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An Analysis of International Income Inequality

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Abstract

This study measures and decomposes world income inequality between world's geographic regions during the past two decades using Theil's two measures of inequality. The study finds that the extent of income inequality has been decreasing over the years mainly because of increasing per capita income in China and to some extent India. Income inequality has been highest, but declining sharply over time in East Asia & Pacific. Sub-Saharan Africa and Middle East & North Africa show moderate income inequalities, while other regions of the world show low inequality. The study finds that the contribution of income inequality between regions has been substantially larger than the contribution of inequality within regions.

Keywords: Income inequality; Geographical blocks; Theil's Entropy

JEL classification: D63, O18, P25

1. Introduction

With the passage of time and the world's economies emerging as a global village, the issue of world income distribution has gained importance. A small number of countries are very rich, accounting for a significant proportion of the world GDP. According to *World Development Indicators* (*WDI*) data, based on the country-specific per capita incomes, the richest 20% of the world population (those living in the richest countries) are found to account for 80% of world income, while the share of poorest 20% of the population has remained less than 2% of the world income. Table 1 indicates that the income share of the middle 60% of world population has varied between 13.78 and 26.6, signifying a skewed distribution with long tail of poverty.

Quite a few studies have analysed income inequality across countries. As noted in Heshmati (2004), the earlier work can be divided into two categories. The first approach is to measure international inequality as economic disparities between countries considering per capita GDP of each

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country as the unit of analysis [e.g. Andic and Peacock (1961), Rati R. (1979), Berry *et al.* (1983), Chotikapanich (1997), Deininger and Squire (1996), Park (2001), Podder (1993), Schultz (1998), Sala-i-Martin (2002), Firebaugh and Goesling (2004) and Theil (1979, 1996), Theil and Seale (1994)]. This approach is simple but ignores inequality within each country. The second approach, which is to measure global inequality as economic disparity between all individuals in the world, uses household income as the unit of analysis by utilizing national level surveys [e.g. Milanovic (2002, 2005, 2010)]. But practical application of this approach is limited, as national surveys of all countries in a given period are not easily available and the household income measurement practices can vary considerably across countries.

Table 1: Quintiles of Countries based on Per Capita GDP

Year	Share of Top 20%	Share of Bottom 20%
1960	84.24	1.29
1970	72.88	0.52
1980	76.08	0.67
1990	84.49	0.94
2000	85.20	1.02
2010	80.63	0.61

Note: Calculations are based on WDI.

The present study provides time series (1990 to 2010) of international income inequality measures across countries of the world. In addition it also decomposes international income inequality between different geographical blocks of the world in order to observe the relative extent of inequality within and between various regions.

2. Analytical Framework and Data

The study carries out two tasks; a) measurement of international income inequality over the period 1990 to 2010 based on per capita GDP at PPP adjusted constant 2000 US$ and b) decomposition of the international inequality into geographical blocks of the world.

Of all the measures of inequality, Gini index and Theil's Entropy measures have attracted much attention in empirical literature because of their relative agreement with theoretically desirable properties of an inequality measure. Since the decomposition of Gini index between regions would

include, besides between and within components, a term called trans-variation which has no straightforward interpretation [Dangum (1997)]; the study employs Theil's two well-known measures that are neatly decomposable. Denoting per capita income of country i, per capita world income and the number of countries by Y_i, $\overline{Y}$ and n respectively, Theil's measures are given by:

Theil's First Measure: $$T_1 = \frac{1}{n}\sum_{i=1}^{n}\left(\frac{Yi}{\overline{Y}}\right)\ln\left(\frac{Yi}{\overline{Y}}\right) \quad (1)$$

Theil's Second Measure: $$T_2 = \frac{1}{n}\sum_{i=1}^{n}\left[\ln\left(\frac{\overline{Y}}{Y_i}\right)\right] \quad (2)$$

In case of perfect equality both T_1 and T_2 take the values equal to zero, while in case of perfect inequality T_1 and T_2 take the values equal to $\log(n)$ and $\log(1/n)/n$ respectively.

According to Shorrocks (1980), the two measures are decomposable as follows.

$$T_1 = \underbrace{\sum_{k=1}^{K} s_k . T_1^{\,k}}_{T_W} + \underbrace{\sum_{k=1}^{K} s_k \ln\left(\frac{\overline{Y}_k}{\overline{Y}}\right)}_{T_B} \quad (3)$$

$$T_2 = \underbrace{\sum_{k=1}^{K} p_k . T_2^{\,k}}_{T_W} + \underbrace{\sum_{k=1}^{K} p_k \ln\left(\frac{\overline{Y}}{\overline{Y}_K}\right)}_{T_B} \quad (4)$$

Where s_k and , p_k are respectively the income and population shares of group k, used as weights. The first term in each case measures weighted inequality within the k sub-groups and the second term explains inequality between the sub-groups. In order to calculate between groups inequality, Theil measures set mean income of each country within each group equal the respective group mean. The income inequality within groups is measured as the weighted sum of inequalities within various groups.

Income inequality between countries can be based on GDP as the unit of analysis, but in this case all countries are given equal weight irrespective of their populations. Per capita GDP is obviously a better unit of analysis, provided in the income inequality measures the income units (countries) are

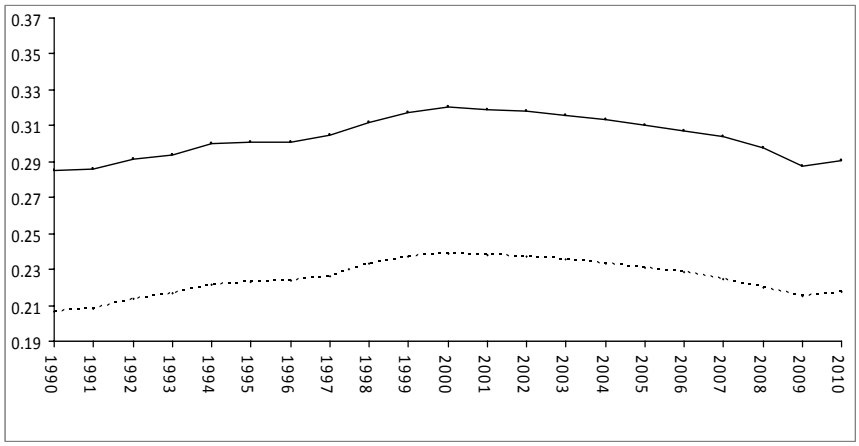
appropriately weighted by population or income shares as the case may be. Furthermore, all per capita incomes have to be converted to one currency (e.g. US$) and adjusted for PPP. The data for the present study are taken from latest issue of *World Development Indicators* ((WDI)-2012, an annual publication of World Bank. Since data for many countries are missing for the earlier years, the present study covers the period 1990 to 2010 for 170 countries.

3. Trends in International Inequality

The results of international income inequality presented in Figure 1 show a declining trend throughout the period of analysis. This indicates that divergence between income and population share of different countries has been decreasing with the passage of time. Furthermore, as expected, Theil's second measure that uses income shares rather than population shares as weights shows greater degree of inequality and faster rate of decrease over the years[2].

Figure 1: Trends in International Income Inequalities

(….. Theil's First Measure, ____ Theil's Second Measure)



Our results are in harmony with those preseted in Firebaugh and Goesling (2004) that if countries are weighted according to population, the

[2] The estimates of Theil's indices without PPP adjustment of per capita GDP show no substantial difference in trend.

international inequality shows declining trend. Chotikapanich *et.al* (2009) also found that international income inequality declined between 1993 and 2000. They emphasized that decline in inequality was largely attributable to economic growth in China. Similar results were found in Sutcliffe (2004), Warner *et al.* (2011) for China and Wolf (2004) for China and India.

China accounts for more than 21% of the world population and had annual compound GDP growth rate at 9.5% during 1990-2000. India accounts for more than 18% of the world population and had annual GDP growth rate at 4.7% during the same period. In comparison to these two countries the growth rate of rest of the world had been just 2.13%. Therefore, it is worthwhile to determine how the trends in inequality are affected if one or both of these countries are excluded from the sample. The results are shown in figures 2 to 4.

As suspected the trends in international income inequality are almost reversed when China is excluded from the sample (Figure 2). Both the indices show an increasing trend in income inequality till 2000 and a mild decreasing trend thereafter. Thus, the substantial decrease in income inequality over the years may be attributed to inclusion of China, a relatively poor but fast growing country, in the sample. On the other hand, exclusion of India (Figure 3) has no substantial effect on the general trends of income inequality across countries, though the rate of decline in inequality is somewhat dampened.

Figure 2: Trends in International Income Inequalities (Excluding China)
(….. Theil's First Measure, ____ Theil's Second Measure)

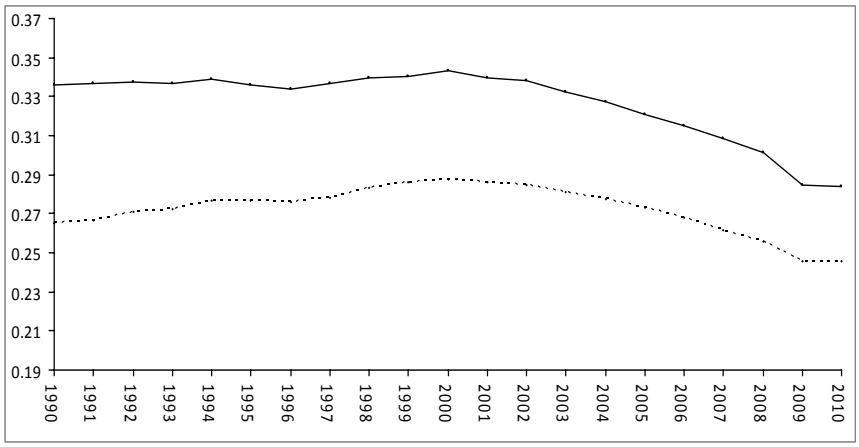


Figure 3: Trends in International Income Inequalities (Excluding India)
(….. Theil's First Measure, ____ Theil's Second Measure)

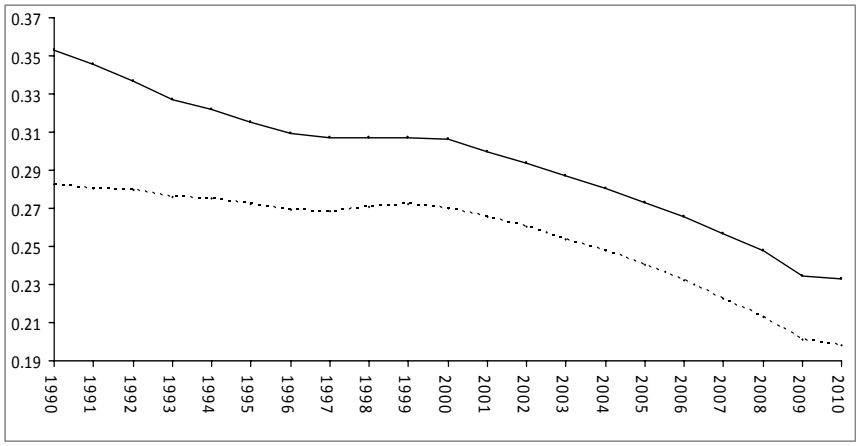
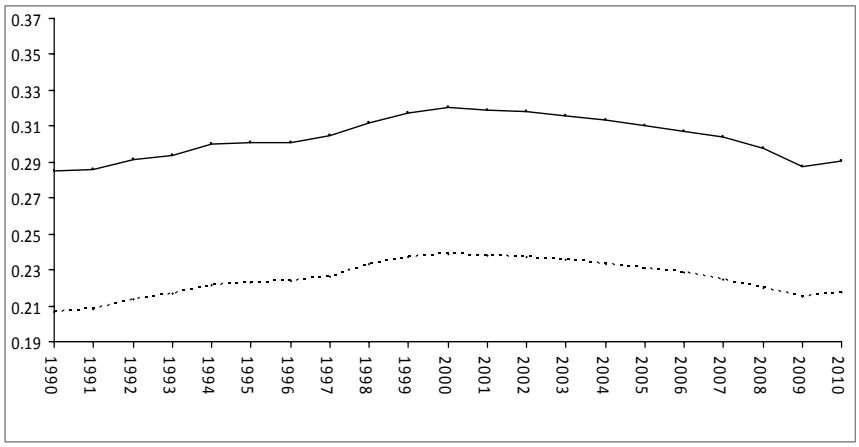


Figure 4: Trends in International Income Inequalities
(Excluding China and India)
(….. Theil's First Measure, ____ Theil's Second Measure)



This is so because the growth rate in India has not been as phenomenal as in China. Both China and India account for close to one fifth of the world's population, both have per capita income less than the world average and the GDP growth rate of China has been about twice as fast as that of India, which in turn has been more than twice as fast as the growth rate of the rest of the world. This explains why, as indicated in Figure 4, the presence of China and

India in the sample have suppressed the income inequality across countries in recent years to a reasonable extent.

4. Decomposition of International Income Inequality

The decomposition is carried out with respect to the Wold Bank's classification of countries in seven geographic regions. The decomposition statistics for all the years under consideration, not presented here, indicate smooth trends over the years with no sudden jumps. Therefore in order to preserve space, the statistics are presented with the gap of five years, that is, for the years 1990, 1995, 2000, 2005 and 2010. The decomposition results are reported in table 2.

The first two blocks of the table provide some indication of regional income disparity. For example, as of the year 2010 the share of North America in world income has been more than four times its share in world population while the income share of Sub-Saharan Africa has been only one fifth of its population share. This means that per capita income in North America has been about 20 times the per capita income in Sub-Saharan Africa. On the upper side of income distribution North America is followed by Europe & Central Asia with per capita income about half of the former. On the lower tail, Sub-Saharan Africa is closely followed by South Asia. The income share of Latin America & Caribbean has been slightly higher than its population share whereas the income share of East Asia & Pacific has been somewhat lower than its population share.

The next two blocks show income disparity between countries within each region. Both the measures show that the degree of inequality was highest in East Asia & Pacific, which declined drastically after every five years. Sub-Saharan Africa and Middle East & North Africa show moderate income inequalities, which remained quite stable over the years. The level of inequality in the other four regions has been quite low and stable.

Coming now to the last two blocks, it is noticeable that Theil's second measure produces a larger contribution of inequality within regions than Theil's first measure. The reason is that Theils second measure assigns largest weight (based on population) to the region of East Asia & Pacific where the income inequality is the highest whereas Theil's first measure assigns largest weight (based on income) to the region of Europe & Central Asia and North America where the income inequality is relatively quite low. In any case the results show that the contribution of income inequality between regions has

Table 2: Decomposition of World's Per Capita Income Inequalities by Geographic Regions

Inequality statistics	Regions	1990	1995	2000	2005	2010
Percentage income shares	East Asia & Pacific	18.78	21.94	22.18	24.12	27.91
	South Asia	3.87	4.44	4.83	5.57	6.97
	Europe & Central Asia	37.67	32.87	31.61	30.35	28.21
	Sub-Saharan Africa	2.29	2.19	2.18	2.34	2.63
	Latin America & Caribbean	8.59	9.14	8.88	8.50	8.85
	North America	24.71	25.06	25.90	24.49	21.95
	Middle East & North Africa	4.09	4.36	4.42	4.61	3.48
Percentage population shares	East Asia & Pacific	33.87	33.35	32.84	32.17	31.73
	South Asia	22.07	22.62	23.21	23.67	24.32
	Europe & Central Asia	16.34	15.37	14.48	13.80	13.45
	Sub-Saharan Africa	9.63	10.28	10.94	11.68	12.66
	Latin America & Caribbean	8.23	8.45	8.54	8.60	8.71
	North America	5.43	5.35	5.29	5.22	5.23
	Middle East & North Africa	4.43	4.58	4.70	4.86	3.91
Theil's first measure	East Asia & Pacific	0.402	0.307	0.252	0.187	0.117
	South Asia	0.008	0.008	0.007	0.008	0.010
	Europe & Central Asia	0.056	0.095	0.096	0.074	0.061
	Sub-Saharan Africa	0.195	0.199	0.196	0.196	0.183
	Latin America & Caribbean	0.019	0.020	0.025	0.024	0.022
	North America	0.001	0.001	0.001	0.001	0.001
	Middle East & North Africa	0.157	0.153	0.149	0.136	0.135
Theil's second measure	East Asia & Pacific	0.330	0.240	0.191	0.142	0.095
	South Asia	0.008	0.008	0.008	0.009	0.012
	Europe & Central Asia	0.069	0.123	0.127	0.096	0.078
	Sub-Saharan Africa	0.158	0.166	0.169	0.169	0.160
	Latin America & Caribbean	0.022	0.027	0.031	0.031	0.030
	North America	0.001	0.001	0.000	0.001	0.001
	Middle East & North Africa	0.120	0.121	0.118	0.113	0.118
Decomposition of Theil's 1st measure (%)	Contribution of Inequality within East Asia & Pacific	23.79	22.09	18.63	16.95	15.06
	Contribution of Inequality within South Asia	0.09	0.11	0.12	0.17	0.33
	Contribution of Inequality within Europe & Central Asia	6.67	10.21	10.12	8.39	7.88
	Contribution of Inequality within Sub-Saharan Africa	1.40	1.43	1.43	1.72	2.21
	Contribution of Inequality within Latin America & Caribbean	0.53	0.61	0.75	0.76	0.89
	Contribution of Inequality within North America	0.04	0.06	0.06	0.06	0.06
	Contribution of Inequality within Middle East & North Africa	2.02	2.19	2.19	2.36	2.16
	Total Contribution of Inequality within All Regions	34.54	36.71	33.29	30.40	28.59
	Contribution of Inequality Between All Regions	65.46	63.29	66.71	69.60	71.41
Decomposition of Theil's 2nd measure (%)	Contribution of Inequality within East Asia & Pacific	30.55	24.51	19.91	16.39	12.88
	Contribution of Inequality within South Asia	0.48	0.58	0.59	0.78	1.27
	Contribution of Inequality within Europe & Central Asia	3.07	5.79	5.85	4.76	4.53
	Contribution of Inequality within Sub-Saharan Africa	4.16	5.21	5.87	7.07	8.70
	Contribution of Inequality within Latin America & Caribbean	0.49	0.69	0.85	0.95	1.13
	Contribution of Inequality within North America	0.01	0.01	0.00	0.01	0.01
	Contribution of Inequality within Middle East & North Africa	1.45	1.69	1.76	1.98	1.98
	Total Contribution of Inequality within All Regions	40.21	38.48	34.84	31.95	30.51
	Contribution of Inequality Between All Regions	59.79	61.52	65.15	68.05	69.49

been substantially larger than the contribution of inequality within regions. Furthermore, the degree of inequality between regions has been increasing almost steadily over the years. Another notable observation is that, as expected, income inequality within East Asia & pacific has been the main contributor of total inequality within regions.

5. Conclusions

The study arrives at several interesting conclusions. It is shows that the degree of inequality in income between countries has been decreasing steadily over the years. However, this trend in income distribution does not mean that economic conditions in poor countries are improving in most of the countries. Far from it, if China alone is taken out of the picture, the trend is almost reversed, showing slight deterioration in the 1990s and mild improvement in the 2000s. Furthermore, if both China and India are taken out of the picture, the trend would show a no net improvement in income over the past two decades despite some improvement in recent years. Nevertheless, this need not be viewed pessimistically. After all China and India account for about 40% of world's population and, therefore, improvement of economic conditions even in these two countries alone cannot be taken lightly. When it comes to standards of living, what matters is the proportion of world population, rather than the number of countries than show improvement.

Another useful finding of the study is that international inequality mainly comprises of inequality between geographic regions while the contribution of inequality within regions has been relatively small. Further, the contribution of inequality between regions has increased consistently. This pattern has serious implications for the way world economic cooperation contributes to reducing inter-country economic disparity through free trade and movement of production activities. Most formal efforts towards economic cooperation are confined to regional economic cooperation in the form of free-trade area, etc. Where there has been any cross regions (or cross continental) economic cooperation, the effects on reduced disparity are visible. This can be seen in the form of significant improvements in economic conditions in China and India. While both countries have benefitted from free trade and transfer of production facilities, China has reaped the maximum gains. In any case, the study clearly indicates that there is substantial scope foe bridging the gap between rich and poor countries of the world and highlights the importance of international economic cooperation beyond regional boundaries.

References

Andic, S., & Peacock, A.T. (1961). The international distribution of income, 1949 and 1957. *Journal of the Royal Statistical Society, 124*, 206-218.

Berry, A., Bourguignon, & Morrisson, C. (1983). Changes in world distribution of income between 1950 and 1977. *Economic Journal, 93,* 331-350.

Chotikapanich, D., Griffiths, W., Rao, P., & Vicar, V. (2009). Global income distribution and inequality: 1993 and 2000. *Department of Economics, Working Papers Series 1062*, The University of Melbourne.

Chotikapanich, D., Valenzuela, R., & Rao, D. S. (1997). Global and regional inequality in the distribution of income: Estimation with limited and incomplete data. *Empirical Economics, 22*, 533-46.

Dangum, (1997). A new approach to the decomposition of Gini income inequality ratio. *Empirical Economics, 22*, 515-531.

Deininger, & Squire, (1996). A new data set measuring income inequality. *World Bank Economic Review, 10,* 565-591.

Firebaugh, G., & Goesling, B. (2004). Accounting for the recent decline in global income inequality. *American Journal of Sociology, 110*, 283-312.

Fredrik, & Christian, (2005). Estimates of trends in global income and resource inequalities. *Ecological Economics, 55*, 351-364.

Heshmati, (2004). The world distribution of income and income inequality. *Discussion Paper: 1267, IZA.*

Milanovic, B. (2002). True world income distribution, 1988 and 1993: First calculation based on household surveys alone. *Economic Journal, 112,* 51-92.

Milanovic, B. (2005). Can we discern the effect of globalization on income distribution? Evidence from household surveys. *World Bank Economic Review, 19*, 21-44.

Milanovic, B. (2010). Global inequality recalculated and updated: The effect of new PPP estimates on global inequality and 2005 estimates. *Journal of Economic Inequality, 10*, 1-18.

Park, (2001). Recent trends in the global distribution of income. *Journal of Political Modelling, 23*, 497-501.

Podder, N. (1993). A profile of international inequality. *Journal of Income Distribution, 3*, 300-314.

Ram, R. (1979). International income inequality: 1970 and 1978. *Economic Letters, 4*, 187-90.

Sala-i-Martin, (2002). The distribution "Rise" of global income inequality, *NBER working paper,* 8933.

Schultz, (1998). Inequality in distribution of personal income in world: How it is changing and why? *Journal of Population Economics, 11*, 307-344.

Shorrocks, (1980). The class of additively decomposable inequality measures. *Econometrica, 48*, 613-625.

Sutcliffe, (2004). World inequality and globalization. *Oxford Review of Economic Policy, 20*(1) 15-37.

Theil, H., & Seale, J. (1994). The geographic distribution of world income, 1950-90. *De Economist, 4*, 387-419.

Theil, H. (1979). World income inequality. *Economics Letters, 2*, 99-102.

Theil, H. (1996). Studies in global econometrics. *Kluwer Academic Publishers,* Amsterdam.

Warner, D., Rao, P., Griffiths, W. E., & Chotikapanich, D. (2011). Global inequality: Levels and trends, 1993-2005. *Discussion Papers Series, 436,* School of Economics, University of Queensland, Australia.

Wolf, M. (2004). States are cure and disease. *World Economy,* Special Report.

World Development Indicators (2012). http://data.worldbank.org/data-catalog/world-development-indicators, World Bank.