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Whether Development Indices Affect Economic Growth: A Cross-Country Analysis

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Abstract

This study aims to examine the relationship between economic growth and highly featured development indices using a cross sectional data of 12 countries from both developed and developing world between the years 2000 and 2013. The indices of corruption, democracy, freedom of press, human development, global competitiveness, economic freedom, and the featured development indicators of World Bank such as average schooling years, life expectancy, female labour force participation rate, health expenditures rate in GDP, export rate of high technology, and employment rate are used to investigate the relationship in between economic growth and development indices. In order to exploit this relationship, all individual indices are reformed to produce form a single index, what we call harmonic index. The findings show that the higher scores of harmonic Index are associated with higher GDP per capita all levels except Saudi Arabia.

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Keywords: Economic growth; development index; development indicator; harmonic index

1. Introduction

Statistical evidence shows us that the most developed countries in the world are indeed those with the highest GDP per capita (htttp://worldbank.org). GDP per capita is calculated by dividing amount of GDP by the number of population and it actually tells us nothing about income distribution or spending among the members of population. In addition, growth in GDP per capita alone doesn't necessarily result in broader social and economic advancements. The weaknesses inherent in the use of GDP as a measure of development have revealed the need of

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creating other development measures. A number of well-known development indices mostly composed of several development indicators and GDP per capita itself provide us a broad range of insight on the social and economic development of the countries.

This study examines the relationship in between economic growth and a number of development indices and highly featured development indicators of World Bank using a cross country data of USA, UK, Germany, Japan, France, Greece, Brazil, Turkey, Russia, India, China, and Saudi Arabia for the years of 2000 and 2013.

In this study, the development indices of human development, corruption, democracy, freedom of press, global competitiveness, economic freedom, and featured development indicators of World Bank such as average schooling years, life expectancy, female labor force participation rate, health expenditures rate in GDP, export rate for high technology, and employment rate are used to explore whether these development indices and indicators affect economic growth. All indices above are re-structured as individual development indices ranging between 0 and 100 and from worse to better. The indices used in this study are all publicly available indices of private institutions. The featured development indicators and GDP per capita are drawn from World Bank database. In order to exploit the relationship in between economic growth and development indices, all indices are initially restructured and the re-structured individual indices are then used to form a single index what we call harmonic index. Later, percentage change in the harmonic index and percentage change in GDP per capita are graphed for all countries investigated in this study to observe their patterns over years. The results demonstrate that all countries are those with high scores of harmonic index and GPD per capita as well, except Saudi Arabia. On the other hand, comparing the trends in percentage change in the harmonic index and percentage change in GDP per capita doesn't present an associated link. Furthermore, the trend graphic of percentage change in the harmonic index between years of 2000-2013 reveals that USA, Germany, Japan, and France contain a steady trend while developing countries, e.g. Saudi Arabia, Turkey, and Russia, show strong fluctuations. Although there is a significant amount of literature examining the relationship of various development indices and indicators with economic growth, this study contributes to the literature revealing this relationship by forming a single composite index including all prominent development indices.

The following section presents the related literature showing supporting evidence for the effect of development indices on the economic growth. The next part explains the content of data, the structure of harmonic index and the format of analysis. The later section presents the empirical findings. The final part pinpoints the results and concludes.

2. Literature Review

Helliwell (1994), has investigated the relationship between democracy and economic growth using data from 125 countries between the years 1960 and 1985. Barro (1996), studied the determinants of economic growth using cross sectional data of 100 countries between the years 1960 and 1990. The findings of the study reveal that the greater GDP growth rate is associated with higher initial schooling, higher life expectancy, lower fertility, lower government consumption, better maintenance of the rule of law, lower inflation, and improvements in the terms of trade. Political freedom doesn't have a strong effect on growth but the study's findings exploit an existence of a nonlinear relation. The results also show that expansion of political rights enhance economic growth but only at low levels. On the other hand, at a moderate level of democracy, expansion of democratic rights reduces growth. Although, democracy has a small effect on economic growth, increase in the standard of living is strongly associated with the country's will to experience democracy. Mo (2001), develops a new point of view on corruption's role in economic growth. The study reveals numeric estimates of the effect of corruption on economic growth and results about the importance of channels used to transmit corruption. According to the results of the study, a 1% increase in the corruption level reduces the growth rate by about 0.72% or, in other words, a one-unit increase in the corruption index reduces the growth rate by 0.545 percentage points. The study shows that political instability, with 53% of the total effect, is the most important transmission channel through that corruption has a strong effect on economic

growth. The study's findings also reveal that corruption reduces the level of human capital and the share of private investment.

Požega, Sučić, and Crnković (2011) investigated the relationship between human capital and world's economic development, and tested whether the countries with more developed human capital have also more developed economies and higher rate of economic growth. The results of the study reveal that increase in Corruption Index is associated with the increase in GNP per capita and also increase in GNP per capita growth rate. The study also shows that moral and intellectual capital have a very significant and positive relationship with the GNP per capita, on the other hand, social capital has a positive, yet not significant, relationship with the GNP per capita. Falk (2009) introduced a dynamic growth model using cross sectional data of 22 OECD countries between the years 1980 and 2004 and investigated the relationship between the change in the high-tech export share and change in economic growth. The results of the study show that business R&D intensity and the share of high-tech exports have a significantly positive relationship with GDP per working age population. Furthermore, elasticity tests reveal that business R&D intensity is more important than the share of high-tech exports in explaining GDP per working age population.

The previous literature has generally investigated whether some economic development indicators and indices singularly affect the GDP, the growth in GDP or the growth in GDP per capita. These studies sited above mostly support the significant influence of indices and/or indicators on economic growth. Therefore, this study takes a further step by including a number of indices and indicators to structure a single composite index so called harmonic index explained in the following section.

3. Data and Analysis

All development indices employed in this study are obtained from publicly available reports of non-profit private institutions and needed annual data are drawn from the websites of these institutions. The human development index (HDI) is the most well-known of development indices and it is published on a regular basis by the United Nations Development Program (UNDP) in its Human Development Report. The human development is a composite index and countries are ranked according to their overall performance in three individual development areas; life expectancy, education, and per capita GDP. Transparency International Institution reports corruption index annually and in corruption index countries are ranked according their misuse of public power for private benefit on the perceptions of the countries' citizens. Freedom House Institute publicize democracy index, or in other words, freedom index and the index ranks the countries according to their relative compliance to standard-set global political rights and civil liberties. Furthermore, freedom of press index is an annual report of Freedom House Institute. The index ranks the countries according to the number of threats occurred (taking into account number of sues, censorships, jailed journalists) and also media independence. World Economic Forum reports global competitiveness index (GCI) annually. The GCI is a composite index and ranks countries in their overall performance in 12 different criteria; institutions, appropriate infrastructure, a stable macroeconomic framework, good health and primary education, higher education and training, efficient goods markets, efficient labor markets, developed financial markets, the ability to harness the benefits of existing technologies, and its market size, both domestic and international, by producing new and different goods using the most sophisticated production processes, and innovation. Finally, economic freedom index is an annual report of The Heritage Foundation and the index ranks the countries according to rule of law, limited government, regularity efficiency, and trade openness.

In this study, featured development indicators of World Bank such as average schooling years, life expectancy, female labor force participation rate, health expenditures rate in GDP, export rate for high technology, and employment rate are also used to exploit the relationship in between economic growth and development indicators. World Development Indicators (WDI) is a World Bank's collection and the data used is gathered by officially recognized international sources. WDI provides the most current and precise global development data available. The development indices and indicators used in this study and their source are summarized as below;

Table 1. Indices and Indicators Descriptions

Development Indices / Indicators	Description / Source
Corruption	The Corruption Perceptions Index (CPI) is published by Transparency International (https://www.transparency.org) since 1995 annually and ranks countries by their misuse of public power for private benefit.
Democracy	Freedom of Press Index is published by Freedom House (https://freedomhouse.org) annually since 1972 and ranks countries by the compliance with the standard-setting global political rights and civil liberties
Freedom of Press	Freedom of Press is reported by Freedom House (https://freedomhouse.org) annually since 1980 and ranks countries by the number of the threats to media.
Human Development	Human Development Index is published by United Nations Development Programme (http://www.undp.org) annually and the countries are ranked by their performance in life expectancy, education, and per capita income.
Global Competitiveness	Global Competitiveness Index is published by World Economic Forum (http://www.weforum.org) annually and countries are ranked in their overall performances in 12 different criteria; institutions, appropriate infrastructure, a stable macroeconomic framework, good health and primary education, higher education and training, efficient goods markets ,efficient labour markets, developed financial markets, the ability to harness the benefits of existing technologies, and its market size, both domestic and international, by producing new and different goods using the most sophisticated production processes, and innovation.
Economic Freedom	Economic Freedom Index is reported by The Heritage Foundation (http://www.heritage.org) annually since 2000 and the countries are ranked by their compliance with the rule of law, limited government, regularity efficiency, and trade openness since 2000.
Average Schooling Years	The minimum years of mandatory education is indicated.
Life Expectancy	The average number of years spent in life w/o a new-born infant mortality is indicated.
Female Labor Force Participation	The percentage of female labour force in total employment is indicated. People who are 15 years old and older meet the International Labour Organization's definition of the economically active population and goes into labour force definition.
Health Expenditures (%GDP)	The percentage of total health expenditures in GDP is indicated. Sum of public and private health expenditure is the total of health expenditure. Provision of health services (preventive and curative), family planning activities, nutrition activities, and emergency aid designated for health are covered, yet not provision of water and sanitation.
High Tech Exports (% of Manufactured Exports)	The percentage of high technological exports in total manufactured exports is indicated. High R&D intensity especially in aerospace, computers, pharmaceuticals, scientific instruments, and electrical machinery are known as high technology manufacturing.
Employment to Population	The proportion of country's population who is employed is indicated.

All these six development indices and six development indicators summarized in Table 1 are originally reported in various scales and levels by their publisher institutions. The below table describes the original scales of indices and development indicators.

Table 2. Raw Data Scale

Development Indices /Indicators	Scale
Corruption	0-100, from worse to better
Democracy	0-10, from better to worse
Freedom of Press	0-100, from better to worse
Human Development	0-1, from worse to better
Global Competitiveness	0-7, from worse to better
Economic Freedom	0-100, from worse to better
Average Schooling Years	in years, maximum 12.9
Life Expectancy	in years, maximum 83.33
Female Labor Force Participation	0-100
Health Expenditures (%GDP)	0-100
High Technological Exports (%Manufactured Exports)	0-100
Employment to Population	0-100

All raw indices and indicators data above are re-structured ranging from 0 and 100 and from worse to better. The development indicators of average schooling years and life expectancy are re-structured by setting the maximum

number of years in schooling and life as the base year. Later, the percentage change in all re-structured indices and indicators are calculated and these percentage changes are used to form percentage change in so called harmonic index. The percentage change in harmonic index is the average of percentage change of all indices and indicators used in this study. The final form of data is presented below;

Table 3. Descriptive Statistics

Indices	N	Minimum	Maximum	Mean	Std. Deviation
Percentage Change in GDP per Capita	168	-0.28	0.38	0.0787	0.12300
Corruption Index	168	-0.24	0.23	0.0069	0.06505
Freedom Index	168	-0.14	0.18	0.003	0.02832
Freedom of Press Index	168	-0.16	0.13	-0.0078	0.03954
HDI	168	-0.9	8.93	0.0551	0.69276
Global Competitiveness Index	168	-0.13	0.25	0.0044	0.03709
Index of Economic Freedom	168	-0.11	0.13	0.0006	0.03079
Average Schooling Years	168	-0.16	0.18	0.0171	0.03348
Life Expectancy	168	-0.01	0.02	0.0036	0.00315
Female Labor Force Participation	168	-0.12	0.11	0.0012	0.02300
Health Expenditures (% of GDP)	168	-0.18	0.49	0.0117	0.06331
High Technology Exports	168	-0.74	2.65	0.0124	0.30820
Employment to Population	168	-0.08	0.05	-0.001	0.01612
Harmonic Index	168	-0.08	0.21	0	0.03000

All the indices and development indicators and GDP per capita used in this study may be correlated with each other and indeed some are contained similar information. The Table 4 below shows the correlation matrix of percentage change in development indices, indicators, harmonic index, and GDP per capita.

Table 4. Correlation Matrix

	% GDP per capita	Corruption	Freedom	Freedom of Press	HDI	Global Competitiveness	Index of Economic Freedom	Avg. Schooling Yrs	Life Expectancy	Female Labor Force Participation	Health Expenditures (% GDP)	High Technology Exports	Employment to Population	Harmonic Index
% GDP per capita	1	-0.1	0.1	-0.02	0.002	0.11	-0.04	0.1	0.06	-0.09	-0.25	-0	0.2938	0.16
Corruption		1	0.1	-0.01	0.026	0.1	0.096	-0	0.04	-0.06	0.122	0.1	-0.008	0.3
Freedom			1	0.221	-0.01	-0.04	0.04	0.3	0.07	-0.03	0.055	0.02	-0.014	0.4
Freedom of Press				1	0.018	-0.07	-0.012	0	-0.1	-0.16	-0.13	-0.1	-0.042	0.2
HDI					1	0.05	-0.066	-0	0.09	-0.01	-0.03	0	0.0036	0.12
Global Competitiveness						1	0.111	0.1	0.11	-0	-0.14	0.29	0.1167	0.04
Index of Economic Freedom							1	0.1	0.12	-0.03	0.066	0.01	0.1251	0.09
Avg. Schooling Yrs								1	0.05	-0.07	-0.02	-0.1	0.005	0.1
Life Expectancy									1	-0.09	0.077	-0	-0.052	0.03
Female Labor Force Participation										1	-0.16	0.11	0.48	0.04
Health Expenditures (% GDP)											1	-0.1	-0.25	0.07
High Technology Exports												1	0.0407	0.02
Employment to Population													1	0.1
Harmonic Index														1

The correlation matrix does not show a strong correlation among variables investigated. As variables are re-structured in percentage change over years, the model representing the relationship between economic growth and development indices and indicators may be described as below:

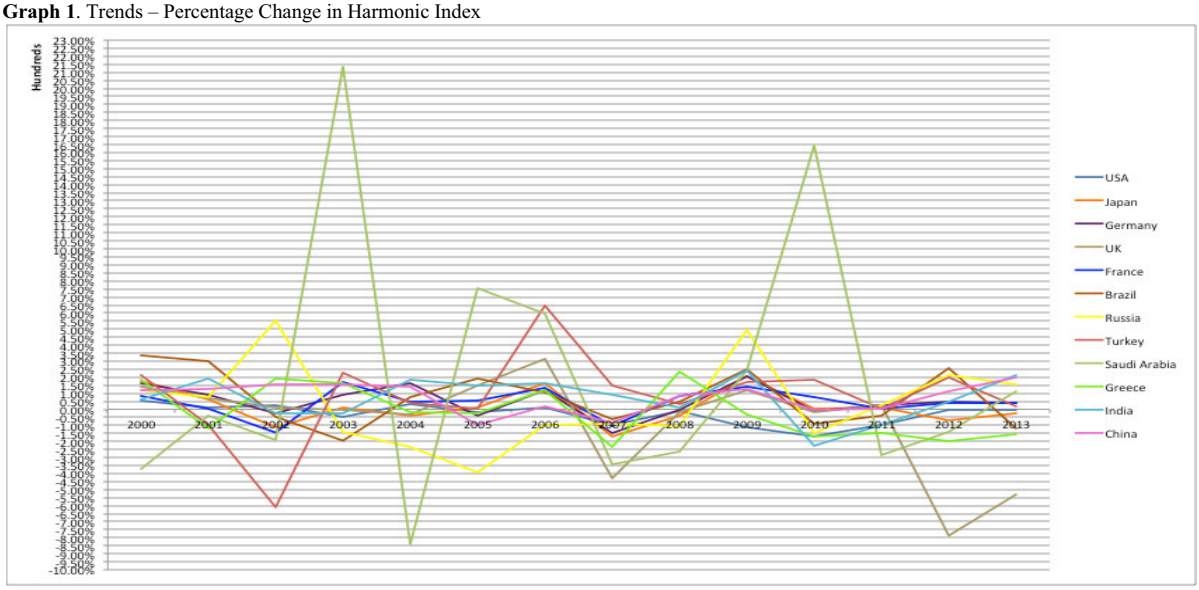
$$\%\Delta \text{GDP per Capita}_{it} = \alpha_i + \%\Delta C_{it} + \%\Delta D_{it} + \%\Delta F_{it} + \%\Delta HDI_{it} + \%\Delta G_{it} + \%\Delta EF_{it} + \%\Delta S_{it} + \%\Delta L_{it} + \%\Delta FL_{it} + \%\Delta HE_{it} + \%\Delta HT_{it} + \%\Delta E_{it} + \%\Delta H_{it} + \varepsilon_{it}$$

Where C is the Corruption Index, D is the Democracy Index, F is the Freedom of Press Index, HDI is the Human Development Index, G is the Global Competitiveness Index, EF is the Economic Freedom Index, S is the Average Schooling Years, L is the Life Expectancy, FL is the Female Labor Participation Rate, HE is the Health Expenditures Rate, HT is the High Technology Export Rate, E is the Employment Rate, H is the Harmonic Index.

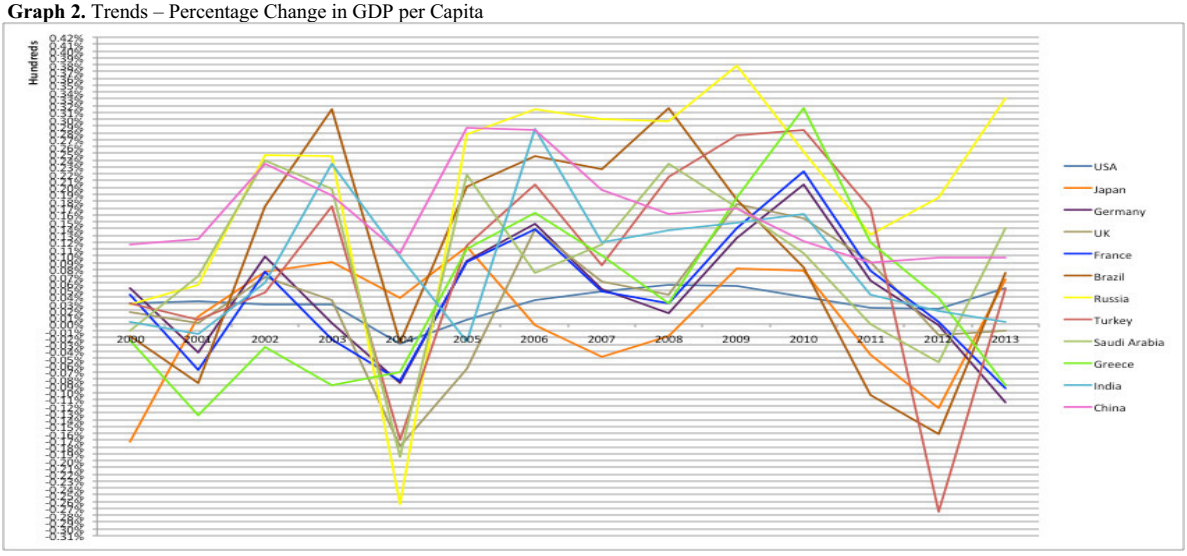
4. Results

In this study the percentage change in GDP per capita and the percentage change in harmonic index over the years are graphed in order to see whether there exists an associated pattern between these two variables over the years. The Graph1 shows the trends in percentage change in harmonic index and the Graph 2 presents the percentage in GDP per capita for countries between the years of 2000 and 2013.

Graph 1. Trends – Percentage Change in Harmonic Index



Graph 2. Trends – Percentage Change in GDP per Capita



The comparison of two trend graphics show that there are substantial amount of rises in harmonic index for Saudi Arabia in 2003 and 2010 and a big fall in 2004. However, the rise in harmonic index is not associated with the percentage change in GDP per capita in related years. Furthermore, there exists a general fall of percentage change in GDP per capita in 2004 for all countries which cannot be related with the fall in percentage change in Harmonic Index for Saudi Arabia. The graphic also shows that Turkey has a substantial fall in 2002 and a rise in 2006, however; these movements do not seem to match with the trend of percentage change in GDP per capita for Turkey accordingly.

The trend graphic of percentage change in harmonic index demonstrates that there exist big fluctuations in developing countries of Saudi Arabia, Russia, and Turkey in certain years. On the other hand, developed countries of USA, Germany, UK, Japan, and France follow a steady trend. Also, the trend graphic of percentage change in GDP per capita shows a steady trend for developed countries of USA, Germany, UK, Japan, and France. However, percentage change in GDP per capita doesn't seem to follow the pattern on the graphical illustration, where percentage change in Harmonic Index has, and vice versa.

5. Conclusion

The comparison of two trend graphics show that there are substantial amount of rises in harmonic index for Saudi Arabia in 2003 and 2010 and a big fall in 2004. However, the rise in harmonic index is not associated with the percentage change in GDP per capita in related years. Furthermore, there exists a general fall of percentage change in GDP per capita in 2004 for all countries which cannot be related with the fall in percentage change in Harmonic Index for Saudi Arabia. The graphic also shows that Turkey has a substantial fall in 2002 and a rise in 2006, however; these movements do not seem to match with the trend of percentage change in GDP per capita for Turkey accordingly.

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