Title: Wealth code unlocked: The combined effect of emotional intelligence and intelligence quotient.

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Abstract:

Background: Intellectual quotient (IQ) is a measure of intellectual “ability” of performing, comprehension, and learning. Previous study reported that intelligence measures predict various measures of job performance and income. Emotional intelligence (EI) is the capacity of awareness, controlling and expression of one's emotions, seeking more feedback, and managing one's emotion to handle interpersonal relationships judiciously and empathically. These characteristics are also important for personal and professional success.

Objective: This study tests a hypothesis whether the average national income rank is best predicted by the combined effect of the population's average intelligence quotient (one's ability to perform and learn) and emotional intelligence (emotional ability to express and handle interpersonal relationships).

Method: The population average intelligence quotient, emotional intelligence, and indices of good governance, which include corruption perception index and educational expenses for each country were obtained from public data sources. The outcome variable for this study was the average national income rank. All the variables that are significant in univariate analysis were included in the multivariate regression analyses but excluded from the final model if not significant.

Result: The total number of countries included in the final analysis was 81 because of missing values in different variables. The product of intelligent quotient (IQ) scores and emotional intelligence (EI) were found highly correlated at -0.75 ($p < 0.05$) with the national average income rank. The independent effect of intelligence quotient (IQ) and emotional intelligence (EI) was found not significant when their interaction effect (the product of IQ and EI) was introduced in the model. The R square value for the multivariate model with the interaction effect of intelligence quotient (IQ) and emotional intelligence (EI) was the highest at 0.73. The final model also included measures of good governance such as educational expense and corruption perception index (CPI). The corruption perception index (CPI) and educational expense were strongly correlated with measurements of good governance such as democracy index, functioning of government, electoral process and pluralism, political participation, and civil liberty, but these variables were found not significant in the multivariable model.

Conclusion: The study concludes the effect of emotional intelligence and intelligence quotient are complementary to each other and holds the key to predicting average national income or

wealth rank. This study also implies a nation may build more wealth if educational institutes focus on developing emotional intelligence (EI) and intelligence quotient (IQ).

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Introduction:

Intellectual quotient (IQ) is a measure of intellectual “ability” of performing, comprehension, and learning. The IQ score was developed by the West European according to the West European standard. It is still debatable whether this quotient can be applied to people on entirely different continents with different social structures, cultures, values, and ways of thinking. Again, finding an average intelligence quotient of a certain nation is challenging. A previous study reported that intelligence quotient measures predict various measures of job performance and income [1]. Zagorsky (2007) reported that each point increase in IQ test scores raises income by between \$234 and \$616 per year after holding a variety of factors constant [2].

Emotional intelligence (EI) is the capacity of awareness, controlling and expression of one's emotions, seeking more feedback, and managing one's emotion to handle interpersonal relationships judiciously and empathically. These characteristics are important for personal and professional success. A previous study suggested that emotional intelligence has a significant, positive effect on subsequent salary levels, and it helps individuals to acquire the social capital

needed to be successful in their careers [3]. Rooy et. al suggested that the emotionally intelligent worker is more likely to empathize with others leading to a supportive work environment and professional success [4]. Momm et al reported, emotion recognition abilities are responsible for how well one can sense another person's emotions from their face and voice. This ability leads to high political skills and interpersonal facilitation which leads to more cooperative, considerate, and helpful team members leading to higher annual income [5].

Thus, it is important to investigate whether a nation's average emotional intelligence measure can predict its income rank as such a hypothesis was not tested before. It is also important to investigate the combined effect of intelligence quotient (one's ability to perform and learn) and emotional intelligence (emotional ability to express and handle interpersonal relationships) hold the key to average national income rank.

Methodology:

The study considered the percentage of any country's population who said they had experienced the full range of positive and negative emotions (feel well-rested, respected, smile, or laugh, do something interesting, enjoyment, physical pain, worry, sadness, stress, anger) on the previous day as a surrogate measure of emotional intelligence. It was a part of Gallup's emotional study which collected people's positive and negative daily experiences based on more than 151,000 interviews with adults in over 140 countries in 2018 [6]. The emotional intelligence used in this study had a mean value of 47 percent (ranging in between 36 to 54) with a standard deviation of 4.5. The current study also included a total of 97 countries' average population IQ which was collected from the results of 9 international studies [7]. The intelligence quotient used in this

study had a mean value of 100 points with a standard deviation of 15 (an IQ between 85 and 115 was considered normal). The product of EI and IQ value was divided by 1000 for the purpose of scaling down to the same magnitude as the other variables used. The average national income included in this study was obtained for the year 2019 data [7]. The national average income rank was measured on a scale of one (1) to one hundred forty (140) where one means the highest average national income and one hundred forty means the lowest. By using a rank of average national income as the dependent variable, a great deal of variation was removed from the data.

The other factors that can explain the average national income were indices of good governance, such as the democracy Index, electoral process, and pluralism, functioning of government, political participation, civil liberties, education expense and corruption perception index. These data about the measures of good governance were obtained from the world population review website [8] and the data related to corruption perception index (CPI) 2020 were obtained from the transparency international website [9]. The CPI score was measured on a scale of zero (0) to one hundred (100) where zero means highly corrupt and one hundred means very clean.

All these data sets were merged by country using Python data analysis software. Subsequently, a master data file was built which had the population's rank by average national income (GNI Rank), emotional intelligence (EI), intelligence quotient (IQ), average income, population size, democracy index, electoral process, and pluralism, functioning of government, political participation, education expense, and corruption perception index (CPI). The outcome variable for this study was the income rank of a country based on average national income. The

correlation matrix was conducted to evaluate the correlation coefficient between the studied variables. Single and multivariate regression analyses were done using Stata statistical analysis software. Variables that were significant in univariate analysis were included in the multivariate model but excluded from the final model if they were not significant. The total sample size used in the multivariate analysis was 81 countries due to missing values. This study did not replace any missing values of the key study variables such as average annual income, emotional intelligence and intelligence quotient scores leading to a decreased sample size from 140 to 81. However, the missing data related to educational expense and corruption perception index, and other measures of good governance were replaced with their average value.

Results:

The total number of countries included in the study was 102 because the rest of the country’s average intelligence quotient scores were not available. Among those 102 countries, twenty-one (21) were excluded from the analysis because of missing data related to emotional intelligence. The income rank of the countries was done by average national income (in million USD) and the top thirty (30) countries were shown in Table 1.

Table 1: Ranked list of countries from 1st to 30th by the average national income: Demonstrating the multiplying effect of emotional intelligence (EI) and intelligent quotient (IQ).

Income	EI	IQ	Product	Average	Democracy	Education	Electoral	Functioning	Political	Civil	CP
Rank			IQ & EI	Income	Index	Expense	Process	Government	Participation	Liberties	Index

Luxembourg	50	99	4950	54254	9	204	10	9	7	10	80
Switzerland	49	102	4998	50054	9	204	10	9	8	9	85
Denmark	50	99	4950	39017	9	204	10	9	8	9	88
Japan	47	105	4935	36784	8	204	9	8	7	9	74
Sweden	49	99	4851	36480	9	204	10	10	8	9	85
United States	54	98	5292	36470	8	204	9	7	8	8	67
Netherlands	49	102	4998	33689	9	204	10	9	8	9	82
Austria	47	100	4700	32004	8	204	10	7	8	9	76
Finland	50	101	5050	31447	9	204	10	9	9	10	85
United Kingdom	49	100	4900	30986	9	204	10	8	9	9	77
Germany	47	100	4700	30892	9	204	10	9	8	9	80
Belgium	52	100	5200	30741	8	204	10	8	5	9	76
Kuwait	50	85	4250	29283	4	204	4	4	4	4	42
Ireland	51	94	4794	28420	9	204	10	8	8	10	72
Canada	54	101	5454	27683	9	204	10	10	8	10	77

Italy	47	97	4559	25889	8	204	10	6	8	8	53
Australia	50	99	4950	25665	9	204	10	9	8	10	77
Singapore	36	108	3888	25561	6	906	4	8	5	7	85
Hong Kong	46	108	4968	25419	6	915	4	4	6	9	77
Spain	53	97	5141	19808	8	884	10	7	8	9	62
New Zealand	52	100	5200	18676	9	204	10	9	9	10	88
Cyprus	52	92	4784	17915	8	767	9	6	7	9	57
Greece	49	92	4508	16859	7	541	10	5	7	9	50
Slovenia	48	97	4656	15480	8	805	10	7	7	8	60
Portugal	50	95	4750	14181	8	724	10	8	6	9	61
South Korea	42	106	4452	13759	8	522	9	8	7	8	47
Saudi Arabia	50	81	4050	10618	2	700	0	3	2	1	53
Estonia	43	99	4257	9575	8	458	10	8	7	9	75
Croatia	43	95	4085	8877	7	350	9	6	6	7	47
Trinidad and Tobago	50	85	4250	7984	7	274	10	7	6	7	40

	ANIR	ANI	IQ	EI	IQ*EI	DI	EPP	FG	PP	CL	CPI	EE

Average National Income Rank (ANIR)	1.00											
Average National Income (ANI)	-0.86*	1.00										
Intelligence Quotient (IQ)	-0.67*	0.59*	1.00									
Emotional Intelligence (EI)	-0.32*	0.32*	0.04	1.00								
Product of IQ and EI (IQ*EI)	-0.75*	0.70*	0.83*	0.59*	1.00							
Democracy Index (DI)	-0.68*	0.60*	0.55*	0.36*	0.68*	1.00						
Electoral process & Pluralism (EPP)	-0.56*	0.46*	0.47*	0.31*	0.58*	0.94*	1.00					
Functioning of Government (FG)	-0.66*	0.59*	0.59*	0.39*	0.72*	0.93*	0.84*	1.00				
Political Participation (PP)	-0.66*	0.57*	0.51*	0.31*	0.61*	0.90*	0.81*	0.80*	1.00			
Civil Liberty (CL)	-0.66*	0.57*	0.54*	0.31*	0.65*	0.97*	0.93*	0.88*	0.85*	1.00		
Corruption Perception Index (CPI)	-0.79*	0.76*	0.67*	0.27*	0.74*	0.82*	0.68*	0.84*	0.73*	0.80*	1.00	

Educational Expense (EE)	-0.57*	-0.36*	0.49*	0.06	0.42*	0.33*	0.27*	0.32*	0.27*	0.38*	0.49*	1.00

A correlation matrix was done using all the available variables (Table 2), including average national income rank, intelligence quotient (IQ), emotional intelligence (EI), product of IQ and EI, average national income, democracy index, the electoral process and pluralism, government functionality, political participation, educational expense, and corruption perception index (CPI). Variables that have a significant correlation with the average national income rank was used for multivariate regression analysis. The variables that are not significant were excluded from the multivariate analysis in a step-by-step fashion. The independent effect of intelligence quotient (IQ) scores and emotional intelligence (EI) was found not significant but their interaction effect (the product of IQ and EI) was strongly significant after adjustment of measures of good governance which includes corruption perception index and educational expense (Table 3). This indicates a multiplying effect of the intelligence quotient (IQ) and emotional intelligence (EI) is the key to explain a country's income growth irrespective of all other conditions that can impact the ranked average income. According to the current study, if emotional intelligence scores can be increased by 5 points through training of the whole nation, while holding intelligence quotients constant at 100, the effect size will change $(500 / 1000) \times (-12.48)$; [product of IQ and EI was divided by 1000 to scale it down]. Corruption perception index (CPI) was highly correlated with all other measures of good governance such as the democracy index, functioning of government, electoral process & pluralism, political participation, civil liberty. These variables were excluded from the final multivariate model as they were found not significant.

Table 3: The combined effect of Intelligent Quotient (IQ) and Emotional Intelligence (EI) on the national income rank: A multivariate analysis (n=81)

Variables	Coefficient	Standard Error	Lower Limit	Upper Limit	P-value
Product of IQ and EI*	-12.48	3.45	-19.35	-5.61	<0.001
Educational Expense	-0.02	0.01	-0.04	-0.01	<0.010
Corruption Perception Index (CPI)	-0.66	0.12	-0.90	-0.41	<0.001
Constant	137.60	10.80	116.10	159.09	<0.001

EI (emotional intelligence); IQ (Intelligence Quotient); R Square value = 0.73

Fig. 1 shows the trendline on the scatter plot of the product of IQ and EI over the income ranks of the countries. On a single variable regression analysis, when average national income rank was regressed over the product of IQ and EI, the R square value was 0.57. This explains the product of IQ and EI is the most important variable that explains the income rank of any country.

Figure 1. Scatter plot of the product of intelligence quotient (IQ) and emotional intelligence (EI) along with the trend line.

Figure 2: Model to predict the average national income rank or average national income growth:

$$IncomeRank_i = 137.60 - 12.48 * (ProductofIQandEI_i / 1,000) - 0.02 * AverageEducationalExpense_i - 0.66 * CorruptionPerceptionIndex_i + \varepsilon_i$$

*Corruption Perception Index obtained from Transparency international report.

Fig. 2 shows any country's income rank can be predicted using the model that includes the product of emotional intelligence and intelligence quotient, educational expense, and corruption perception index (CPI) which are measures of good governance. This model can be used to

evaluate the return of investment for different educational and training programs to improve emotional intelligence for a certain population group.

Discussion:

It is important to understand a predictor that places a country ahead or behind other countries in terms of wealth or average income. If such predictors can be identified, the country can achieve wealth growth by allocating resources to increasing strength in that dimension. This study found the interaction between IQ and EI to be the most important factor in predicting the rank of countries based on average national income. The product of IQ and EI was found strongly correlated at -0.72 ($p < 0.05$). In addition, in the multivariate regression analysis, the product of IQ and EI was also significant at $p < 0.001$. Both the IQ and EI were individually found not to be significant in the final model. In addition, the correlation coefficient between IQ and EI was also found not significant, indicating that both are measuring two different characteristics. The significant interaction effect of IQ and EI indicates a product of the two has a relationship with income growth. Collectively, these findings indicate that even if a country has a high IQ and moderate or low EI, their average national income will mirror a country with high EI and moderate or low IQ. A similar finding was reported at the individual level by Cote and Miners in 2006, where EI can be more important to individuals with low IQ [10].

Using univariate analyses, the study found that the combined effect of IQ and EI score is highly correlated with average national income rank, yielding a significant p-value (<0.05) and an R-square value of 0.53. Alone, the interaction effect explains more of the variability in income rank

than any other variable in this study. It is important to note that the R-square value of IQ regressed on income rank is only 0.44, and the R-squared value of EI regressed on income rank is merely 0.11. Thus, this combined effect, or the interaction effect is the hidden key that elucidates the nuanced relationship between income, IQ, and EI, all at the national level. And since the average national income level exists as a representative value for an entire country, other unified, representative variables can be used to explain the average national income. In a multivariate analysis, the most predictive model included three variables: the interaction effect of IQ and EI, educational expenditure, and the corruption perception index (CPI). All three variables were highly significant, and the model had an R-squared value of 0.73, meaning that these three variables were able to explain 73% of the variance in the income ranks. With a country's average income depending on a countless number of inconceivable variables, it is surprising that just three variables were able to capture so much of the underlying mechanism. That is why just these three variables can be considered as the hidden key for economic success for any given nation.

Given the study utilized national level average income as an outcome variable, the factor that can confound the national income is good governance. The measurements for good governance were measured to be the democracy index, electoral process, and pluralism, functioning of government, political participation, civil liberty, educational expense, and corruption perception index (CPI). All these variables were found highly correlated (Table 2). However, the final model did not include the democracy index, political participation, electoral process & pluralism, functioning of government, and civil liberty, which were likely explained by the corruption perception index and educational expense. The average national income rank depends on the corruption perception index, and educational expense after adjusting for the product of IQ and

EI. This indicates that good governance is also fundamental for income growth, which is supported by other studies [11].

This study finding cannot be extrapolated to an individual level but to a group level or regional level because the data used in the analysis were national averages. Given the estimates used in this study were average national income, intelligence quotient (IQ), and emotional intelligence (EI), the study could test the effect size irrespective of races, religions, cultures, across geographic locations. In such a case, a group of individuals with high EI and low IQ should have a better income potential compared to a group of individuals with low EI and low IQ. For example, a group of individuals with an EI score of 50 and IQ score of 100 should have similar income potential compared to a group of individuals with an EI score of 45 and IQ score of 111 where the product in both cases is 5000. According to this study, the income potential for all people in that country with an equal product of IQ and EI score (e.g. 5000) should follow the same normal distribution pattern where the majority of people with the same product of IQ and EI make that average income on that normal distribution curve. However, the current study did not test the effect of age, sex, race, religion, education, and experience as it used average income, IQ and EI score. Obtaining a representation sample that would reflect the average income for a certain group of population from the whole world might not change the study conclusion given the remarkably high R square value of the final model. The strongly significant interaction product also indicates that both IQ and EI are complementary to each other where even a group with higher IQ scores and lower EI score can navigate through the obstacles and reach a certain potential income compared to those of comparatively lower IQ score and lower EI scores. This findings implies a

nation can build more wealth if educational institutes focus on developing emotional intelligence (EI) and intelligence quotient (IQ).

Kovas, et al found that genes largely contribute to similarity in performance which indicates the heritability of IQ [12]. However, according to the “Flynn effect” there is a rise in IQ scores over time [13]. The current study also supports the Flynn effect as most nations increase their average wealth or income over the period. This is possibly due to country change in ways that promote cognitive and social skills leading to increase in IQ and possibly EI. Previous randomized experimental study also suggests that emotional intelligence can be enhanced through training and development [14]. In such cases, improving IQ and EI should be one of the cornerstones of academic training in the school.

The current study finding is much more than just a predictive model to explain the rankings of any country’s wealth. The final multivariate model brings attention to three dimensions of a nation that can be improved upon. This study suggests that increasing the product of IQ and EI, increasing educational expenditure, and reducing corruption in a country will predict a reduced value of average income rank or increase any country’s wealth, placing the country higher on the world’s stage.

Limitations:

The current study could not comment about the casualty as it used cross sectional data. To find the causal relationship at the individual level, multicenter randomized clinical trials are needed to evaluate the combined effect of emotional intelligence, and intelligent quotient on subsequent annual income growth at individual and national level. In addition, this study used emotional awareness data from Gallup emotional study [6]. Instead, an emotional intelligence score that assesses all five domains of emotional intelligence may explain more variability of the average annual income growth.

Conclusion:

The study concludes the effect of emotional intelligence and intelligent quotient are complementary to each other and holds the key to predicting average national income or wealth rank. The study also found the effect of good governance like corruption perception index and educational expenses are significant for average national income. This study implies a nation may build more wealth if educational institutes focus on developing emotional intelligence (EI) and intelligence quotient (IQ). Future studies involving molecular genetics, neuroscience and economics are needed to investigate whether there is a causal relationship between development of emotional intelligence, and intelligent quotient on an individual's annual income.

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