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Decoupling Entrepreneurship Capital from Capital Stock

DENNIS RIDLEY* **& ABDULLAH KHAN****

Abstract: Per capita real gross domestic product adjusted for purchasing power parity (G) is parsimoniously explained by capitalism (C), democracy (D) and rule of law(R). G is estimated from a CDR index equal to the vector inner (dot) product of global invariant parameters [1.53 0.14 0.23 -1.21] and country specific [C D R C·D·R]. The data are for year 2014 and 79 countries that represent practically all people in the world. C is measured by total capitalization then split into human capital of entrepreneurship imagination and creativity and capital stock of knowledge, machines, computers, training, recording devices etc. The contribution of entrepreneurship to G is found to be 6 times that of capital stock.

Keywords: CDR index; GDP; Capitalism; Democracy; Rule of Law; Entrepreneurship

JEL: E02, P16

INTRODUCTION

The idea of explaining per capita real gross domestic product adjusted for purchasing power parity (*G*) by capitalism (*C*), democracy (*D*) and rule of law(*R*) was introduced by Ridley (2016) and Ridley, Davis and Korovyakovskaya (2017). But, no formal measurements were made. Ridley (2017) presented a parsimonious model $G=f(C,D,R)$ based on published country market capitalization as the measure of capitalism, ranking in democracy, and ranking in rule of law (Goel, Mazhar and Nelson, 2016; Czap and Nur-tegin, 2012. See also Couttenier and Toubal, 2017; de Soto, 2000). Ridley (2017) used an ordinary least squares (OLS) model based on year 2014 data for 79 countries that represent practically all people in the world. This paper goes further using two stage least squares (2SLS) to

* Professor, School of Business & Industry, Florida A&M University and Dept. of Scientific Computing, Florida State University, Tallahassee, Fl., E-mail: dridley@fsu.edu.
** Associate professor, School of Business, Claflin University, Email: akhan@claflin.edu

decouple the human capital ideas of imagination and creativity from capital stock of human knowledge, machinery, recording and computing devices, etc. This is the first time that this decoupling of capital has been performed. It is also the first time that an estimate of the value of ideas has been computed.

Unlike the Solow (1956) growth model of capital stock and labor, *C* is measured from the sum of entrepreneurship capital and capital stock and assumes that investors act rationally and without bias. Its current value is discounted future earnings for current and all subsequent years. Capitalism is the mechanism for capital formation and the company is the instrument of capitalism (Micklethwait and Wooldridge, 2003). We define a capitalist as a person who seeks to deploy personal effort in such a way as to maximize the benefit to him or herself. This includes all rational human beings (Smith, 1776; Young, 2016). Democracy ranking reflects the ability of citizens to freely select government and corporate leadership, and invest capital. It is a proxy for new pathways that connect human capital ideas of imagination and creativity. Rule of law is the enforcement of contracts and discouragement of corruption. It is a proxy for stability that attracts capital. This research finds that the intangible factors of *C*, *D* and *R* greatly outweigh the tangible factor of natural resources (*N*). Furthermore, natural resources can contribute to corruption in the absence of democracy and rule of law (Norman, 2009; Frankel, 2012). This suggests that countries may do better to embrace a national policy that focuses on raising their *C*, *D* and *R*.

Different economic schools of thought suggest different determinants of economic growth. However, the consensus is that institutions reflected in *D* and *R* play a significant role (Acemoglu, Johnson and Robinson, 2005; Hamilton,1919; Hodgson; 2000, North; 1991). The literature appears to be settled on the impact of *R*. But, there is considerable debate over the role of *D*. In a review of several studies on data from 1949 to 1992 (see Adelman and Morris, 1967; Dick, 1974; Huntington and Dominguez, 1975; Weede, 1983; Kormendi and Meguire, 1985; Kohli, 1986; Landau, 1986; Sloan and Tedin, 1987; Marsh, 1988; Pourgerami, 1988; Scully, 1988, 1992; Barro, 1989; Grier and Tullock; 1989, Remmer, 1990; Pourgerami, 1991; Helliwell, 1992), the findings of Przeworski and Limongi (1993) were split between positive, negative and no effect. But, none of those studies include an interaction $C{\cdot}D{\cdot}R$ term. The *C, D, R,* model does include an interaction term. The result is a positive democracy effect and negative friction between capitalism, democracy, and rule of law, where all three make significant contributions to explaining *G*. These will be explained further in the section

on the regression model. Regarding the direction of causation, *D* and *R* are the same type as economic freedom of the world (EFW) variables, and Gwartney, Holcombe and Lawson (2004, 2006) showed the direction of causation to be from EFW to *G*.

The remainder of the paper is organized as follows. Section 2 is a global cross sectional regression analysis. Section 3 shows a corresponding vexillological chart that easily identifies countries. Section 4 reconciles the macro and micro economic models of *G* and production. Section 5 contains concluding remarks and suggestions for future research.

REGRESSION ANALYSIS

The OLS regression model is defined as

$$g = \beta_0 + \beta_C C + \beta_D D + \beta_R R + \beta_{CDR} C \cdot D \cdot R + \beta_N N + \varepsilon$$

where the parameters and variables are dimensionless under linear transformation as follows

g	=	(G - lowest G)/(highest G-lowest G)
C (Capitalism)	=	(per capita capitalization-lowest per capita capitalization)/ (highest per capita capitalization-lowest per capita capitalization)
D (Democracy)	=	(lowest democracy rank-democracy rank)/(lowest democracy rank-highest democracy rank)
R (Rule of law)	=	(lowest corruption rank-corruption rank)/(lowest corruption rank-highest corruption rank)
N (Natural resources)	=	(per capita total natural resource rents-lowest per capita total natural resource rents)/(highest per capita total natural resource rents-lowest per capita total natural resource rents).
ε	=	normally distributed zero mean constant standard deviation random error.

These transformations standardize the variables and ensures upper and lower bounds on $0 \leq g, C, D, R, C \cdot D \cdot R, N \leq 1$.

Democracy and corruption are rank ordered, where the highest =1 and the lowest = the number of countries.

Data for these standardized variables are listed in a *supplementary spreadsheet*.*Click here to download supplementary source data*.

DATA SOURCES

G (PPP, constant international$ for 2014, reported by the IMF)	http://www.imf.org/external/data.htm
Population	http://data.worldbank.org/indicator/SP.POP.TOTL
Capitalization (US$ mundi)	http://www.indexmundi.com/facts/indicators/CM.MKT.LCAP.CD/rankings
Democracy rank	http://democracyranking.org/wordpress/rank/democracy-ranking-2014/
Corruption rank	https://www.transparency.org/research/cpi/
Total natural resources (% of G)	http://data.worldbank.org/indicator/NY.GDP.TOTL.RT.ZS

Democracy rank & corruption rank for Bermuda was set to that for United Kingdom as the governing country

Democracy rank & corruption rank for Hong Kong was set to that for United Kingdom as the recent & last governing country

Barbados (high CDR) and Equatorial Guinea (high G) are too small for attention by the reporting agencies.

There are 150 countries for which 79 contain complete data for the regression. The degrees of freedom for error are 79-5-1=73. The results of the regression analysis are given in Table 1. The zero intercept implies that g is zero when *C, D, R* and *N* are zero and that there are no other relevant variables. The estimated model is $\hat{g}=1.53C+0.14D+0.23R-1.21{\cdot}C{\cdot}D{\cdot}R+0.38N$. That is, g is estimated from the vector inner (dot) product of global invariant parameters [1.53 0.14 0.23 -1.21] and country specific [*C D R C·D·R*]. For convenience this will be referred to as the CDR index. *G* can be estimated from $\hat{G}=\hat{g}$(highest *G*-lowest *G*)+lowest *G* where highest *G*=83,066 and lowest *G*=1,112.

All regression coefficients in the OLS model are significantly different from zero at a level of significance of 10% (|t statistic| > $t_{0.1,73}$=1.67). The coefficient of multiple determination R^2_{adj}=0.83. That this, 83 percentage of the variation in g is explained by the model. The F ratio = 81.03 > $F_{0.01,5,73}$=3.28 indicates that at a level of significance of 1%, the model is a good fit to the data. The greatest contributor to explaining g is *C* with a contribution of 59%. *D, R* and *C·D·R* contribute 5, 10 and 3% respectively for a total of 18%. In the *C, D, R* paradigm, *D* and *R* are heterogeneous exogenous catalysts that facilitate the conversion of *C* to g. *D* and *R* do not take place in the operation, do not get used up, but remain unchanged at the end. Because they are unchanged, they must be heterogeneous and

exogenous from *C*. The function of *R* is to create stability that attracts *C*. The function of *D* is to create additional pathways for connecting ideas on how to deploy *C* effectively. The negative coefficient associated with the interaction term $C{\cdot}D{\cdot}R$ represents friction due to differences in ideas that are almost certain to occur in a democracy. If there were perfect agreement and the agreement was the best possible decision, the decision could not be bettered and the coefficient would be zero. The partial contribution from *N* is a negligible 6%. The intangibles *C, D* and *R* contribute (83-6)/6~13 times as much as natural resources. This is a most surprising result.

Finally, the fitted errors from the model were examined and exhibited no patterns. They did not show any correlation with $\hat{g}$. They passed a chi squared goodness of fit test for normality at a 5% level of significance.

Table 1. OLS and 2SLS Regression Results

OLS		2SLS			
		1st stage least squares with latitude (d) as instrumental variable for C		2nd stage least squares	
Fitted equation for $\hat{g}$		Fitted equation for $\hat{C}$		Re-Fitted equation for $\hat{g}$	
Variable	Estimated coefficient	Variable	Estimated coefficient	Variable	Estimated coefficient
Intercept	0.00 (0.08)	Intercept	0.04 (3.27)	Intercept	0.00 (0.02)
C	1.53 (6.69) [0.59]	d	-0.10 (3.77)	$\hat{C}$	1.30 (2.66)
D	0.14 (1.69) [0.05]	D	-0.16 (4.64)	D	0.12 (0.88)
R	0.23 (2.60) [0.10]	R	0.22 (6.43)	R	0.28 (1.95)
$C{\cdot}D{\cdot}R$	-1.21 (4.40) [0.03]	$C{\cdot}D{\cdot}R$	1.11 (27.11)	$\hat{C}{\cdot}D{\cdot}R$	-0.98 (1.88)
N	0.38 (5.59) [0.06]	N	-0.02 (0.61)	N	0.38 (4.45)
R^2_{adj}	0.83	R^2_{adj}	0.94	R^2_{adj}	0.74
F ratio	81.03	F ratio	272.58	F ratio	46.64

Note: Student |t| coefficients are in parentheses (). Partial correlations are in parentheses []

ENTREPRENEURSHIP VERSUS CAPITAL STOCK

In the *C, D, R* paradigm, *C* is measured by total market capitalization. *C* is measured from the sum of exogenous human capital ideas also known as entrepreneurship, and endogenous capital stock. *C* is converted to the production of goods and services. Some production is consumed and some is reinvested in capital stock. Capital stock is residual skill, stored knowledge from teaching ideas to other persons, and reinvestment in fixed capital less depreciation and obsolescence (Janssen, Claus and Sauer, 2016). The

endogenous capital stock in *C* will bias the coefficient of *C* in the OLS model. Like La Porta et. al. (1999), latitude or absolute distance from the equator (*d*) is used as an instrumental variable for *C* to obtain a consistent estimate. Latitude is assumed to be correlated with *C* and uncorrelated with the errors in the OLS model. The results are given in Table 1. In the 1st stage least squares regression is statistically significant (t=3.77). In the estimated 2nd stage least squares regression the consistent estimate of the coefficient of *C* is 1.30 and R^2_{adj}=0.74. The reduction in R^2_{adj} is 0.83-0.74=0.09 per unit or 9%. This was the contribution from capital stock. The contribution of total capital to R^2_{adj} is 0.59. So, the contribution from entrepreneurship is about (0.59-0.09)/0.09~6 times as much as capital stock from old ideas that occurred earlier.

VEXILLOLOGICAL CHART

The relationship between *G* and the CDR index is shown in the vexillological chart in Figure 1. In additional to the regression line, bubbles and flags are used to identify 21 of the 79 countries by name and size, selected for their contrast in population size, location, climate, wealth, natural resources, history and culture. They line up remarkably well.

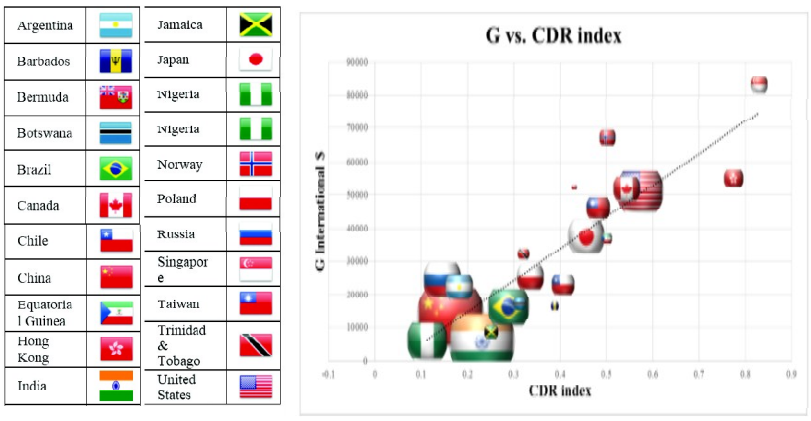

Figure 1. Year 2014 G vs CDR index for 79 countries (line). Bubble size (21 countries) is the square root of diameter

FROM INTANGIBLE WEALTH TO TANGIBLE WEALTH

Simultaneously with the distribution of *C* to investee companies, products are created in individual micro-economic units of production that employ

physical capital and labor. In general, consider *m* countries, *i=1,2,3,..m*, where country *i* contains n_i production units. The *i*th country estimate is $\hat{G}_i$=$\hat{g}_i$(highest *G*-lowest *G*) + lowest *G*, where in equilibrium, $\hat{g}_i = f(C_i, D_i, R_i) = \hat{\beta}_C C_i + \hat{\beta}_D D_i + \hat{\beta}_R R_i + \hat{\beta}_{CDR} C_i \cdot D_i \cdot R_i$. Production of $\hat{G}_i$ is obtained from the sum of n_i micro-economic production units. Consider a deterministic Cobb-Douglas function $v_{ij}=f(K_{ij}, L_{ij})$ applied to the *j*th unit of production in the *i*th country, where K_{ij} is existing capital stock plus capital stock obtained by the investment of the fraction f_{ij} of $\hat{G}_i$, L_{ij} is the matching quantity of physical labor in person-hours per annum, and v_{ij} is the annual value of production. All labor is identical in nature and functionality. Any human differences due to knowledge, experience and skills are transferred into production capacity of capital stock. Assuming constant returns to scale, then $v_{ij}=A_{ij}K_{ij}^{\alpha_{ij}}L_{ij}^{1-\alpha_{ij}}$, where A_{ij} is the total factor productivity and a_{ij} and 1- a_{ij} are output elasticities of capital and labor respectively. The total monetary value of production for country *i* is given by

$$\sum_{j=1}^{n_i} v_{ij}=\sum_{j=1}^{n_i} A_{ij}K_{ij}^{\alpha_{ij}}L_{ij}^{1-\alpha_{ij}}=\sum_{j=1}^{n_i} A_{ij}(f_{ij}\hat{G}_i)^{\alpha_{ij}}L_{ij}^{1-\alpha_{ij}}.$$

The global monetary value of production of all *m* countries is therefore

$$\sum_{i=1}^{m}\sum_{j=1}^{n_i} A_{ij}(f_{ij}\hat{G}_i)^{\alpha_{ij}}L_{ij}^{1-\alpha_{ij}}.$$

Or, substituting for $\hat{G}_i$,

$$\sum_{i=1}^{m}\sum_{j=1}^{n_i} A_{ij}\{f_{ij}[f(C_i, D_i, R_i)(\text{highest } G - \text{lowest } G) + \text{lowest } G]\}^{\alpha_{ij}}L_{ij}^{1-\alpha_{ij}}.$$

CONCLUSIONS

The high R_{adj}^2 of 83% in the straight line linear *C*, *D*, *R* regression model, the complete randomness in the residuals (not shown), and the overall aptness of the model suggest that the conversion of *C* to *G* occurs with approximately the same efficiency across the world. That is, the *C* to *G* conversion process is global invariant. The 17% of *G* that is not explained by the model may be due to the absence of private capital that is not publicly traded. Private capital data will never be available, so we must proceed with the data that are available. The conversion process is governed by the laws of natural science (Kuhn, 2012). What are commonly thought of as differences in productivity between countries are actually differences in their ability to attract *C*. Countries that rank high in *R* attract more *C*. Countries that have raised their CDR index have increased their *G* markedly. The intangible CDR index is approximately 13 times more important than natural resources for raising *G*. Entrepreneurship is approximately 6 times more import than

capital stock. That and global invariance explains why some former low CDR index low *G* countries like Singapore, Hong Kong and Bermuda have been able to transform themselves to high CDR index high *G* countries in just decades, while their geographic neighbors with low CDR index remain poor. The policy implication of this finding is that low *G* countries should focus on raising their CDR index by effectuating higher levels of *D* and *R* rather than lamenting over geography and natural resources that cannot be changed. Future research may reveal how best to improve *D* and *R* to attract and deploy *C* effectively.

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