



IS HUMAN DEVELOPMENT INDEX OR GDP MORE RELEVANT IN MEASURING WORLD INCOME INEQUALITIES?

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Abstract

The great majority of the studies in the field of international economic inequalities rely on “income data” where only few number of studies adopt conventional indicators of development (such as Human Development Index (HDI)). The aim of the current paper is to analyze the level and evolution of inequalities across 128 countries by using both GDP and HDI data and compare, in this way, the results from both variables. The period of analysis runs from 1990 to 2012. In terms of methodology, we employ Kernel Density estimations and cross sectional regressions to examine this issue. Our analyses indicate two important results. First, disparities in income and HDI have been shown to decline over the years. Second, there have been huge disparities in income but only moderate level of inequalities in development. In the light of our findings, we may consequently argue that either GDP data exacerbates the disparities or HDI underestimates it. Using only one type of measure may lead to distorted results.

Key words:

World Economic Inequalities; Convergence; HDI; GDP; Kernel Density Estimation.

INTRODUCTION

In the literature on economic convergence and inequalities, much of the empirical studies rely on the Neo-Classical foundation of growth (Solow, 1956). Its main prediction implies a catch-up process during which low income countries tend to grow faster than the richer ones and, therefore, income convergence occurs as an outcome of capital accumulation process. (Solow 1956; Barro, 1991; Barro and Sala-i Martin 1991; 1992).

This proposition has been tested by a large number of empirical papers. Barro (1991) is one of the initial studies which have shown evidence on the income convergence

across 98 countries over a period 1960-1985. A typical methodology used to test the convergence is to examine the relationship between initial income of countries and their growth rate over a period.

Throughout the years, many other studies have investigated this issue as well. Some of the well-known examples are Firebaugh (1999) who has analysed the evolution of income disparities across 120 nations over a period 1960-1989 and found an evidence on rising tendency, Burguignon and Morrisson (2001) who have investigated the evolution of world income inequalities across citizens of a set of countries over the period 1820-1992 and reported that from the beginning of 19th Century, the distribution of income had worsened until the end of Second World War and stabilized afterwards, Sala-i Martin (2006) who has analysed the evolution of income inequality using several indices across 138 countries over a period 1970-2000 and reported evidence on declining disparities during 1980s and 1990s.

The great majority of the studies in this field have adopted "income data" in order to measure the inequalities. However, imbalances in development are not bound to income as the "development" term includes other dimensions as well (like education and health).

Despite this, only few number of studies use conventional indicators of development (like Human Development Index (HDI) calculated by United Nations Development Program (UNDP)) to analyse the evolution of inequalities in the world (see for some examples, Decancq et al. 2006; Pillarisetti, 1997)

The aim of the current paper is to investigate the inequalities across 128 countries by using both income (GDP) and conventional development variables (HDI) and compare, in this way, the results from both variables. The period of analysis runs from 1990 to 2012 (23 years). In terms of methodology, we employ Kernel Density estimations to depict the level and evolution of inequalities and run cross-sectional regressions to examine whether incomes or development levels tend to converge among countries.

Remaining parts of the paper is organized in a following way: Section 2 is devoted to explaining the data, methodologies and the results of empirical analyses, section 3 is devoted to concluding remarks.

DATA AND EMPIRICAL ANALYSES

An initial step in our analyses is to define our variables and dataset. The set of countries covered in this study are documented below in Table 1. It includes 128 countries for which the data is available. Two types of variables are used in this study. The first one is income data provided by United Nations which has also used source data from World Bank. The income has been measured by per capita real GDP of countries calculated using 2011 year Purchasing Power Parity (PPP). The second variable is the HDI index data provided by the United Nations Development



Program. HDI is a standard and conventional measure of development and specified by taking into account various dimensions. It is basically the geometric average of income level of countries, level of education (most often measured by mean years of schooling and expected years of schooling) and the level of health services (measured by life expectancy index).

TABLE 1. SET OF COUNTRIES

Countries			
Albania	Egypt	Lithuania	Senegal
Algeria	El Salvador	Luxembourg	Serbia
Armenia	Fiji	Malawi	Sierra Leone
Australia	Finland	Malaysia	Singapore
Austria	France	Mali	Slovakia
Bahrain	Gabon	Malta	Slovenia
Bangladesh	Gambia	Mauritania	South Africa
Barbados	Germany	Mauritius	Spain
Belgium	Ghana	Mexico	Sri Lanka
Belize	Greece	Moldova	Sudan
Benin	Guatemala	Mongolia	Swaziland
Bolivia	Guyana	Morocco	Sweden
Botswana	Honduras	Mozambique	Switzerland
Brazil	Hong Kong, China	Namibia	Tajikistan
Brunei Darussalam	Hungary	Nepal	Tanzania
Bulgaria	Iceland	Netherlands	Thailand
Burundi	India	New Zealand	Togo
Cameroon	Indonesia	Nicaragua	Tonga
Canada	Iran	Niger	Trinidad and Tobago
Central African Republic	Ireland	Norway	Tunisia
Chile	Israel	Pakistan	Turkey
China	Italy	Panama	Uganda
Colombia	Jamaica	Papua New Guinea	Ukraine
Congo	Japan	Paraguay	United Arab Emirates
Congo	Jordan	Peru	United Kingdom
Costa Rica	Kazakhstan	Philippines	United States
Côte d'Ivoire	Kenya	Poland	Uruguay
Cyprus	Korea (Republic of)	Portugal	Venezuela
Czech Republic	Kyrgyzstan	Romania	Viet Nam

Denmark	Lao	Russian Federation	Yemen
Dominican Republic	Latvia	Rwanda	Zambia
Ecuador	Lesotho	Saudi Arabia	Zimbabwe

In the rest of the paper, the GDP and HDI denote the two variables respectively. The descriptive statistics on both variables, for 1990 and 2012, are presented below in Table 2.

TABLE 2. DESCRIPTIVE STATISTICS

Measure	HDI_1990	HDI_2012	GDP_1990	GDP_2012
Max	0,866	0,943	115748,0	86587,0
Min	0,216	0,333	435,0	451,0
Mean	0,597	0,700	13061,8	18006,5
SD	0,166	0,159	15802,3	17573,8
CoV (SD/Mean)	0,28	0,23	1,21	0,98

Data Source: UNDP, own calculations

HDI scores of countries range between 0.86 and 0.59 in 1990 and between 0.94 and 0.33 in 2012. Average HDI score is 0.59 in 1990 and 0.70 in 2012. The coefficient of variation (CoV) (Standard Deviation/Mean) in the last row indicates the level of cross-country inequality. It is 0.28 in 1990 and 0.23 in 2012. Hence, the HDI scores seem to have more equally distributed over the years.

The inequalities in per capita GDP are, in fact, much higher than the HDI as the CoV is 1.21 in 1990 and 0.98 in 2012. Although the inequality in GDP tends to decline over the years, its level is comparatively much higher than the disparities in HDI.

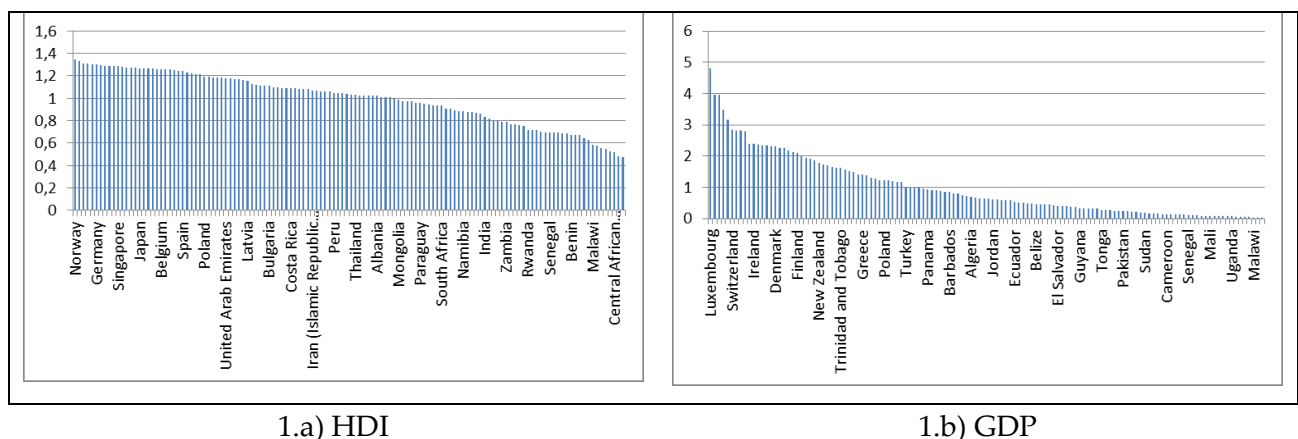


FIG 1. RELATIVE GDP and HDI SCORES OF COUNTRIES in 2012, AVERAGE=1,

Data Source: UNDP, own calculations

In order to observe better cross-country disparities, we present in Figure 1 above the each variable in 2012 relative to their cross-sectional average. Hence, in the figures above, the value of 1 indicates an average country and deviations from 1 shows the disperison from the mean In terms of HDI, most developed country is Norway with a relative score about 1.4



and the least developed country has a score about 0.5. Hence, the most developed country has almost 3 times higher HDI score than the least developed one.

In terms of GDP, the richest country has per capita income about 5 times higher than an average country. The country which has lowest income has about 0.025 relative income. Hence, there are huge differences in terms of GDP per capita between countries. The richest one has almost 192 times more per capita income than the poorest one. The disparities in HDI and GDP can be due to many socio-economic reasons. They might be due to differences between countries in human and social capital, disparity in physical infrastructure, level and quality of investments, public goods and services, climate and geography etc.

To be able to understand better the evolution of cross-country disparities over time, we estimate the Kernel Density estimations of each variable relative to their cross-sectional average (Wand and Jones 1995; Silverman 1998). Hence, in the figures below, the value of 1 indicates an average country. The estimations are performed in Eviews 4 software program.

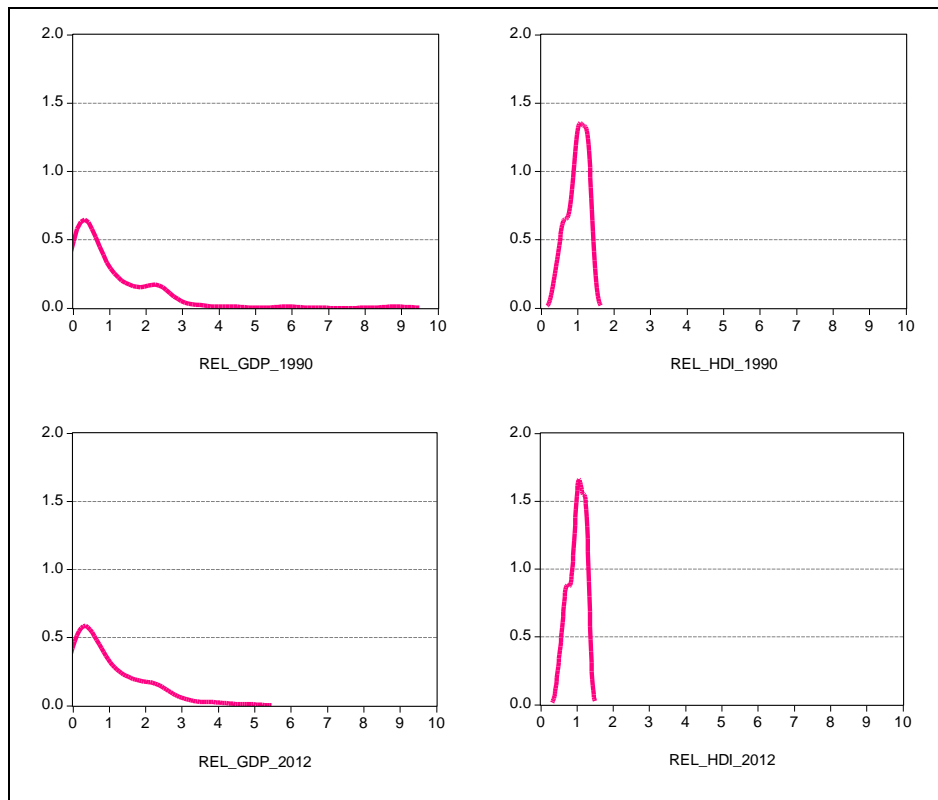


FIG 2. KERNEL DISTRIBUTION OF HDI vs. INCOME(1990), AVERAGE=1, Data Source: UNDP, own calculations

In 1990, HDI exhibit a very normal distribution shape while GDP shows a much dispersed distribution. In 2012, both variables seem to have more homogenous shape as the probability mass concentrates more around value 1. Hence, two important results can be learned from the analysis. First, inequalities have declined over 1990-2012 regardless of which variable has been analyzed. Second, perhaps more importantly, the inequalities observed in GDP are much more higher than the disparities observed in HDI variable.

In order to support this evolution inferentially, we run the following basic cross-sectional convergence regression:

$$\Delta \ln y_i = \beta_0 + \beta_1 \ln y_i + \beta_2 \text{pop}_i + \varepsilon_i \quad i=1, \dots, 128 \quad (1)$$

where y denotes the variable interest (GDP or HDI). Subscript i denotes the countries, $\ln y_i$ is the initial level of variable in 1990 (in natural logarithms) and $\Delta \ln y_i$ is the growth of the variable (logged and first differenced) over the 2012-1990 period. pop_i is the population share of countries in world population in year 2012. Population data has been obtained from UNDP database. Finally, ε_i represents the error term which assumed to follow a normal, identical and independent distribution.

We estimate 4 types of regression using OLS (Ordinary Least Squares) technique and the results are summarized in Table 3. In the first two columns (Model 1 and 2), GDP is used as a variable of interest whereas in the last two columns (Model 3 and 4) HDI is used. In the models 2 and 4, population shares have been added as an explanatory variable to capture the effect of different population sizes of countries. P-Values are presented in parenthesis.

We apply a White's Heteroskedasticity test for each regression. In case that the heteroskedasticity is evident, we use White's Heteroskedasticity Consistent Standard Error Estimators (White 1980; Kim et al. 2006).

TABLE 3. REGRESSION TABLE

Dependent Variable:	GDP	GDP	HDI	HDI
	(Model 1)	(Model 2)	(Model 3)	(Model 4)
<i>constant</i>	0.029654***	0.022701***	0.025599***	0.025174***
(P-Value)	(0.0000)	(0.0000)	(0.0000)	(0.0000)
<i>ln_y</i>	-4.12E-07**	-3.09E-07***	-0.028144***	-0.027774***
(P-Value)	(0.0150)	(0.0005)	(0.0000)	(0.0000)
<i>pop</i>	-	0.717011**	-	0.026121***
(P-Value)	-	(0.0146)	-	(0.0059)
R_Squared	0.046055	0.429730	0.464988	0.474952
F_Statistics	6,083073**	47,09716***	109,5089***	56,5367***
White_Heterosk.	1,091	76,59***	15,55***	8,02***
Number of Observations	128	128	128	128

*** represents statistical significance at 1%, ** at 5%, * at 10% level.

Data Source: UNDP, own calculations

As an outcome, in all regressions, \ln_y has a negative and significant coefficient at 1 %. This indicates a strong and robust evidence of economic convergence and declining disparities among countries. In other words, initially poorer or relatively less developed countries tend to grow more in terms of both GDP and HDI over the period. Population variable has positive and significant coefficient in both regressions, indicating basically the fact that big



countries in population (like China, India, Brasil, etc.) tend to grow faster than the smaller countries.

CONCLUSIONS

In this paper, we have investigated the recent trends in income and development inequality between 128 countries. Our empirical analyses indicate two major results.

- First, the disparities in income and HDI have been shown to decline from 1990 to 2012. This has been confirmed by several analyses, both via Kernel Density Estimations and regression analysis. Indeed, this result is robust even if the relative population sizes of countries are taken into account;
- Second, it has been shown that there are huge disparities in income between countries but only moderate disparity in development. Such that, in 2012, the most developed country has HDI score about 3 times more than the least developed country. And, this ratio is comparatively much higher in GDP since the richest country has about 192 times more income per capita than the poorest state. Why this difference occurs is really a complicated question. It might be due to the data problems related to reliability in measuring GDP, education and health services data or due to any other socio-economic phenomena. In the light of our findings, we may consequently argue that either GDP data exacerbates the disparities or HDI data underestimate it. Anyhow, the researchers should be cautious in that sense. Using only one type of measure may lead to distorted results. Hence, both measures should be employed.

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