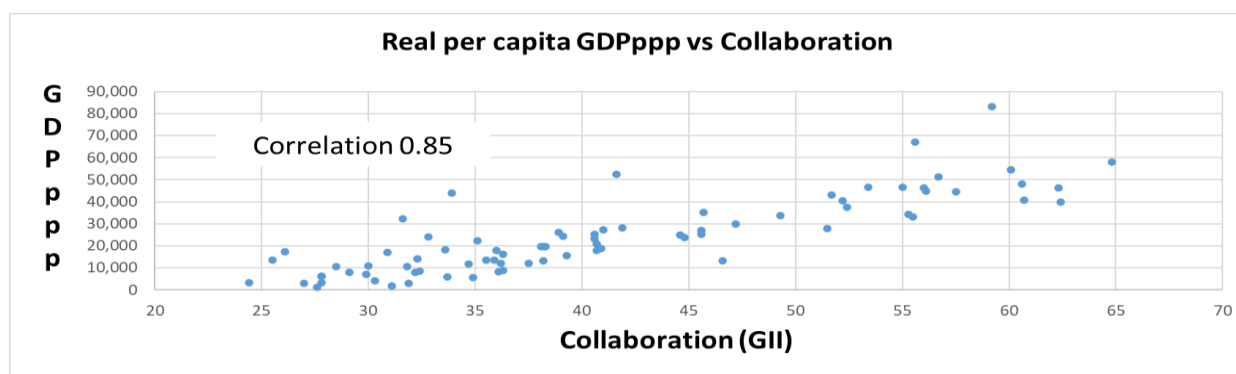
IQ - [Countries by IQ - Average IQ by Country \(worldpopulationreview.com\)](#)

### 3.1 Collaboration and Gross Domestic Product

There are no published data for collaboration by country. The closest available data are the global innovation index (GII) published by the world intellectual property organization (WIPO) ([Indicator Rankings & Analysis | Global Innovation Index](#)). The GII comprises an innovation input sub-index and an innovation output sub-index. The innovation input sub-index comprises institutions, human capital and research, infrastructure, market sophistication and business sophistication. The innovation output sub-index comprises knowledge and technology outputs and creative outputs. We choose to use innovation as a proxy for collaboration. Ridley and

Korovyakovskaya (2021) gives two examples of how collaboration and innovation are used interchangeably. Ridley (2017) proposes micro intrapreneurship for tapping into the creativity of low-level employees. This is as close a measure as we can find.

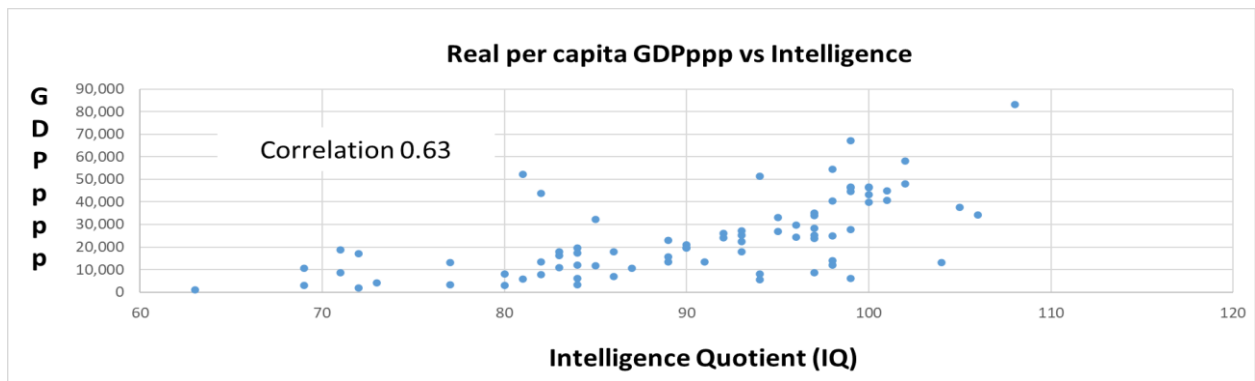
We are interested in the relationship between economic growth and collaboration. GDPppp data are reported by the IMF (<http://www.imf.org/external/data.htm>). GDPppp measures the potential for standard of living. Collaboration and innovation are often used interchangeably. Table 1 lists GDPppp and GII for 79 countries for which all data are available. The missing countries do not provide all data. In any case their population sizes are fewer than one million. The graph of GDPppp versus GII is plotted in Figure 1. GDPppp and GII appear to be highly positively correlated. The actual correlation coefficient is 0.85 (not controlling for IQ). GDPppp declines with declining collaboration. The collaboration values are relative in rank but have no meaning in absolute measure. There are no collaboration values below 24. If collaboration went theoretically to zero, and that were all that determined GDPppp, then GDPppp would be negative and wealth that is subject to depreciation and obsolescence would decline.



**Figure 1.** Per Capita Real GDPppp vs Collaboration (GII)

### 3.2 Intelligence and Gross Domestic Product

We are interested in the relationship between economic growth and intelligence. The measure that we use for intelligence is country average IQ ([Countries by IQ - Average IQ by Country \(worldpopulationreview.com\)](http://worldpopulationreview.com)). IQ scores are thought to reflect the quality of education in certain parts of the world, as well as the accessibility and resources available to people in those geographic regions. Areas of the world with lower IQ scores are less developed and poorer than countries with higher IQ scores. Table 1 lists GDPppp and IQ data. The graph of GDPppp versus IQ is plotted in Figure 2. GDPppp and IQ appear to be positively correlated. The actual correlation coefficient is 0.63 (not controlling for GII). GDP declines with declining IQ. There are no IQ values below 63. If IQ could theoretically go to zero, and that were all that determined GDPppp, then GDPppp would be negative and wealth that is subject to depreciation and obsolescence would decline.



**Figure 2.** Per Capita Real GDPppp vs Intelligence Quotient

### 3.3 Regression Analysis

The preceding graphs and correlations are between GDPppp and GII ignoring IQ, and GDPppp and IQ ignoring GII. The following regression analysis calculates the partial correlations with both variables in the presence of each other. Consider the model:

$$\text{GDPppp} = \beta_0 + \beta_1 \text{GII} + \beta_2 \text{IQ} + \varepsilon,$$

where  $\beta_0$  is the intercept on the GDPppp axis,  $\beta_1$  is the marginal contribution of collaboration to GDPppp,  $\beta_2$  is the marginal contribution of Intelligence to GDPppp, and  $\varepsilon \sim \mathcal{N}(0, \sigma^2)$  is a normally distributed random error with a mean of 0 and constant variance  $\sigma^2$ . Collaboration is a choice that people make and is therefore an exogenous variable. Intelligence is a property of the human mind and is therefore also an exogenous variable. Therefore, least squares optimization is expected to yield unbiased estimates of the regression coefficients. The least squares linear regression fitted model is:

$$\begin{aligned} \text{Estimated GDPppp} &= -33607.9 + 1303.2\text{GII} + 47.8\text{IQ} \\ &\quad (9.2) \quad (0.3) \quad R_{adj}^2=0.71 \end{aligned}$$

The coefficient of multiple determination adjusted for the number of variables  $R_{adj}^2=0.71$ . We can test the significance of GII and IQ as follows.

Consider the null hypothesis  $H_0$  that  $\beta_1=0$  and there is no significant relationship, versus the alternative  $H_1$  that  $\beta_1 \neq 0$  and there is a significant relationship between GDPppp and collaboration.

$$\begin{aligned} H_0: \beta_1 &= 0 \\ H_1: \beta_1 &\neq 0 \end{aligned}$$

Our regression computation gives us an estimate for  $\beta_1$ ,  $b_1=1303.2$  with standard error of estimate  $s_{b_1}=141.2$ . Since  $t = b_1/s_{b_1}=1303.2/141.2 = 9.2 > t_{\alpha=0.01, v=79-3} \approx 2.64$ , where  $v$  is



the number of degrees of freedom for error, we conclude with a level of significance  $\alpha=1\%$  that there is a significant relationship between GDPppp and collaboration.

Consider next the null hypothesis  $H_0$  that  $\beta_2=0$  and there is no significant relationship, versus the alternative  $H_1$  that  $\beta_2\neq 0$  and there is a significant relationship between GDPppp and IQ.

$$H_0: \beta_2 = 0$$

$$H_1: \beta_2 \neq 0$$

The estimate for  $\beta_2$ ,  $b_2=47.8$  with standard error of estimate  $s_{b_1}=152.7$ . Since  $t = b_2/s_{b_2} = 47.8/152.7 = 0.3 < t_{\alpha=0.01, v=79-3} \approx 2.64$ , we conclude that there is no significant relationship between GDPppp and IQ. This implies that collaboration is a superior predictor of GDPppp.

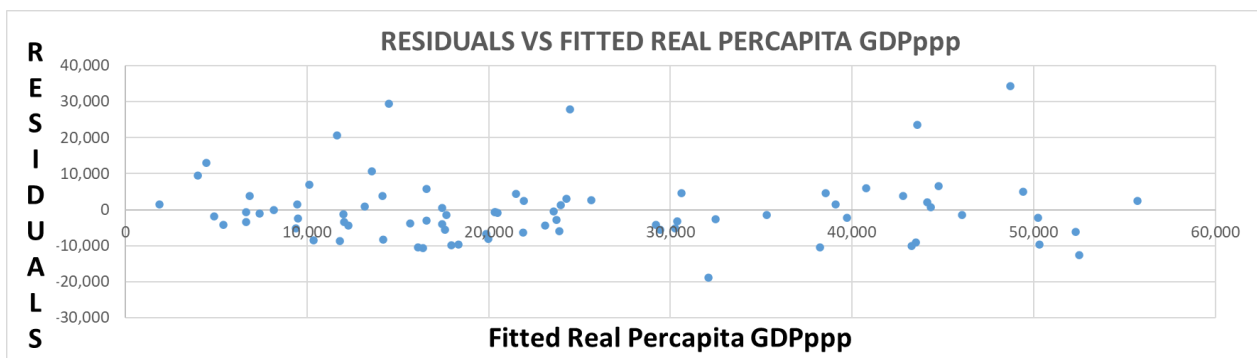
Finally, consider the hypothesis  $H_0$  that IQ is a better predictor of GDPppp than is collaboration.

$H_0$ : Intelligence quotient is a better predictor of GDPppp.

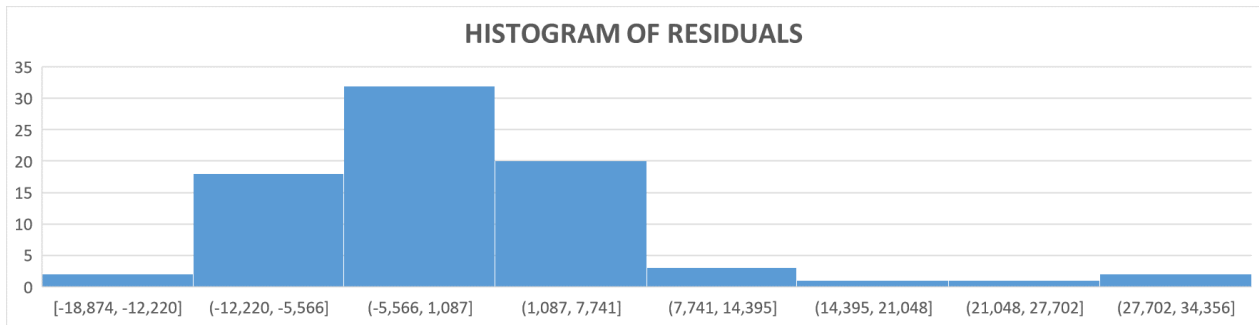
$H_1$ : Collaboration is a better predictor of GDPppp.

Since the relationship between GDPppp and collaboration was found to be statistically significant and the relationship between GDPppp and IQ was found not to be statistically significant, we reject  $H_0$  and conclude that collaboration is the better predictor. There is only a 1% chance that these conclusions are reached erroneously.

A plot of the residuals from the regression is shown in Figure 3. There is no appearance of heteroscedasticity or serial correlation in the errors. A histogram of the residuals is plotted in Figure 4. The errors appear to be approximately normally distributed. Therefore, the regression model appears to be appropriate in the circumstances.



**Figure 3.** GDPppp Residuals vs Fitted GDPppp



**Figure 4.** Histogram of Residuals of GDPppp

Consider next what happens if natural resources (as measured by natural resources rents (N) <http://data.worldbank.org/indicator/NY.GDP.TOTL.RT.ZS>) are added to the above model. Natural resources are exogenous. A geographic effect was tested by adding absolute distance from the equator (L), but it was not statistically significant and was removed. Government spending and country size also had no effect on GDPppp. Institutional variables such as common law versus administrative law, for example, are already included in the measure of collaboration. The least squares linear regression fitted model is:

$$\text{Estimated GDPppp} = -40953.2 + 1309.8\text{GII} + 100.1\text{IQ} + 1.56\text{N}$$

$$(11.78) \quad (0.83) \quad (6.91) \quad R_{adj}^2=0.83$$

The result is somewhat higher  $R_{adj}^2=0.83$ . The coefficients of collaboration and natural resources are significantly different from zero ( $t=11.78 > t_{\alpha=0.01, \nu=79-4} \approx 2.64$  and  $t=6.91 > 2.64$ ). But the coefficient for IQ is not ( $t=0.83 < t_{\alpha=0.01, \nu=79-4} \approx 2.64$ ). If GII and IQ are excluded from the model where  $\text{GDPppp}=f(\text{N})$ , the coefficient of determination is  $R_{adj}^2=0.06$ . That is, N explains about 6% of GDPppp. The partial contribution to  $R_{adj}^2$  from GII when GII is added to the model is 0.82. So, the partial contribution  $R_{adj}^2=0.82-0.06=0.76$ . That is GII explains about 76% of GDPppp if IQ is ignored. The estimated partial correlation  $r(\text{GDPppp}, \text{GII}|\text{N}) = \sqrt{0.76}=0.87$ . The partial contribution to  $R_{adj}^2$  from IQ when IQ is added to the model is 0.49. So, the partial contribution  $R_{adj}^2=0.49-0.06=0.43$ . That is IQ explains about 43% of GDPppp if GII is ignored. The estimated partial correlation  $r(\text{GDPppp}, \text{IQ}|\text{N}) = \sqrt{0.43}=0.66$ . The conclusion remains that collaboration is a better predictor than IQ. Collaboration is also a better predictor than natural resources.

The innovation output sub-index part of the innovation index and GDPppp may contain some overlapping effects. Also, one might argue that just as a functioning body requires nutrition, so does a functioning brain. GDPppp might affect nutrition GDPppp and nutrition might affect IQ. Also, education and IQ are correlated, although causality and the direction thereof are not

settled (Herrnstein and Murray, 1994). But these correlations are intracountry, and this study is about intercountry measurements. In any case there are no data available for years of education by country and the cross-country qualities of education are by no means equal. Still, there may be a possibility that these variables are not entirely exogenous and that the least squares regression coefficients may be biased. However, the estimates of the t values are so very different that they will not switch their rank positions because of such bias. Also, there will be no diminution in the predictive ability of the regression model.

Still, a check for endogeneity was made. La Porta, et al. (1999) considered legal origin, latitude and ethnolinguistic fractionalization (E) as instrumental variables for capital. All are exogenous, but while L is correlated with GII and IQ, and E is correlated with IQ, none is correlated with GDPppp. Therefore, they are not suitable instrumental variables. We tested for the presence of endogeneity as follows. The residuals (e) from the model where  $GII=f(IQ,N,L)$  were added to the original model such that  $GDPppp=f(GII, IQ, N, e)$  and the model was re-estimated. The coefficient of e was not statistically significant. Similarly, the residuals (e) from the model where  $IQ=f(GII,N,L)$  was added to the original model such that  $GDPppp=f(GII, IQ, N, e)$  and the model was re-estimated. Once again, the coefficient of e was not statistically significant. We repeated the test using E in place of L and the results were the same. So, we conclude that there is no endogeneity.

## 4. Discussion: Collaboration Trumps Intelligence

### 4.1 Capitalism-Democracy-Rule of Law

Ten percent of the people in the world are rich and are getting richer while ninety percent live on \$2 to \$3 per day. Given that the potential for standard of living is a function of the CDR index (Ridley, 2020a,b), we are interested to know how to raise the CDR index of a country. Collaboration is the mechanism by which rule of law will attract capital and democracy will create additional pathways for the deployment of capital. We regressed GDPppp on country collaboration, intelligence, and natural resources. The result showed that collaboration has a statistically significant effect on GDPppp, intelligence does not, and natural resources do. This outcome is somewhat counter intuitive. One would expect intelligence to play a significant role in economic growth and development. Perhaps the answer lies in the fact that IQ tests are designed to be performed by individuals. It may only measure a sliver of intelligence. And while the ability to collaborate might require intelligence, it is not the type that is measured by IQ. Even so, high IQ in no way implies low other intelligence, other than that directly measured by IQ. A person with superior IQ can decode the society within which they live, then rise rapidly up to a high paying or otherwise preferred position. But no collaboration on any innovation may be required to accomplish this upward transition. In that case, the demonstration of IQ can continue indefinitely with no concomitant economic growth.

### 4.2 Source of Wealth

We know from Ridley (2020a,b) that the source of wealth is human capital ideas of imagination and creativity. At the very time of this writing, the territory at the exact intersection of Central

Asia, South Asia and the Middle East, is a perfect reverse example of corruption and low rule of law repelling its source of wealth: native human beings (capital) fleeing their country, fellow countrymen and political leaders, in fear of their lives (Reuters, 2021; Bing news, 2021). Natural resources have a small effect on GDPppp. Government spending, country size, location, culture and population physical characteristics have negligible effect on GDPppp. We also know from Ridley, Ngnepieba and de Silva (2021) that learning that takes place in a collaborative mode produces university course grades that are higher and that are symmetric normally distributed. Human intelligence is a notion that is implicit in human capital. Soup de nuts, every child brings and injects their own intelligent capital into the world. Intelligence can be exploited by cooperation and self-interest for trade and ordinary economic growth (Adam Smith, 1776, 2010). Ridley (2020a, p12) contains the seminal presentation of a CDR econometric model for the a priori computation of world average endogenous growth. The estimate reported there is 1.8% and represents ordinary economic growth. We mention in passing an interesting observation that this equates to  $\frac{1}{4}e^2$ , where  $e$  is Napier's constant (Euler's number) and the base for the natural logarithm. When intelligent capital is organized through collaboration, one can expect extraordinary economic growth. By itself, or when disorganized, intelligence may be effective in ordinary economic growth, but ineffective for extraordinary economic growth and development. That is, intelligence is a necessary but not sufficient attribute for extraordinary economic growth.

#### *4.3 Intelligence and Underdevelopment*

There are many countries with intelligent people but that are underdeveloped with low economic growth. Imagine a group of people who are certified highly intelligent. This is a super intelligent environment. Each member of the group considers themselves as equally or more intelligent than the rest. Why would they defer to the rest? Instead, they do with sincerity what the others consider to be sabotage if they do not agree. It's not what one doesn't know that gets one into trouble. It's what one knows for sure that just isn't so. Collaboration overcomes this problem. By collaborating in a shared goal and for a shared reward, the group members can trust each other to intelligently perform their role to the best of their ability. And then, having developed that approach, they may even listen to a person of lesser intelligence but who has recognizable valuable relevant specific experience. Surowiecki (2005) explains how the wisdom of crowds can exceed that of the smartest individual amongst them. Collaboration trumps intelligence.

#### *4.4 Collaborate with Whom?*

We have assumed that collaboration is an activity for law abiding governments, corporations, citizen organizations and citizens. But what if the collaboration tool falls into the wrong hands? What about collaboration by corrupt governments and criminal organizations. We posit that extralegal corrupt activities are limited to cooperation with individual goals in mind, and do not qualify as collaboration. By definition, informal criminal organizations do not have access to courts where they can settle their disputes. They resort to tribal gangsterism and the systematic destruction of themselves and their members. When the formal intralegal

organizations are weak, and also do not collaborate, extralegal organizations are not only self-destructive they are nation destructive. We would like to think that if said criminals were to collaborate, then the more they collaborate the more they would learn the benefit of shifting from extralegal activity to intralegal activities which would make them law abiding contributors to national economic growth and development. We point to historic crime organizations in America that shifted from extralegal mob activities to intralegal legitimate growth businesses. Is it because they collaborated? Are today's perpetual self-destructive gangsters cooperating but not collaborating? In any case, legitimate organizations must strengthen collaboration to overcome crime and corruption. Collaboration must be used to create crime fighting strategies. See Sergi and Qerimi (2007) and Qerimi and Sergi (2012) for more on fighting corruption and organized crime. See Acemoglu, et al. (2005) for more on the institutions that separate high economic growth South Korea from low economic growth North Korea. See Acemoglu, et al. (2019) for more on democracy and economic growth. Ridley and de Silva (2019) show how to remove corrupt dictators so as to raise the CDR index.

## 5. Conclusions

This research investigates the relative effects of collaboration and intelligence on standard of living. Standard of living was regressed on collaboration, intelligence and natural resources. Collaboration was found to be a statistically significant predictor of standard of living. Intelligence was not. Natural resources were. By itself, intelligence has no significant impact. There are scenarios in which it might even be an obstacle to collaboration. It is only when intelligence is organized by collaboration that extraordinary economic growth occurs. Future research might include ways to teach global collaboration methodology for the advancement of economic growth with the objective of maximizing total wealth and the amount available to the least among us. Also, the way that collaboration creates new products and services is fairly well understood and appreciated. But what precisely is the mechanism by which collaboration can create rule of law, especially property rights (see also Ridley and Nelson, 2022) that attract capital that can be deployed democratically for economic growth and development?

## Conflict of Interest Statement

On behalf of all authors, the corresponding author states that there is no conflict of interest.

## Data availability statement

All data are included in this paper

## Software

Computations were performed with the Microsoft 365 xcel statistical add-in package.

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