

An Examination of  
Global Income Convergence  
For 1960-1990

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### Abstract

In this paper, I examine the question of whether poor countries have been catching up with rich countries over the period 1960-1990. Our data set, which is based mainly on the Penn World Tables, consists of 161 countries and territories. I find that international inequality, as measured by the Gini coefficient and the Theil entropy index, did not fall during this period. That is, the evidence does not support the convergence hypothesis, according to which the per capita income levels of poor countries tend to converge towards those of rich countries over time.

## I.Introduction

Relative to the issues of economic growth and development, the distribution of income among individuals and households has traditionally been largely neglected among economists;the enlargement of the pie is generally deemed to be more significant than the division of the pie. Recently, however, there has been growing interest in the area in both industrialized countries and developing ones, although for entirely different reasons. In the richer parts of the world, the rising interest has been motivated by the achievement of affluence and a re-orientation of priorities from efficiency toward equity. In poorer countries, on the other hand, income distribution has begun to command greater attention in the context of development and poverty - does economic growth in and of itself always reduce inequality and poverty, or does the reduction of poverty sometimes require conscious redistributive efforts, even in the presence of rapid growth?

In this paper, rather than examine the income distribution of particular countries over time or compare the income distributions of different countries, I analyze the trends in international income distribution over the past three decades. Causal observation alone suggests that there are vast differences in the standards of living across countries. In particular, a large gap exists between developed and developing countries. At the same time, growth performances have varied enormously across the developing world. While some developing countries, particularly in East Asia, have experienced spectacular growth rates far surpassing those of industrialized countries, others, most notably in Sub-Saharan Africa, appear to have stagnated or even regressed in some cases. In light of such diverse performances, it is unclear whether there has been convergence, or a narrowing of the income gap between the rich and the poor countries.

The central task of this paper is to look at the empirical evidence on international convergence in the period 1960-1990. For this purpose, we make use mainly of the data in Penn World Tables(PWT), which provide a systematic attempt to render the incomes of different countries comparable. In constructing an index of income inequality among nations, we making the following two assumptions - there is perfect income equality among the citizens of each country in our sample and all the countries in our sample constitute a single world economy. The construction and application of this index will be, hopefully, our primary contribution to the literature on convergence. As such, our contribution is largely methodological. It is important to note that what is new here are not the indices themselves, for which we use existing conventional ones such as the Gini index, but our derivation of a single measure of international income inequality, which we use to analyze trends in the inequality of income across countries.

## II.Growth Theory and Convergence

By international convergence, I mean a tendency for the living standards of the countries of the world to converge over time. Or, equivalently, it refers to the poor countries catching up economically with rich ones over time. In order for convergence to occur, the poor countries must experience higher rates of growth than richer ones. In the final analysis, the concept of convergence is a prediction about the pattern of economic growth across countries over time. Therefore, the logical point of departure for a theoretical review of convergence is a review of the neoclassical approach to growth theory. The two main strands of the neoclassical approach are the Solow model and the endogenous growth models.

### (i) Solow Model

Solow(1956) derives the most basic neoclassical model of economic growth by combining the neoclassical production function with the assumption that a constant proportion of output is saved for the purpose of increasing the stock of capital. Solow's initial framework could not explain rising per capita incomes, a key stylized fact of modern economic growth. To overcome this problem, Solow(1957) explicitly introduced a variable which represents the state of technology in the economy, namely total factor productivity, as an additional element of the production function. Growing per capita incomes could now be attributed to two factors - growth in the capital-labor ratio and technological progress, the celebrated Solow residual. Solow emphasized the second factor relative to the first, but assumed it to be exogenous.

In an empirically oriented 1992 paper, Mankiw, Romer and Weil(henceforth MRW) extend the basic Solow model to include human capital. Their work represents a general trend toward recognizing the potentially significant role of human capital accumulation in the growth process. A major assumption MRW make is that the level of technology is identical for all countries. The MRW model differs from the basic Solow model mainly in predicting a higher proportion of output being allocated to capital, both physical and human. As in the basic Solow model, the MRW model predicts that per capita income growth is unsustainable in the absence of technological progress.

Building on earlier work by Ramsey(1928), Cass(1965) and Koopmans(1965) endogenized the consumption-saving decision as the outcome of intertemporal optimization by a representative individual. In doing so, they rectified a serious shortcoming of the basic Solow framework - the exogeneity of savings. Their main

contribution to growth theory was to incorporate into the analysis the fact that savings behavior of rational individuals was guided by the rate of return to savings.

We now examine the implications of the Solow model for international economic convergence. As we have seen, according to the basic Solow model, exogenous technological progress is the primary determinant of economic growth. Unfortunately, the model's assumption of exogenous technological progress means that we can explain any pattern of growth rates across countries simply by assuming a corresponding pattern of technological progress rates across countries. Thus, although the model does not contradict convergence, neither does it predict it.

On the other hand, if we assume identical rates of technological progress across countries as MRW do, the Solow model does give us concrete predictions about economic convergence across countries. Those predictions depend critically on whether or not there is international capital mobility. If capital is immobile, each country converges to Solow's steady state, which grows at the uniform rate of technological progress - thus, there is no tendency for the per capita incomes of different countries to converge. The assumption of immobile capital, combined with uniform technological progress, imply that over time all countries will grow at the same rate. In stark contrast, if we assume capital to be internationally mobile, the Solow model predicts that poor countries will catch up with rich ones over time. The basic insight is that rich countries have high capital-labor ratios relative to poor countries. Diminishing marginal productivity of capital means that the rate of return to capital will be higher in poor countries. Consequently, capital will flow from rich countries to poor countries, pushing the world economy toward convergence.

## (ii) Endogenous Growth Model

Romer(1986) and Lucas(1988) pioneered a line of theoretical research which attempts to explain economic growth as an endogenous, rational process subject to the influence of policymakers. As such, this school of thought downplays the notion that exogenous technological progress is the primary engine of steady-state economic growth. The two most basic models of endogenous growth are the simple AK model and the extended AK model which allows for human capital.

The AK model, elaborated in Rebelo(1991), assumes constant returns to scale to capital. In this model, optimization by the representative individual determines the consumption and capital accumulation paths. The main implication is that capital accumulation alone determines the growth rate and since capital is not subject to diminishing marginal productivity, an increase in the rate of capital accumulation permanently raises the growth rate. Any policies which affect the decision to accumulate physical capital will permanently affect the growth rate. Economic growth is endogenous and does not require technological progress to be sustainable.

Barro and Sala-i-Martin(1994) expand the basic AK model by incorporating human capital. They assume constant returns to both types of capital, human and physical. The representative individual would always want to maintain a human capital-to-physical capital ratio to be equal to the ratio between the scale parameters because at this ratio, neither form of capital is subject to diminishing marginal productivity and sustained economic growth does not require exogenous technological progress. Any policy which increases the rate of accumulation of either type of capital will permanently increase the rate of economic growth.

The simple AK model does not predict convergence. In the absence of policies which affect the rate of capital accumulation, countries with different income levels do not

experience different rates of growth. As for the human capital-augmented AK model, its predictions about convergence in the case where all countries have the same level of technology and there is capital mobility differs significantly from the predictions of the Solow model. More precisely, poor countries will not always catch up with rich countries but only to the extent that they are relatively well-endowed with human capital. Thus, what is critical for international convergence is the level of human capital in developing countries.

### III. Empirical Literature

Now we turn to the question of whether the Solow model's prediction of economic convergence is supported by empirical evidence. Romer(1989), Barro(1991), Barro and Sala-i-Martin(1992) and Parente and Prescott(1993), among others, have recently addressed this question. They all find no empirical evidence for convergence. That is, on average, the actual pattern of economic growth across countries does not indicate that poor countries have been catching up with rich countries.

Perhaps the most obvious way to test for convergence is to plot rates of economic growth against initial levels of per capita income and check for any discernible pattern. Romer(1989) and Barro(1991) do this but do not find any systematic pattern. More formally, Sala-i-Martin(1990a, 1990b) estimate an equation based on the economy moving along its optimal path towards its steady-state per capita growth rate and find that the initial level of income is statistically insignificant as a determinant of the rate of economic growth.

An alternative way to empirically investigate convergence is to observe the evidence on international capital flows. In particular, the Solow model predicts capital to flow from rich countries to poor countries since the latter is relatively poorly endowed with capital and capital is subject to diminishing marginal productivity. Lucas(1990) finds

that empirical evidence fails to support rich country-to-poor country capital flows of the magnitude predicted by the Solow model. Furthermore, Feldstein and Horioka(1980) point out that countries with high savings rates tend to have high rather than low investment rates as the diminishing marginal productivity assumption of the Solow model would imply.

Finally, Barro and Sala-i-Martin(1991) examine convergence with two sets of more disaggregated data - the U.S. states and 73 European regions. They find qualified evidence which lends support to convergence among the U.S. states. This finding may be consistent with the arguments raised by Blanchard and Katz(1992), which stresses the key role of labor mobility in promoting regional convergence within a country or an economic unit. Barro and Sala-i-Martin find evidence for convergence among the European regions to be much weaker than their evidence for U.S. states.

#### IV.Measures of Inequality

There are three desirable properties we look for in any measure of inequality. First, mean or scale independence - the index does not change if everyone's income changes by the same proportion. Second, population size independence - the index does not change if the number of people at each income level is changed by the same proportion. Third, the Pigou-Dalton condition - any transfer from a rich person to a poor person which does not alter their relative ranks lowers the value of the index.

In this paper, we make use of two inequality indices - the Gini coefficient and the Theil entropy index. Both of the indices are widely used and satisfy the three desirable properties discussed above. In addition to the indices, we examine the percentile shares of income - the proportion of global income accruing to percentiles of global population. For fuller discussions of measuring inequality, please refer to Theil(1967), Atkinson(1970), Sen(1973), Cowell(1977) and Bartels(1977), among others.

## V.Data and Methodology

Our primary data set is the Penn World Tables(henceforth PWT), version 5.6. For a comprehensive explanation of this data set, please refer to Summers and Heston(1991). As is well known, PWT's great advantage is that all the economic variables are expressed in a common set of prices and in a common currency. The development of this database has allowed for more meaningful comparisons of variables across countries and has, in fact, served as a catalyst in empirical research on analysis of the international pattern of economic growth.

Where data is not available in the Penn World Tables, we use estimates based on either the Tables themselves or alternative sources, such as the World Almanac, Handbook of Nations and the World Development Report. Our main purpose in expanding the data set in such a manner is to achieve the highest level of completeness. Since what we are interested in is trends in global inequality, we want our data set to incorporate as much of the world as much as possible.

The full universe of our sample consists of 161 countries and territories. All political entities with a population of at least one million are included in our sample, as well as a number of entities with smaller populations. Our sample covers well over 99% of the global population. Our variables of interest are the population(POP in PWT) and per capita income(RGDPC in PWT) of each political entity. We examine the data at 5-year intervals for the period 1960-1990.

We do not make use of income distribution within individual countries, which are available on a limited basis in, for example, the World Development Report. The reason is that in this paper, global income inequality refers to the inequality among the nations of the world rather than the individuals of the world. The key assumption we make in this connection is that all the individuals of a country earn the same level of

income. Although there are rich Bangladeshis and poor Americans, an American will be rich on average and the Bangladeshi will be poor on average. The question we investigate is whether, on average, the gap between the Bangladeshi and the American has been narrowing or not over the last three decades. Or, equivalently, whether or not Bangladesh has been catching up with the U.S..

Before we proceed, let us briefly examine trends in the global population, global income and global per capita income implied by our data set. Global population and global income is obtained by summing up the populations and national incomes in our data set while per capita income is derived by dividing global income by population.

	Population (in millions)	Total Income (in billion US\$)	Per Capita Income (in US\$)
1960	3,034.463	6,713.408	2,212
1965	3,334.056	8,666.272	2,599
1970	3,686.315	11,164.98	3,029
1975	4,053.464	13,576.77	3,349
1980	4,424.143	16,589.04	3,750
1985	4,802.0256	18,997.39	3,956
1990	5,255.081	22,168.57	4,219

Table 1:Trends in Global Population, Income and Per Capita Income

## VI.Empirical Evidence

Before we proceed, it must be emphasized that the empirical evidence we refer to here are actually factual rather than truly empirical. We do not rely on any underlying probability models or draw inferences to larger populations. Instead, we simply report recent trends in international income inequality for the period 1960-1990.

### i)Percentile Shares of Global Income

We divide the global population - or more precisely, the total population of the countries and territories in our sample - into fifths, tenths and twentieths. Our first step is to rank all the political entities by their per capita income. Thus, in 1960, Ethiopia is at one end and the U.S. at the other. For the case of fifths, we first divide the global

population by five. For example, if there are four billion people in the world, each fifth would consist of 800 million. In constructing the poorest fifth, we would include all Ethiopians as well as the populations of the next poorest countries until 800 million people living in the poorest countries are included. Conversely, the richest fifth would consist of all Americans as well as the populations of the next richest countries until 800 million people living in the richest countries are included. We repeat the exercise for the middle three fifths. Countries at the cut-off points will have a part of their population included in one fifth and another included in another fifth. We apply the same methodology in dividing the global population by tenths and twentieths in terms of per capita national income.

	1960	1965	1970	1975	1980	1985	1990
q1	0.048094	0.042266	0.042954	0.04229	0.042448	0.044793	0.046028
q2	0.058519	0.050881	0.049384	0.04755	0.051208	0.060351	0.061616
q3	0.082121	0.076047	0.07052	0.065567	0.067434	0.071998	0.071046
q4	0.205649	0.210136	0.216184	0.238654	0.234082	0.216213	0.200109
q5	0.605617	0.62067	0.620959	0.605939	0.604828	0.606645	0.6212

Table 2: Shares of Global Income by Twenty Percentiles

In Table 1, q1 refers to the share of global income accruing to the poorest fifth of the global population, as defined earlier, while q2 indicates the share of the richest fifth. There does not appear to be a perceptible trend toward convergence. As Figure 1 illustrates, the share of global income accruing to each has remained fairly stable.

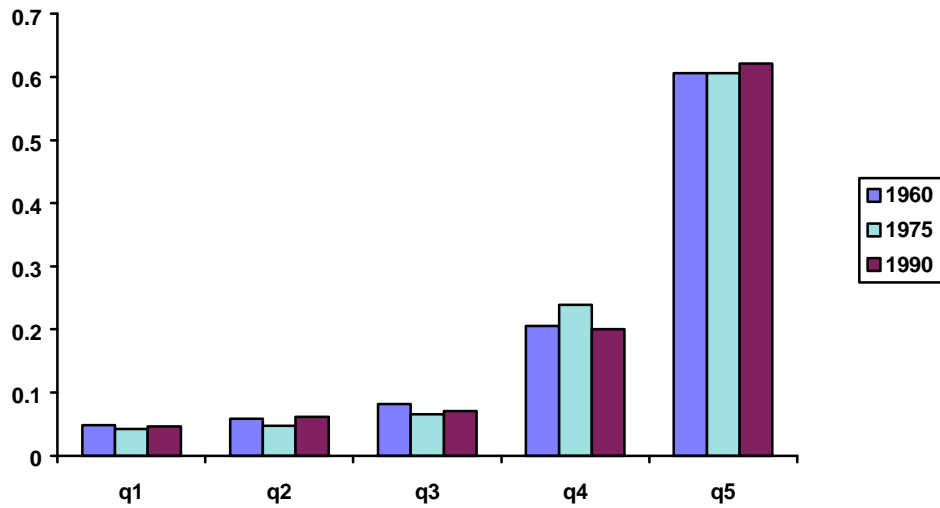


Figure 1: Shares of Global Income by Twenty Percentiles

We now examine the data on the basis of tenths of populations rather than fifths.

	1960	1965	1970	1975	1980	1985	1990
q1	0.022466	0.020068	0.019974	0.01942	0.018926	0.018151	0.016855
q2	0.025628	0.022198	0.02298	0.02287	0.023522	0.026642	0.029173
q3	0.026238	0.022844	0.023177	0.023218	0.025286	0.02833	0.30231
q4	0.032281	0.028037	0.026207	0.024333	0.025922	0.032021	0.31386
q5	0.034755	0.03	0.26908	0.026366	0.0273	0.032021	0.031424
q6	0.47366	0.046047	0.043612	0.039202	0.040134	0.039977	0.039622
q7	0.087679	0.084516	0.081255	0.088774	0.085921	0.07991	0.071706
q8	0.117971	0.12562	0.134929	0.14988	0.148161	0.136303	0.128404
q9	0.209361	0.22576	0.239436	0.236414	0.233457	0.233687	0.234998
q10	0.396256	0.39491	0.381523	0.369525	0.371371	0.372958	0.386203

Table 3: Shares of Global Income by Ten Percentiles

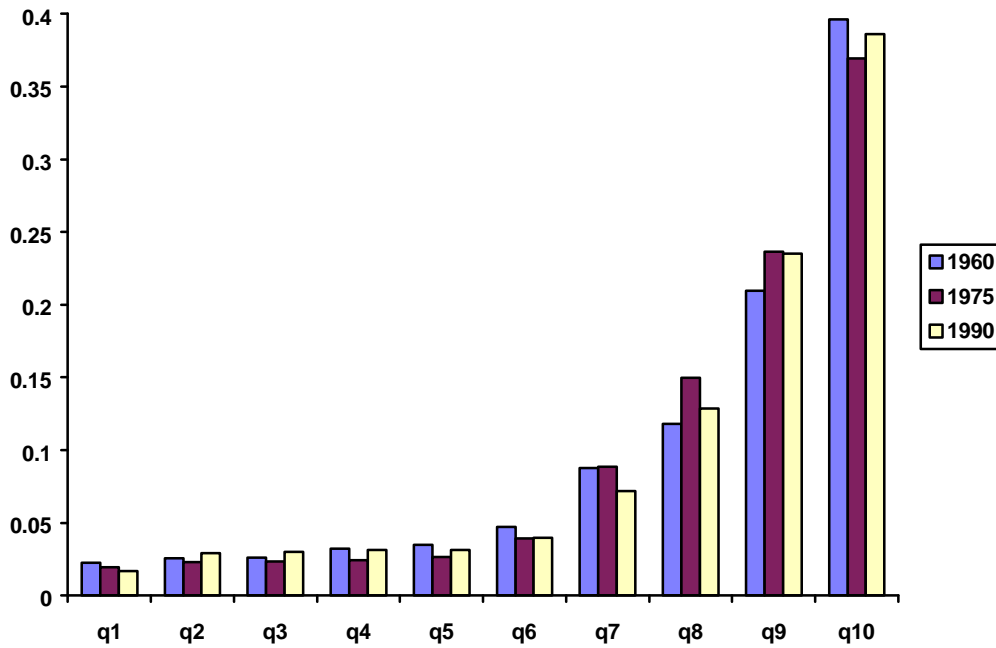


Figure 2: Shares of Global Income by Ten Percentiles

Finally, we break down the global population in twentieths or five percentiles.

	1960	1965	1970	1975	1980	1985	1990
q1	0.009652	0.008969	0.008484	0.007985	0.007194	0.006606	0.006152
q2	0.012814	0.011099	0.01149	0.011435	0.011731	0.011545	0.010702
q3	0.012814	0.011099	0.01149	0.011435	0.011761	0.013321	0.014191
q4	0.012814	0.011099	0.01149	0.011435	0.011761	0.013321	0.014982
q5	0.012814	0.011115	0.01149	0.011435	0.012325	0.013332	0.014982
q6	0.013423	0.011728	0.011687	0.011783	0.012961	0.014998	0.015249
q7	0.014969	0.013591	0.012968	0.012166	0.012961	0.016011	0.015693
q8	0.017312	0.014446	0.01324	0.012166	0.012961	0.016011	0.015693
q9	0.017312	0.014446	0.01324	0.012327	0.012961	0.016011	0.015693
q10	0.017443	0.015554	0.013668	0.014039	0.014339	0.016011	0.015732
q11	0.020581	0.020704	0.019023	0.016307	0.017332	0.017774	0.016919
q12	0.026785	0.025343	0.024589	0.022894	0.022802	0.022202	0.022703
q13	0.038174	0.03492	0.035128	0.037258	0.035632	0.032529	0.02931
q14	0.049505	0.049597	0.046127	0.051517	0.050289	0.047381	0.042395
q15	0.054172	0.05865	0.06552	0.072179	0.066641	0.05647	0.050864
q16	0.063798	0.06697	0.069408	0.0777	0.08152	0.079833	0.07754
q17	0.079959	0.091595	0.105917	0.104063	0.097188	0.092197	0.088896
q18	0.129402	0.134165	0.133519	0.132351	0.136269	0.14149	0.146102
q19	0.172629	0.170811	0.167382	0.164645	0.165682	0.162515	0.172709
q20	0.223627	0.224099	0.214141	0.20488	0.205689	0.210442	0.213494

Table 4: Shares of Global Income by Five Percentiles

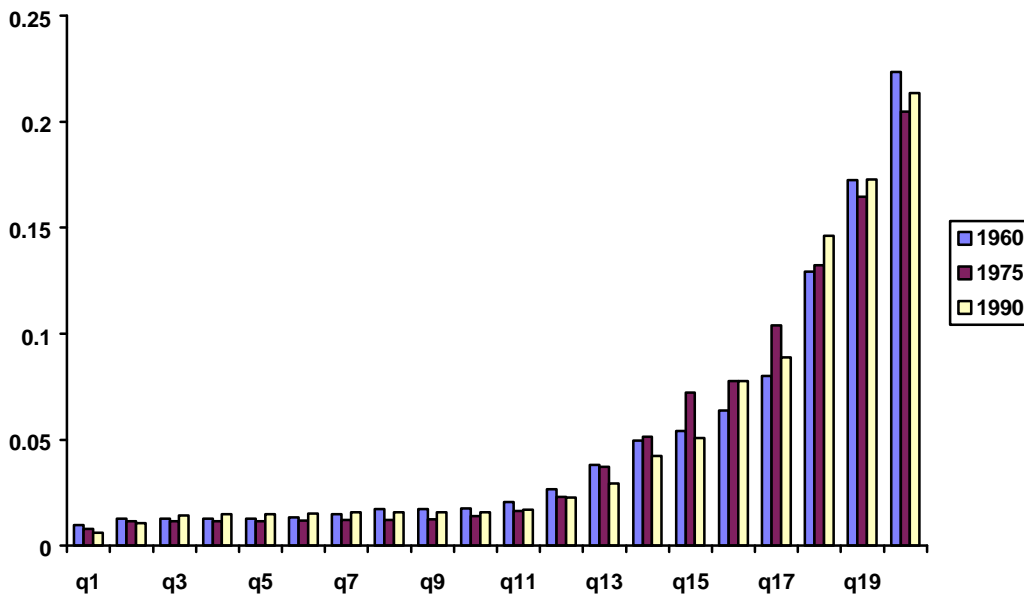


Figure 3: Shares of Global Income by Five Percentiles

As with twenty percentiles, there does not seem to be any significant convergence and the share of each percentile seems to have remained fairly stable over 1960-1990.

ii) Range

Perhaps the most elementary gauge of income inequality is range, or the difference between the highest and lowest income level. The range can convey only limited information since it ignores the distribution of income between the extremes. Be that as it may, we list the range in terms of fifths, tenths and twentieths of population to get an idea of the gap between the average incomes of the richest and poor countries.

We begin with a look at the differences between the richest and poorest fifths.

	1960	1965	1970	1975	1980	1985	1990
1	532	549	650	708	796	883	971
2	6699	8067	9404	10148	11340	11954	13103
3	6167	7518	8754	9440	10544	11071	12132
4	12.6	14.7	14.5	14.3	14.2	13.5	13.5

\*Row 1 - average income of q1, Row 2 - average income of q5, Row 3 - difference between q5 and q1, Row 4 - the ratio of q5 to q1

Table 5: Range of Twenty Percentile Incomes

We now examine the gap between the richest and poorest tenths.

	1960	1965	1970	1975	1980	1985	1990
1	497	522	605	650	710	715	711
2	8767	10265	11555	12377	13925	14699	16292
3	8270	9743	10950	11727	13215	13984	15581
4	17.6	19.7	19.1	19	19.6	20.6	22.9

\*Row 1 - average income of q1, Row 2 - average income of q10, Row 3 - difference between q10 and q1, Row 4 - the ratio of q10 to q1

Table 6:Range of Ten Percentile Incomes

Finally, we analyze the range in terms of twentieths of global population.

	1960	1965	1970	1975	1980	1985	1990
1	427	466	514	535	540	521	519
2	9895	11650	12972	13725	15425	16588	18012
3	9468	11184	12458	13190	14885	16067	17493
4	21.2	25	25.2	25.7	28.6	31.8	34.7

\*Row 1 - average income of q1, Row 2 - average income of q20, Row 3 - difference between q20 and q1, Row 4 - the ratio of q20 to q1

Table 7:Range of Five Percentile Incomes

Interestingly enough, the ratio or relative gap between the richest and the poorest differs substantially depending on whether we are using fifths, tenths or twentieths of global population as our units of comparison. For fifths, the ratio rises until 1970 and then falls thereafter. For tenths, the ratio rises in 1965 but falls in 1970 and 1975, only to rise again from 1980 on. Finally, for twentieths, the ratio rises throughout. The overall rise is substantial - from 21.2 in 1960 to 34.7 in 1990.

In terms of the increase in average incomes of the richest and poorest countries of the world, there has been a substantial increase in the richest countries over 1960-1990, regardless of whether we use fifths, tenths or twentieths. On the other hand, for the poorest, the rise in average income over the same period differs substantially depending on whether we use fifths, tenths or twentieths. When we use fifths, the increase is almost two-fold. The increase is roughly 40% for tenths, while for twentieths, the increase is smaller still - roughly 25%. Most alarmingly, for the poorest

twentieth, average income has hardly moved between 1970 and 1990, while we can say the same for the poorest tenth between 1980 and 1990.

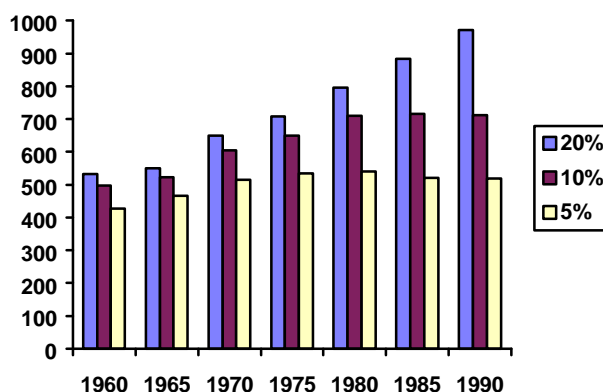


Figure 4: Per Capita Income of the Poorest 5%, 10% and 20%

### iii) Gini Coefficient

Gini coefficient is the most well-known and widely used measure of inequality. It is based on the Lorenz curve, which plots the cumulative share of total income against the cumulative share of total population. If there were perfect inequality, the Lorenz curve would be a 45-degree line since 20% of the population would have 20% of total income and so on. More generally, the smaller is the area between the 45-degree line and the actual income distribution, the smaller is the degree of inequality. The Gini coefficient is a convenient one-number summary of inequality in the sense of the Lorenz curve. The formula for calculating the Gini coefficient is:

$$G = 1 + \frac{1}{n} - \frac{2}{n^2 y} (y_n + 2y_{n-1} + \dots + ny_1) \text{ where } y_i = \text{income of } i \text{ th person}$$

$$\text{and } y_1 \leq y_2 \leq \dots \leq y_n$$

We derive the values of Gini coefficients for fifths, tenths and twentieths of the population by simply replacing incomes with shares of income, and the average income with the average share of income so that

$$G = 1 + \frac{1}{n} - \frac{2}{n^2 q} (q_n + 2q_{n-1} + \dots + nq_1) \text{ where } q_i = \text{income of } i \text{ th group}$$

$$\text{and } q_1 \leq q_2 \leq \dots \leq q_n$$

Making use of this, we obtain the below.

	1960	1965	1970	1975	1980	1985	1990
20%	0.50487	0.52643	0.52912	0.52736	0.52305	0.51182	0.51554
10%	0.52877	0.54979	0.55097	0.54855	0.54488	0.53341	0.53849
5%	0.53546	0.55620	0.55591	0.55354	0.55091	0.54073	0.54595

Table 8:Gini coefficients for 1960-1990

Regardless of the population share we use, the Gini coefficient exhibits the same pattern - an initial rise, a subsequent fall and finally, a slight rise in 1990. Furthermore, in all three cases, the value of the coefficient in 1990 does not differ substantially from its 1960 value.

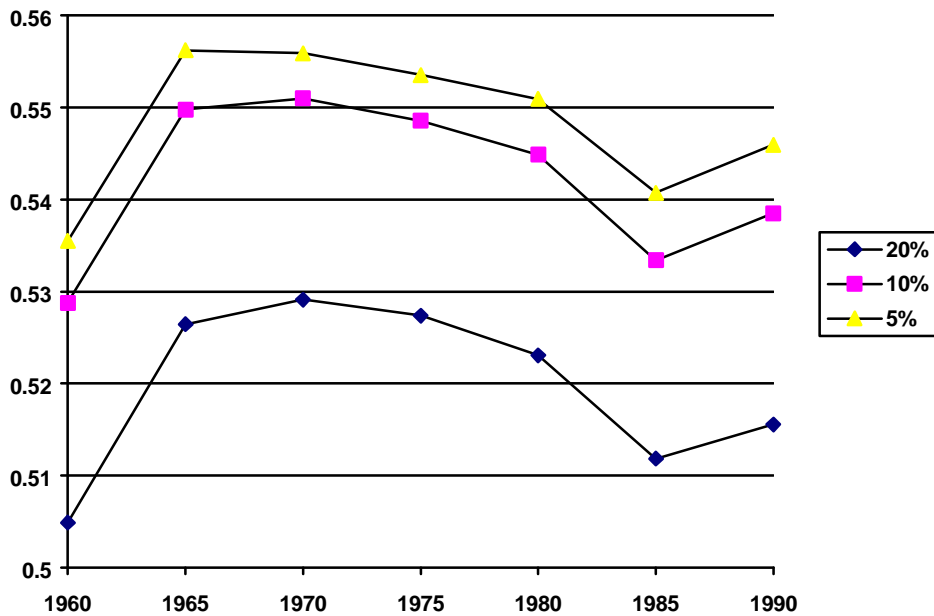


Figure 5:Gini Coefficient Trends, 1960-1990

#### iv)Theil Index

The entropy index  $T$  developed by Theil(1967) is based on the notion of entropy in information theory. It can be expressed as

$$T = \sum_{i=1}^n (y_i / Y) \log \frac{(y_i / Y)}{(1/n)} \text{ where } (1/n) \text{ is the population share of person } i$$

and  $(y_i / Y)$  is the income share of person  $i$

For our purposes, we need to replace the individual share  $(y_i / Y)$  with  $q$  so that

$$T = \sum_{i=1}^n q_i \log \frac{q_i}{(1/n)} \text{ where } (1/n) \text{ is the population share of group } i$$

and  $q_i$  is the income share of group  $i$

Theil interprets  $T$  as “the expected information of a message which transforms population shares into income shares.” When there is perfect equality,  $T$  becomes zero and conversely, when there is perfect inequality so that a single person receives all the income,  $T$  assumes its maximum value of  $\log n$ .  $T$  also satisfies the three desirable properties.

	1960	1965	1970	1975	1980	1985	1990
20%	0.46315	0.50441	0.51168	0.50669	0.49728	0.47711	0.49044
10%	0.49610	0.53382	0.53701	0.53076	0.52300	0.50205	0.51933
5%	0.50713	0.54341	0.54287	0.53683	0.53141	0.51475	0.53357

Table 9: Theil Entropy Index for 1960-1990

The general patterns are the same as for the Gini coefficient and the squared coefficient of variation, in terms of both trends and changes between 1960 and 1990.

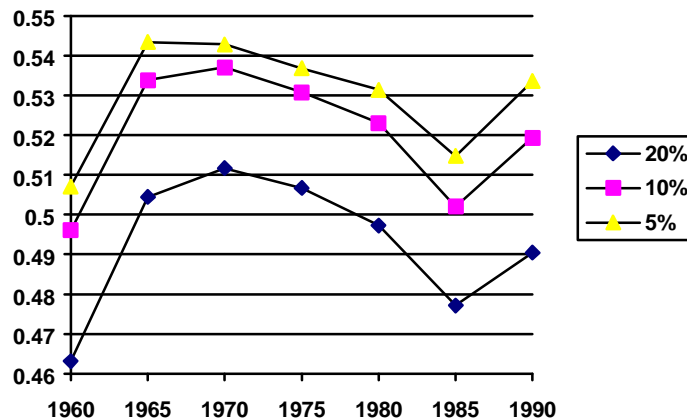


Figure 6: Trends in the Theil Entropy Index, 1960-1990

## VII. Concluding Remarks

In this paper, we examined the question of whether poor countries have been catching up with rich countries over the period 1960-1990. Our evidence indicates a negative answer. In terms of per capita income, our chosen index of economic welfare, the gap between the developed and developing areas of the world has not narrowed during this period. If anything, according to both the Gini coefficient and the Theil index, inequality across countries has increased slightly. Our finding is consistent with earlier studies on the issue, discussed above.

The most obvious interpretation of our result is that despite the rapid economic growth experienced by some developing economies, primarily in East Asia, developing economies as a whole have not been able to close the gap. In this connection, it is worth remembering two points - the combined populations of the East Asian miracles, while substantial, are not large enough to significantly affect the global income distribution and perhaps more significantly, for every development miracle, there has been one or more disaster.

As suggested earlier, it is hoped that this paper will make methodological contributions toward the empirical analysis of international income inequality. Our indices of global inequality provide a convenient one-number summary of the extent of inequality across countries. Those indices are designed to measure inequality among countries rather than individuals since they are based on the assumption that there is perfect income equality within each country - if all the countries of the world had identical per capita incomes, our global indices would indicate perfect equality for the world. We can readily apply the measurement methodology developed here to the analysis of income inequality in smaller geographical or other contexts.

A significant advantage of our indices is that the effect of any country on the index depends on the size of its population. That is, the per capita income of China matters much more than that of Namibia. Strictly speaking, convergence is a proposition about the pattern of growth rates across countries so relative populations should not be relevant. However, common sense alone suggests we should take them into consideration - China's catching up would lend much greater support to the convergence hypothesis than a similar performance by Namibia.

Finally, an interesting line of future research is to examine in greater detail the possible reasons for the apparent absence of international convergence. For example, let us accept the Solow model's implicit rationale for convergence - the flow of capital from rich countries to poor countries. Then one possible explanation is that those flows are limited to only a few developing countries which prosper while the others stagnate at best. Or, considering the large amount of capital flight from poor countries to rich countries, net flows from the latter to the former may be negative.

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