Factors that influence Economic Growth in BRICs Member Countries and OECD Developed Countries: A Panel Data Analysis

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Abstract:

This paper investigates the factors that affect economic growth in developed nations, such as the U.S., the United Kingdom, France, Germany, Australia and others. It also includes developing countries such as Brazil, Russia, India, China and South Africa (BRICS). This study incorporates several independent variables to examine their influence on economic growth in these two groups of nations. The study looks at contributing factors for economic growth, such as life expectancy, primary education, secondary education, expected import, expected export, population growth rate, FDI level, and public expenditure, using macro-level data from two sources: the World Bank and the Organization of Economic Co-operation and Development (OECD). The results show that the education levels in a population determine a country's human capital, which heavily influences economic growth.

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1.0   INTRODUCTION

Real GDP per capita growth is one of the most significant factors that measures a country's economic development. Real GDP per capita growth depends highly on numerous other indicators. This study aims to identify the specific factors that influence real GDP per capita growth for both developed and developing countries, determining whether factors differ between the two. From a social perspective, this analysis is important because factors that theoretically have impact on growth of GDP might not be significant, and factors that are theoretically irrelevant with GDP growth might be significant.

This paper is guided by the following research objective: First, it investigates the possibility of interdependences among flows of GDP per capita (constant 2010 US$) in both BRICS member countries and OECD developed countries, using dynamic panel data. Second, it incorporates information asymmetry into two models with both developing and developed nations, in order to contrast the differences among the interdependent relationships. Last, it examines whether or not changes in real GDP per capita growth of BRICs and OECD are caused by education level, whether the changes are positive or negative, for how long these changes remain significant, and how many years it takes for the variable to return to normal.

There are three education-related variables used for this paper: first, expenditure on education as percentage of total government expenditure. Second, total number enrolled in primary education. Third, total number enrolled in secondary education. Education level is highly correlated with a nation's human capital development. This variable determines how active a country's economy is, as well as its long term social developments. Education changes the average income level, productivity, life expectancy, population growth rate, and many other variables. This paper prioritizes how education effects the level of real GDP per capita growth for the two groups of countries, evaluating whether education has a significant impact on real GDP, as well as comparing the causality directions between the dependent variable and independent variables.

The rest of the paper is organized as follows: Section 2 provides trend information for the study. Section 3 gives a brief literature review. Section 4 outlines the empirical model. Section 5 discusses data and estimation methodology. Lastly, section 6 presents the empirical results. Section 7 presents the study's conclusions.

2.0 Trend of Real GDP Per Capita
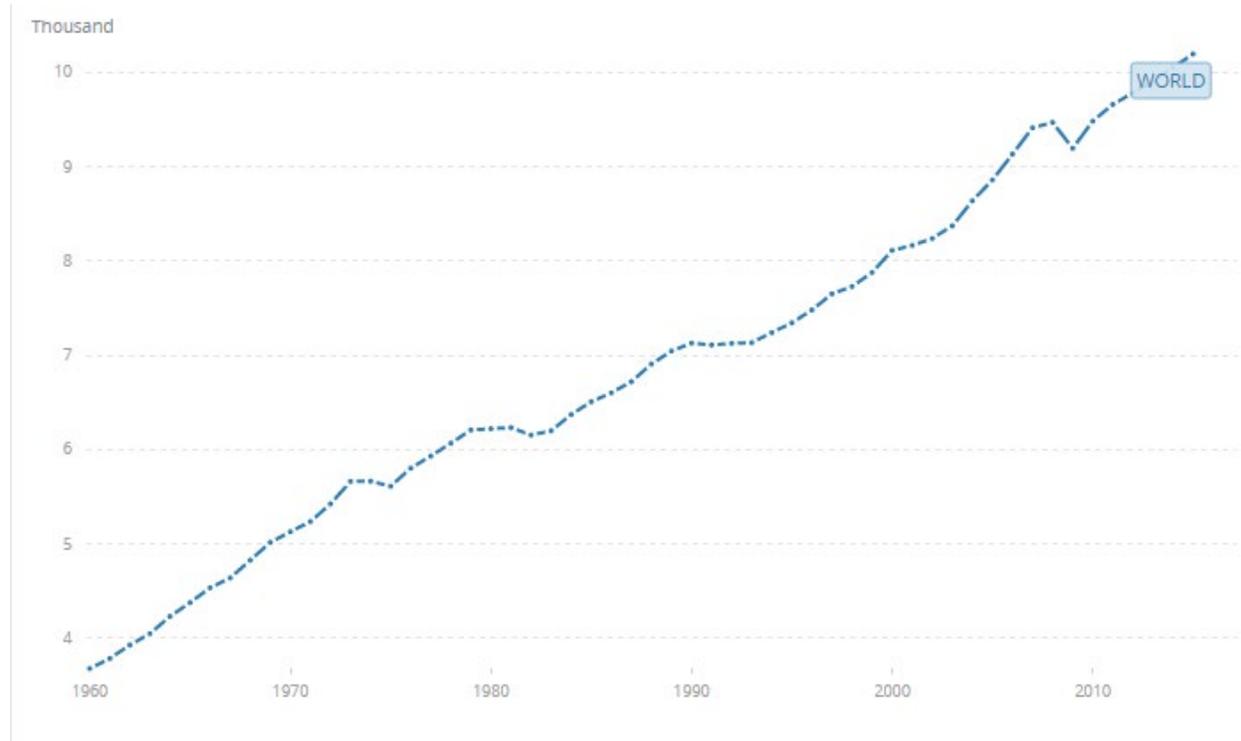
The graph above shows the worldwide GDP Per Capita (constant 2010 US$) level from 1960 to 2015. Data show that real GDP Per Capita was 3.6 thousand dollars in 1960, and reached over 10 thousand dollars in 2015. Real GDP Per Capita has increased by 177% over the past 50 years. Technological improvements on productivity, overall quantity increase in labor are two major factors that positively influenced the real GDP Per Capita growth. The general trend of real GDP Per Capita shows a stable increase over the years, though there are time periods with a decrease in GDP Per Capita. The graph indicates a decrease in GDP Per Capita during the 2008 financial recession. There are many factors that have impacted the GDP Per Capita growth. For example, education, manufacturing, energy consumption, tax revenue, population, unemployment rate, and openness for economy. Thus, the quantity of real GDP Per Capita growth is predicable for every nation and region, by evaluating the relationship between GDP Per Capita growth and economic indicators, governments will be able to establish policies in order to achieve a higher speed of GDP Per Capita growth in the near future, and adjust those indicators that are negatively influencing the economy.

3.0 Literature Review

Studies have been conducted examining the interaction between the economic growth and military spending in OECD developed countries. Hou and Chen (2014), found that military expenditure could have a Keynesian multiplier effect on the economy by increasing total demand and resource utilization, while reducing unemployment. Studies also investigate how foreign investments in real estate impacts economic growth in OECD developed countries. Gholipour et al. (2014) stated that FDI in the real estate sector may also improve growth in the above economies. As one of the foreign investment options, real estate positively influences economics, and real GDP Per Capita. Negative relationships between public debt and economic growth have been found by several studies, which include Mencinger et al. (2015), which talks about the fiscal measures taken in response to financial crises and drops in tax revenues among countries due to reduced economic activity, resulting in a substantial deterioration of government debt. This accumulation of public debt can be associated with a potential adverse effect on future economic growth and economic stability. Policymakers could use debt crisis to create a positive impact on economic growth, thus, the pressure from debt transforms into economic activity. There are studies showing the relationship between Per Capita GDP and educational attainment in high-income countries. Balan et al. (2016) contends that the three levels of education have a positive influence on economic growth for Italy, particularly secondary and higher education. While primary has no significant effect. Italy is an example that shows that secondary education is more significant than primary education for OECD high-income countries.

When considering the economic growth of a country, education is among the most important factors to consider. Some studies have introduced the interactions between universal health coverage and economic growth in BRICs member nations. Rao et al. (2014) studied this over the last two decades, and found that BRICs have undertaken – or have committed to – substantial health care reforms that have been designed to improve equity in services, as well as quality, and financial protection, with the ultimate goal of achieving universal health coverage. These health reforms represent an important attempt to translate the growing wealth of BRICs into better health care. For BRICs, economic development has top priority, followed by health care coverage, which will result in economic growth. Therefore, health coverage depends on economic growth.

Military expenditure has a negative influence on OECD's economic growth. Shieh et al. (2002), however, did find that military expenditure consumes a lot of resources, thereby leaving little for other economic activities, such as investment in public infrastructure, private consumption and general investments, social security programs, etc., and thus slows down economic growth. Therefore, military expenditure has a negative impact on OECD developed member countries and BRICs.

Bhattacharya and Bhattacharya (2016) stated that trade can reduce domestic demand, leading to reduced output, employment, and hence economic growth. Trade openness is measured by the sum of exports and imports as a percentage of GDP, which could influence real GDP Per Capita growth in both positive and negative ways.

BRICs has over 40% of the global population. Environmental conditions in these nations get worse every year. Grossman and Kruger (1991) found that the level of pollution for a sample of countries increased until a threshold level of income is achieved, after which it declines. This implies an inverted U relationship between the income capita and pollution levels. As the world's largest developing countries, BRICs sacrifice their environment for economic growth, and thus, the relationship between the two variables is positive. When those countries reach a threshold level of income, the relationship between the two variables will reverse, and end up negatively correlating with each other.

4.0 Empirical model

$$GP_t = \beta_0 + \beta_1 CE_t + \beta_2 GE_t + \beta_3 NG_t + \beta_4 UT_t + \beta_5 FDI_t + \beta_6 T_t + \beta_7 MV_t + \beta_8 TR_t + \beta_9 HE_t + \beta_{10} ME_t + \beta_{11} EP_t + \beta_{12} ES_t + \varepsilon$$

The overall model used within this paper is shown above. Other models include natural population growth (Gigov 2009), and public debt (Mencinger et al. 2005). While many previous papers have used one or more than one variables in this model in determining the effects on the real GDP Per Capita.

GP_t is the log GDP Per Capita growth in constant 2010 U.S. dollars at year t. In order to make the dependent variable more normally distributed, the variable's value was logged. It represents

the average GDP level per person within a nation. GDP Per Capita growth takes individuals into consideration. Instead of evaluating a country's economy as a whole, it carries a better standard for evaluating how well a country's economy is doing. All GP_t figures were obtained from the World Development Indicators, with values measured in U.S. dollars.

Independent variables consist of twelve variables obtained from the World Development Indicators. All variables are measured yearly, and thus, they are listed at year t. The first variable, CE_t, is the CO_2 emissions, measured in ratio of CO_2 consumption in kilograms and GDP measured in constant 2010 U.S. dollars. CO_2 emissions represent industrial activity, and measures the level of energy use. Therefore, the expected correlation between CO_2 and real GDP Per Capita growth is positive.

The second variable is GE_t, government expenditure on education. It measures the general level of government spending on public education. Generally, the higher the level of education people achieve, will result in a higher GDP for the economy. Thus, the expected correlation between GE_t and real GDP Per Capita growth is positive.

The third variable is NG_t, natural gas rents. As another environmental factor, natural gas rents represent industrial development. Thus, the expected relationship between NG_t and real GDP Per Capita growth is positive.

The fourth variable is UT_t, unemployment total. This variable gives a specific number of unemployed workers. Higher level of unemployed workers will result a lower real GDP Per Capita growth level for any country. The correlation between the two factors is expected to be negative.

The sixth variable is T_t, tax revenue as a percentage of GDP. A higher level of tax revenue is generated by a higher level of tax rate, which slows down economic activity. The correlation between the two variables is expected to be negative.

The seventh variable is MV_t, manufacturing value added. It is a crucial economic factor for BRICs developing countries, but not as significant for OECD developed countries. Thus, because one is developing and the other is developed, the correlation is expected to differ.

The eighth variable is TR_t, trade as a percentage of GDP. It measures the sum of imports and exports as percentages of GDP, which evaluates a country's economic openness. A country's economy can either increase or decrease as a result of international trade.

The ninth variable is HE_t, government expenditure for public health.

The tenth is ME_t, military expenditure. It measures a nation's military spending, which is not economically related to a country's GDP. As part of governmental expenditures, it can either reduce or increase real GDP Per Capita growth.

The eleventh variable is EP_t, enrollment in primary education for both genders. Primary education involves students between the ages of 5 and 11.

The twelfth variable is ES_t, enrollment in secondary education for both genders. Secondary education involves students between the ages of 12 and 18. Both primary and secondary education are expected to have a positive impact on real GDP Per Capita growth.

5.0 Data and Empirical Methodology

5.1 Data

This study uses annual data (panel data) from 1992 to 2016. Data were obtained from the World Development Indicators website (www.databank.worldbank.org, respectively). Summary statistics for BRICs data are provided in Table 1; for OECD data are provided in Table 2.

Table 1 BRICs Summary Statistics

Variable	Observation	Mean	Std.Dev	Min	Max	Sum
Log GDP Per Capita	120	3.6	0.41	2.7	4.07	434
GDP	120	$2.67*10^{13}$	$2.72*10^{13}$	$0.39*10^{11}$	$1.13*10^{14}$	$3.2*10^{15}$
CO_2	110	1.19	0.57	0.178	2.6	130
Agriculture	120	10.015	7.37	2.322	28.73	1201.89
Gov't Expenditure Education	62	4.24	1.27	1.66	6.36	262.98

Health Expenditure	100	6.18	1.67	3.52	8.79	618.55
Military Expenditure	120	2.32	0.96	1.099	5.01	278.99
Manufacturing	108	19.68	6.77	11.40	33.6	2125
Natural Gas	120	0.77	1.6	0.0022	8.54	93.157
Tax Revenue	92	15.06	5.92	7.94	27.59	1385.7
Water Productivity	20	15.5	11.38	1.005	33.702	310.06
Enrollment in Primary Edu	96	53574752	53928069	4968710	141154752	5143176253
Enrollment in Secondary Edu	88	45810201	38649701	3571395	119400528	4031297737
Health Expenditure	100	9.19	3.64	3.6	15.9	919.6
Life expectancy	115	66.07	6.42	51.55	75.78	7598
Population Growth	120	1.05	0.75	-0.46	2.47	126.5
Population	120	$5.5*10^8$	$5.3*10^8$	$3.66*10^7$	$1.37*10^9$	$6.65*10^{10}$
Employment in industry	86	26.3	7.63	15.7	46.9	2261.9
Unemployment	98	9.8	7.8	2.09	27.2	960.4
Employment to population ratio	89	58.113	11.79	33.9	78	5172
FDI	118	$-2.4*10^{10}$	$4.5*10^{10}$	$-2.3*10^{11}$	$3.5*10^{10}$	$-2.9*10^{12}$
Industry	120	4.344	6.556	-21.59	21.01	521.37
Trade	120	42.98	16.23	15.63	110	5158

Table 2 OECD Summary Statistics

Variable	Observation	Mean	Std. Dev	Min	Max	Sum
Log GDP Per Capita	624	4.57	0.211	3.81	5.04	2854.31
GDP	624	$5.7*10^{13}$	$2.14*10^{14}$	$1.99*10^{10}$	$1.46*10^{15}$	$3.586*10^{16}$

CO$_2$	572	0.26	0.11	0.06	0.69	150.49
Agriculture	547	2.9	2.62	0.18	17.39	1594.51
Gov't Expenditure Education	437	5.35	1.25	0	8.6	2338
Health Expenditure	520	8.8	2.08	2.5	17.14	4615
Military Expenditure	604	1.97	1.5	0.12	13.26	1192
Manufacturing	547	16.77	5.28	4.73	36.92	9178.47
Natural Gas	624	0.16	0.43	0	2.99	101.61
Tax Revenue	561	20.41	6.9	0.2	35.08	11454
Water Productivity	131	126	188.7	3.825	1341.41	16560.85
Enrollment in Primary Edu	555	2694749	4656670	27082	25297600	1495586151
Enrollment in Secondary Edu	550	3165143	4684097	20817	2731028	1740828944
Health Expenditure	520	14.7	3.09	6.27	23.355	7646.31
Life expectancy	598	78.79	2.599	65.3	83.58	47121.12
Population Growth	624	0.75	0.62	-1.69	3.455	470.62
Population	624	$3.8*10^7$	$5.9*10^7$	261057	$3.2*10^8$	$2.3*10^{10}$
Employment in industry	589	24.82	4.6	10.8	39	14624
Unemployment	598	7.29	3.92	1.8	27.3	4364
Employment to population ratio	598	56.79	8.06	38.09	82.19	33962.7
FDI	565	$9.5*10^9$	$3.8*10^{10}$	$-1.9*10^{11}$	$2.1*10^{10}$	$5.3*10^{12}$
Industry	543	1.76	6.04	-18.125	90.424	957.02
Trade	622	79.9	53.82	15.92	391.49	49756.5

6.0 Empirical Results

The purpose of this study is to determine variables that have impact on the real GDP per capita growth for OECD developed member countries and BRICs developing countries. This analysis uses a simple linear regression model and mixed models to obtain the results. 31 countries were included in this study. Due to the missing data, the number of observations for each variable and regression model is different. The results of these regressions can be found in table 3-4.

6.1 Results

In the linear regression model for BRICs, four variables are significant: GDP per capita, enrollment in primary education, economic openness, and CO_2 emissions. Within those four variables, GDP per capita is significant at the 1% level, Economic openness and CO_2 emissions are significant at the 5% level, and enrollment in primary education is significant at the 10% level. Those four variables are proven to have a statistical influence on real GDP per capita growth.

GDP per capita is the only variable that is significant at the 1% level, which means people are 99% sure this variable has statistical significance on real GDP per capita growth. When GDP per capita increases by one dollar, real GDP per capita increases by 0.0249% for BRICs. Within this linear regression model, all variables are positively correlated with the dependent variable. Economic openness and CO_2 emissions are both significant at the 5% level, which means that people are 95% sure these two variables have statistical significance towards real GDP per capita growth. Economic openness is measured by trade (export and import as a percentage of GDP). When trade as a percentage of GDP increases by 1%, real GDP per capital will increase by 0.0189%. When CO_2 emissions increase by one kilogram, the real GDP per capita will increase by 0.0162%. Both variables positively influence real GDP per capita growth. Enrollment in primary education is significant at the 10% level. Therefore, people are 90% sure that enrollment in primary education has statistical significance on real GDP per capita growth in BRICs. When enrollment in primary education increases by 1000 more people, the real GDP per capita will increase by 0.01075%.

In the linear regression model for OECD developed countries, eight variables are significant: GDP per capita, enrollment in primary education, enrollment in secondary education, health

expenditure, economic openness, CO_2 emissions, military expenditure, and tax revenue. Within these eight variables, GDP per capita, enrollment in primary education, enrollment in secondary education, health expenditure, military expenditure and tax revenue are significant at the 1% level. Thus, people are 99% sure those variables are statistically significant. Economic openness and CO_2 emissions are significant at the 10% level; people are 90% sure these two variables are statistically significant towards real GDP per capita growth. When GDP per capita increases by one dollar, the real GDP per capita will increase by 0.00000906%. When enrollment in primary education increases by 1000 people, the real GDP per capita will decrease by 0.000000009%. When the total enrollment for secondary education increases by 1000, the real GDP per capita growth for OECD developed countries will increase by 0.000000009%. When health expenditure as a percentage of GDP increases by 1%, the real GDP per capita growth will increase by 0.01427%. When military expenditure as a percentage of GDP increases by 1%, the real GDP per capita growth will decrease by 0.00622%. When tax revenue as a percentage of GDP increases by 1%, the real GDP per capita will increase by 0.0001745%. Within this linear regression model, enrollment in primary education, government expenditure on education, CO_2 emissions, and military expenditure are negatively correlated with real GDP per capita growth. GDP per capita, enrollment in secondary education, health expenditure, economic openness, foreign direct investment, and tax revenue are positively correlated with real GDP per capita growth.

6.2 Regression Tables

Table 3: Regression Results for the real GDP Per Capita

Variables	Linear Regression for BRICs (Coefficient)	Linear Regression for OECD (Coefficient)
GDP Per Capita	0.0249***	0.000009060***
Enrollment in Primary EDU	0.01075*	-0.000000009***
Enrollment in Secondary EDU	0.0001231	0.000000009***

Government Expenditure on EDU	0.002025	-0.001036036
Health Expenditure	0.00127	0.01427***
Economic Openness	0.0189**	0.000159075*
FDI	0.00003672	0.00000001
CO_2 Emissions	0.0162**	-0.068154666*
Military Expenditure	0.00001457	-0.006217864***
Tax Revenue	0.00017915	0.0001745428***

Note ***, **, and * denotes significance at the 1%, 5%, and 10% respectively

Table 4: BRICs Mix Model Regression Results for the real GDP Per Capita

Variables	Pr > F (BRICs)	Pr > F (OECD)
Health Expenditure	0.15	0.0011
Economic Openness	0.33	0.0386
FDI	0.64	0.1877
Health Expenditure	0.38	0.3083
CO_2 Emissions	0.0026	0.0046
Military Expenditure	0.0663	0.0010
Tax Revenue	0.0697	0.0160
Primary EDU*Secondary EDU	0.0001	0.0001
Primary EDU*Gov Expenditure on EDU	0.0002	0.0001
Secondary EDU*Gov Expenditure on EDU	0.1176	0.0001
Primary EDU*Secondary EDU*Gov Expenditure on EDU	0.0003	0.0001

7.0 Conclusion

In this study, a panel data analysis was used for 31 countries over a period of 25 years. Real GDP per capita growth is a significant measure that evaluates a country's economic development. As we have seen from the regression results. There are several social, political, and economic

factors that influence real GDP per capita, both positively and negatively. Factors that are statistically significant for BRICs are not necessarily significant for OECD developed countries. BRICs and OECD developed nations generally have different factors that have significant impact on real GDP per capita growth.

Economic openness is the most significant factor for both BRICs and OECD. Generally, higher levels of CO_2 emissions result in a lower level of real GDP per capita growth for developed nations, while a higher level of real GDP per capita growth occurs for developing nations. BRICs' real GDP per capita growth is strongly influenced by primary education (ages 6 through 12), while OECD developed nations' real GDP per capita growth is significantly influenced by secondary education (ages 13 through 18).

The results are important for policy makers, in order to promote the overall level of real GDP per capita growth for a nation by limiting factors negatively correlated with real GDP per capita growth, and accelerating factors that are positively correlation with real GDP per capita growth.

For future studies, it will be necessary to include regional factors by comparing developing and developed nations within the same region, or continent. It is also important to generate comparisons among randomly selected developing and developed countries and to check the significant indicators for real GDP per capita growth. Brazil, Russia, India, China, and South Africa are five nations with populations over three billion, which is over 40% of the global population. Therefore, the population factor generates bias for the models, creating misleading results from some perspectives. Thus, it is crucial to select random developing nations and compare their variables to developed nations.

This study should lead to a better awareness of what specific factors influence economic growth. The correlations among all the factors should help policymakers to gain a better understanding of what can be done in both developing and developed countries, for a higher real GDP per capita growth. Eventually, with more research, people from both developing and developed nations can have a better understanding about how to promote more rapid economic growth.

Appendix A: Variable Description and Data Source

Acronym	Description	Data Source
GP	Log GDP Per Capita (2010 US Dollar)	World Development Indicators
GDP	Gross Domestic Product (constant LCU)	World Development Indicators
CE	CO_2 Emissions (kg per 2010 US$ of GDP)	World Development Indicators
A	Agriculture, value added (% og GDP)	World Development Indicators
GE	Government expenditure on education, total (% of GDP)	World Development Indicators
HE	Health Expenditure, total (% of GDP)	World Development Indicators
ME	Military Expenditure (% of GDP)	World Development Indicators
MV	Manufacturing, value added (% of GDP)	World Development Indicators
NG	Natural Gas Rents (% of GDP)	World Development Indicators
T	Tax Revenue (% of GDP)	World Development Indicators
WR	Water productivity, total (Constant 2010 US$ GDP)	World Development Indicators
EEG	Expenditure on education as % of total government expenditure (%)	
EP	Enrollment in primary education, both sexes (number)	World Development Indicators
ES	Enrollment in secondary education, both sexes (number)	World Development Indicators
HE	Health Expenditure, public (% of government expenditure	World Development Indicators
LE	Life Expectancy at birth, total (years)	World Development Indicators
PG	Population Growth (annual %)	World Development Indicators
P	Population, total	World Development Indicators
EI	Employment in industry (% of total employment)	World Development Indicators
UT	Unemployment, total (% of total labor force) (National Estimate)	World Development Indicators
EPR	Employment to population ratio, 15+, total(%) (National estimate)	World Development Indicators
FDI	Foreign Direct Investment, net (BoP, current US$)	World Development Indicators
IVA	Industry, value added (annual % growth)	World Development Indicators
TR	Trade (% of GDP)	World Development Indicators

Appendix B: Variables and Expected Signs

Acronym	Description	What it captures	Expected Sign
CE	CO_2 Emissions (kg per 2010 US$ of GDP)	Amount of CO_2 Emissions released in relate to real GDP Per Capita	+
GE	Government expenditure on education, total (% of GDP)	Governmental expenditure on education as total percentage of GDP. Factor motives real GDP Per Capita	+
ME	Military Expenditure (% of GDP)	Governmental expenditure on military as total percentage of GDP	-
MV	Manufacturing, value added (% of GDP)	Percentage of GDP generated by manufacturing industry	+/-
NG	Natural Gas Rents (% of GDP)	Natural gases usage costs as percentage of GDP	+
T	Tax Revenue (% of GDP)	Total tax revenue generated by government as percentage of GDP	-
EP	Enrollment in primary education, both sexes (number)	Total number of people attended school during age 5-11	+
ES	Enrollment in secondary education, both sexes (number)	Total number of people attended school age 12 or beyond	+
HE	Health Expenditure, public (% of government expenditure	Percentage of governmental expenditure on public health	+
UT	Unemployment, total (% of total labor force) (National Estimate)	Total amount people currently unemployed as percentage of total labor force	-
FDI	Foreign Direct Investment, net (BoP, current US$)	Total net quantity of foreign direct invest in U.S. Dollars	+/-
TR	Trade (% of GDP)	Sum of imports and exports as percentage of GDP	+/-

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