JOURNAL OF ECONOMIC DEVELOPMENT
Volume 22, Number 1, June 1997

An Examination of Global Income Convergence for 1960-1990

Donghyun Park*

In this paper, I examine the question of whether the poor countries have been catching up with the 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 index, fell significantly during 1970-1990. That is, the empirical evidence provides support for 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 important than the division of the pie. Recently, however, there has been growing interest in the area in both industrialized countries and developing ones.

There is a large literature on the effect of economic growth on income inequality. According to the inverted U hypothesis pioneered by the Nobel laureate Simon Kuznets, inequality rises at initial stages of economic growth and declines subsequently. Inequality rises at first because everybody is poor at first and the more able are better able to take advantage of the opportunities of a market economy than the less able. However, at a later stage, improved education, lower population growth and other factors lead to less inequality. Empirical support for the inverted U hypothesis has been weak at best. As Fields (1980) suggests, it is not economic growth per se but rather the type of economic growth which has an effect on inequality and the relationship between the two variables is much too complex to generalize.

Instead of exploring the relationship between economic growth and inequality, I analyze the trends in international income distribution over the past three decades in this paper. 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.

* Nanyang Business School, Nanyang Technological University, Singapore 639798.

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 rather 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 raters 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.

1. 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 paper, Mankiw, Romer and Weil (1992) (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.

2. 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 (1992) 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 the Gini coefficient and Theil index. Both measures satisfy all three desirable properties discussed above. We also 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. PWT's estimates of national income are based on purchasing power parity and hence are much more accurate than estimates based on nominal exchange rates. 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. Unfortunately, data limitations prevent us from extending our analysis beyond 1990.

We do not make use of income distribution within individual countries, which are only 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.

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

	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

VI. Empirical Evidence

We now report the principal trends in international income inequality for the period 1960-1990 implied by our data set.

1. 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 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.

Table 2 Shares of Global Income by Twenty Percentiles

	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

In Table 2, q1 refers to the share of global income accruing to the poorest fifth of the global population, as defined earlier, while q5 indicates the share of the richest fifth.

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

Table 3 Shares of Global Income by Ten Percentiles

	1960	1965	1970	1975	1980	1985	1990
q 1	0.022466	0.020068	0.019974	0.01942	0.018926	0.018151	0.016855
q 2	0.025628	0.022198	0.02298	0.02287	0.023522	0.026642	0.029173
q 3	0.026238	0.022844	0.023177	0.023218	0.025286	0.02833	0.30231
q 4	0.032281	0.028037	0.026207	0.024333	0.025922	0.032021	0.31386
q 5	0.034755	0.03	0.26908	0.026366	0.0273	0.032021	0.031424
q 6	0.47366	0.046047	0.043612	0.039202	0.040134	0.039977	0.039622
q 7	0.087679	0.084516	0.081255	0.088774	0.085921	0.07991	0.071706
q 8	0.117971	0.12562	0.134929	0.14988	0.148161	0.136303	0.128404
q 9	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

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

Table 4 Shares of Global Income by Five Percentiles

	1960	1965	1970	1975	1980	1985	1990
q 1	0.009562	0.008969	0.008484	0.007985	0.007194	0.006606	0.006152
q 2	0.012814	0.011099	0.01149	0.011435	0.011731	0.011545	0.010702
q 3	0.012814	0.011099	0.01149	0.011435	0.011761	0.013321	0.014191
q 4	0.012814	0.011099	0.01149	0.011435	0.011761	0.013321	0.014982
q 5	0.012814	0.011115	0.01149	0.011435	0.012325	0.013332	0.014982
q 6	0.013423	0.011728	0.011687	0.011783	0.012961	0.014998	0.015249
q 7	0.014969	0.013591	0.012968	0.012166	0.012961	0.016011	0.015693
q 8	0.017312	0.014446	0.01324	0.012166	0.012961	0.016011	0.015693
q 9	0.017312	0.144446	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	0.51517	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

In Table 4, the values of q2, q3, q4 and q5, as well as q8 and q9, are identical, reflecting the presence of China and India. Therefore, our data is less than completely adequate for analyzing global income convergence in the sense that the primary focus of income inequality is to track the changes in the income of the poor.

2. 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 and is shown for the 20% case in Figure 1. 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. A serious weakness of this index is that it fails to capture small changes in the lower left corner of the Lorenz curve.

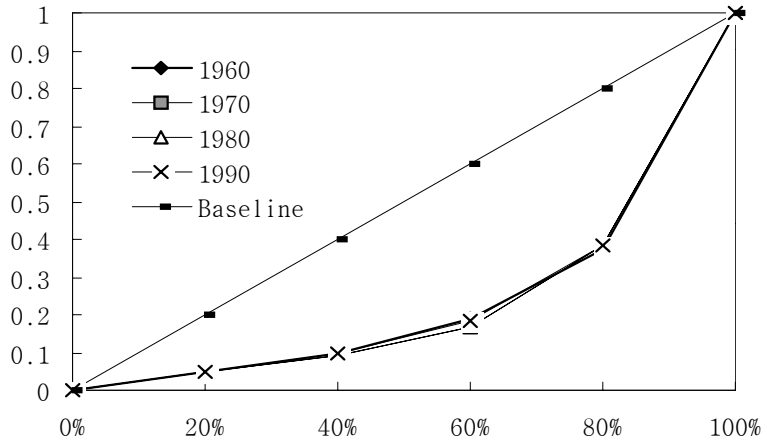

Figure 1 The Lorenz Curve for 20 Percentiles

The formula for the Gini coefficient is:

$$G = 1+\frac{1}{n}-\frac{2}{n^2\bar{y}}(y_n+2y_{n-1}+ny_1),$$

where y_i=income of i th person and $y_1 \leq y_2 \leq \cdots \leq y_n$.
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

$$G = 1+\frac{1}{n}-\frac{2}{n^2\bar{q}}(q_n+2q_{n-1}+nq_1),$$

where q_i=income of i th group and $q_1 \leq q_2 \leq \cdots \leq q_n$.
Making use of this, we obtain the below.

Table 5 Gini Coefficients for 1960-1990

	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

Regardless of the population share we use, the Gini coefficient exhibits the same pattern - a rise for 1960-70 and a fall for 1960-90. That is, convergence does appear to be taking place in the last two decades of our study.

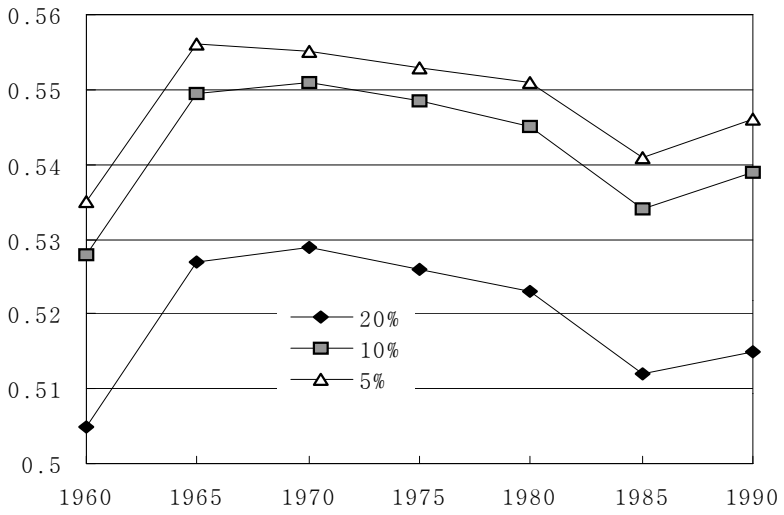

Figure 2 Gini Coefficient Trends, 1960-1990

3. 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

$$T = \sum_{i=1}^{n} (y_i / Y) \log \frac{(y_i / Y)}{(1/n)},$$

where $(1/n)$ 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

$$T = \sum_{i=1}^{n} q_i \log \frac{q_i}{(1/n)},$$

where $(1/n)$ 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. A major advantage of *T* is that it is useful for tracking the income changes of poor countries because, unlike the Gini coefficient, it is sensitive to relatively small income changes in those countries.

Table 6 Theil Entropy Index for 1960-1990

	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

The general patterns are the same as for the Gini coefficient in terms of both trends and changes between 1960 and 1990. Again, significant convergence appears to have occurred for the sub-period 1970-1990.

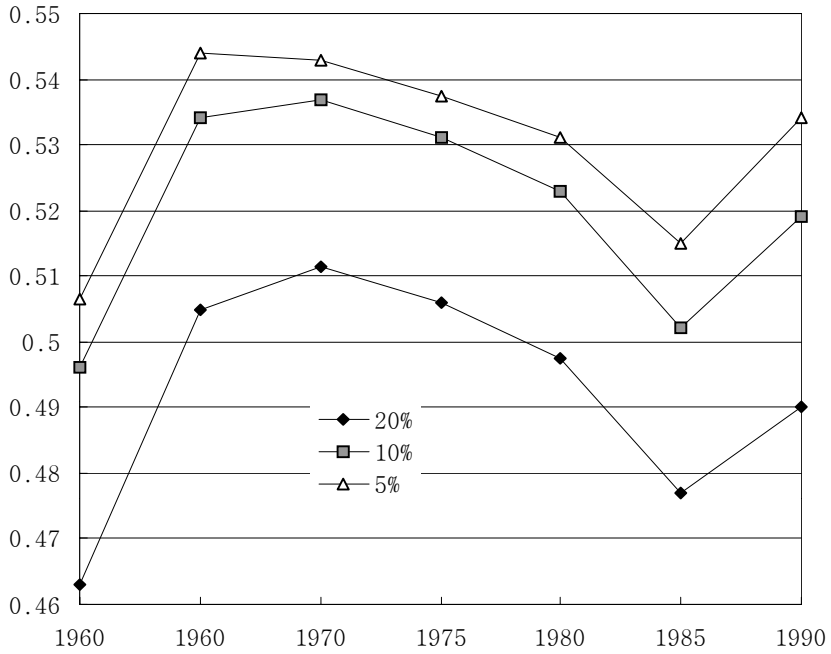

Figure 3 Trends in the Theil Entropy Index, 1960-1990

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 that international inequality did indeed improve, at least during the sub-period 1970-1990. The substantial reductions of both the Gini coefficient and the Theil index for all cases - 5%, 10% and 20% - provide empirical support for the convergence hypothesis. We should mention, however, that both inequality measures rose during the earlier subperiod 1960-1970. The overall pattern is therefore one of increasing global inequality followed by increasing global equality.

The most obvious interpretation of our central result is as follows - while the gap between developed countries and developing countries widened in the 1960s because only the former experienced significant economic growth, the same gap narrowed in the 1970s and 1980s as a number of developing countries began to take off economically. Yet during the same period many developing countries continued to perform poorly. Nevertheless, the impressive growth of the over-achievers, many of them East Asian countries, was more than enough to offset the unimpressive growth of underachievers such as th African countries. This explains why the gap between developing countries as a whole and developed countries has fallen over the period.

We expect even greater empirical support for the convergence hypothesis during the 1990s. In this connection, the recent economic resurgence of China will have a most noticeable impact simply due to the sheer size of its population. The recent improvement in India's economic performance, while less dramatic than that of China, will further promote international convergence. An interesting and meaningful line of future research would be to examine trends in convergence for the period 1990-1995 if and when the data for this period becomes available in the Penn World Tables. The rapid growth of populous Asian countries implies that the recent trend toward greater global equality will continue and persist not only for the remainder of this decade but well into the 21st century as well.

References

Atkinson, A.B., "On the Measurement of Inequality," *Journal of Economic Theory*, 2, 1970, 244-63.

Barro, R.J., "Economic Growth in a Cross-Section of Countries," *Quarterly Journal of Economics*, May, 1991, 407-444.

Barro, R.J., and X. Sala-i-Martin, "Convergence," *Journal of Political Economy*, 100 No. 2, 1992, 223-251.

_____, *Economic Growth*, manuscript, Harvard University, 1994.

Bartels, C.P.A., *Economic Aspects of Regional Welfare, Income Distribution and Unemployment*, Martinus Nijhoff, Leiden, 1977.

Blanchard, O.J., and L. Katz, "Regional Evolutions," *Brookings Papers on Economic Activity*, No. 1, 1992, 1-61.

Cass, D., "Optimum Growth in an Aggregative Model of Capital Accumulation," *Review of Economic Studies*, 32, 1965, 233-240.

Cowell, F.A., *Measuring Inequality*, John Wiley and Son, New York, 1977.

Feldstein, M., and C. Horioka, "Domestic Savings and International Capital Flows," *Economic Journal*, 90, 1980, 314-29.

Fields, G.S., *Poverty, Inequality and Development*, Cambridge University Press, Cambridge, 1980.

Handbook of the Nations, Gale Research, Detroit, various issues.

Koopmans, T., "On the Concept of Optimal Economic Growth," in *The Econometric Approach to Economic Planning*, North-Holland, Amsterdam, 1965.

Lucas, R., "On the Mechanics of Economic Development," *Journal of Monetary Economics*, 22, 1988, 3-42.

_____, "Why Doesn't Capital Flow from Rich to Poor Countries?" *American Economic Review*, Papers and Proceedings 80, 1990, 92-96.

Mankiw, N., D. Romer, and D.N. Weil, "A Contribution to the Empirics of Economic Growth," *Quarterly Journal of Economics*, May, 1992, 407-437.

Parente, S.L., and E.C. Prescott, "Changes in the Wealth of Nations," *Federal Reserve Bank of Minnesota Quarterly Review,* 17, 2, 1993, 3-16.

Ramsey, F., "A Mathematical Theory of Savings," *Economic Journal* 38, 1928, 543-559.

Rebelo, S., "Long-Run Policy analysis and Long-Run Growth," *Journal of Political Economy*, 99, 1991, 500-521.

Romer, P.M., "Increasing Returns and Long-Run Growth," *Journal of Political Economy*, 94, 1986, 1002-1037.

_____, "Capital Accumulation in the Theory of Long-Run Growth," in R. Barro(ed.), *Modern Business Cycle Theory*, Basil Blackwell, Oxford, 1989, 51-127.

Sala-i-Martin, X., "Lecture Notes on Economic Growth," *NBER Working Paper*, No. 3563, 1990a.

_____, "Lecture Notes on Economic Growth," *NBER Working Paper*, No. 3564, 1990b.

Sen, A.K., *On Economic Inequality*, Clarendon Press, Oxford, 1973.

Solow, R.M., "A Contribution to the Theory of Economic Growth," *Quarterly Journal of Economics* 70, 1956, 65-95.

_____, "Technical Change and the Aggregate Production Function," *Review of Economics and Statistics*, 39, 1957, 312-320.

Summers, R., and A. Heston, "The Penn World Table (Mark 5): An Expanded Set of International Comparisons, 1950-1988," *Quarterly Journal of Economics*, May, 1991, 327-368.
Theil, H., *Economics and Information Theory*, North Holland, Amsterdam, 1967.
The World Almanac and Book of Facts, Press Publishing Company, New York, various issues.
World Development Report, Oxford University Press, New York, various issues.