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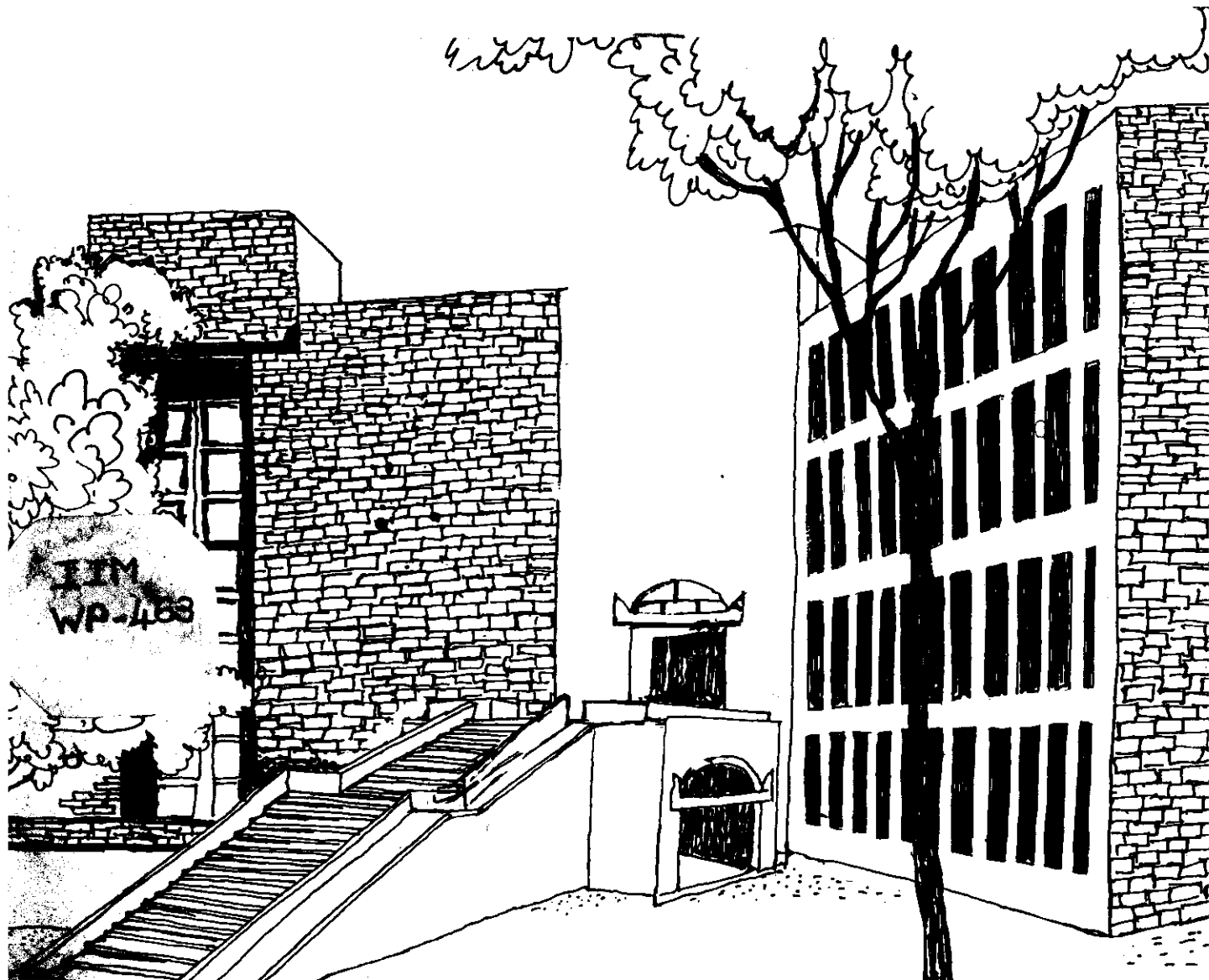
Working Paper

INCOME INEQUALITY ACROSS NATIONS
OVER TIME: HOW MUCH AND WHY?

By

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I. Introduction

The size distribution of income has been a matter of concern for

long, not only among the relatively poor group of people but also eco-

nomists, sociologist and politicians throughout the world. Yet, the

problem continues and the ways and means for alleviating it are not

known unambiguously. The present paper is an attempt to explore the
following:
   (a) measurement of the extent of income inequality across countries,

   (b) measurement of the change in income inequality over the last

       decade,

   (c) examination of the factors responsible for the income in-

       inequality, and

   (d) identification of the shape and position of the Kuznets' curve.

The above aspects of the problem have been studied by other re-

searchers, but the present work is significant in that it uses most

of the inequality measures simultaneously, examines the role of all

the theretically relevant determinants on the presence of income in-

equality, and uses the latest available cross country data. Besides,

the sample of countries studied here differs from the ones found in

the literature. Further, attempts have been hade here to identify

countries into three groups, viz., the low inequality, the medium

inequality and the high inequality group; and the movement of countries
from one group to another has been studied.

II. Income Inequality : Magnitude and Temporal Variation

Several measures of relative income inequality are found in the
literature. These could be grouped into three categories based on
(a) income shares of different percentile groups of population,(b) abso-
lute income of the various segments of the population, and (c) welfare
measures and the absolute income of the various segments of the
population.

The first group includes the measures based on the raw-data on
income shares, Gini coefficient, Theil index and Kuznets index. The
second group consists of the standard deviation of income, or of log
of income, coefficient of variation in income, and measures based on
arithmetic, geometric and harmonic measures of income. The last group
comprises of the Atkinson measure. Since none of these measures is a
perfect measure of inequality and each one of them has certain specific
merits, it is useful to use all these simultaneously to determine the
extent and the direction of change in inequality over time. Unfortunately,
data on income by individuals, households or percentile groups of popu-
lation are not published for most of these countries and so it is not
possible to use the second set of measures. The use of Atkinson mea-
sure necessitates the interpersonal comparison of utility from a given
income, which involves subjective decisions.

and hence is omitted from the measures attempted in this paper.

All the remaining measures are utilized in this study. In particular,
the income share of the bottom quintile of the population (hence forth
called share of the bottom 20%), income share of the top quintile of
population (hence forth called share of the top 20%), Gini co--
efficient, Theil index-I (based on income weights), Theil index-II
(based on population weights), and the Kuznets index have been used.
The methods of computation of these measures are available in the
literature, in particular in Champernowne (4), and Yotopoulos and
Nugent (13). The results on these measures for the 27 selected
countries for two time periods (one for the 1960s and the other
for the 1970s, as far as possible) are provided in Table 1. Incidentally,
it may be noted that the minimum value of each of these measures is
zero and the maximum value for all but Theil's two indices is unity
(for each of Theil's indices, the maximum value is $1.61(\log n^5)$.
Further, a value of zero for Gini coefficient, Theil I, Theil II, and
Kuznets index and of 0.20 fo each of bottom 20% and top 20% will. imply
perfect equality or zero inequality, while a value of zero or unity for
each of bottom 20% and top 20%, of unity for each of the Gini and
Kuznets index, and of 1.61 for each of the Theil's two indices, mean
perfect inequality in income distribution.

It is not necessary to comment on each measure for each country
and each time period. For the purpose of analysis, the mean (arithmetic)

values of each of these measures were obtained for each country group

and each time period and the same are reported in Table 2. Two signi-

ficant conclusions emerge from these results. First, as one would ex-

pect, income inequality is greater in developing(less developed)

countries (LDCs) than in developed countries (DCs). All the six mea-

sures yield consistent results on this count. Second, income inequality

has decreased over time. This is evident by 15 of the 18 comparative

numbers in Table 2. The bottom 20% and the Kuznets index measures are

the ones which yield mixed results in support of this observation.

A further look at the results in Table 2 reveals that the decrease

in inequality for all countries in the decade was the most at 6.8% by

Theil-I index and the least at 0.8% by the bottom 20% measure. For LDCs,

the decrease in inequality was the maximum at 12.9% by the bottom 20%

measure and the minimum at 1.0% by Theil-II measure. In DCs, the de-

cline was the most at 12.0% by the Theil-II index and the least at 3.5%

by the Kuznets index. Thus, it can be concluded that the fall in income

inequality in the last decade was not perceptible.

Yet another way of looking at the inequality would be to see as to

which countries are more seriously plagued by it than others, and which,

if any, has moved from one category to another during the last decade.

For this purpose, the results have been analyzed on the bases of two

indices only, viz the Gini coefficient and the Theil-II index. The

findings are presented in Table 3. In this Table, while classifying

the countries into low, medium and high inequality groups, the minimum and the maximum values of each measure in each period was used and the groups were formed by equal ranges, as indicated in the Table. As one would expect, the two measures do not always classify each country into the same group in any period. Thus, it is not possible to comment on each country with respect to the extent of and the change in inequality. However, some conclusions do emerge from a careful analysis. For example, it is apparent that countries such as Korea, Yogoslavia, the Netherlands, Sweden and U.K demonstrate comparatively low income inequality by both the measures for both the time periods. A further look at the inequality measures for these countries reveals that inequality was the lowest in Korea in the first period and in the Netherlands in the second period. In contrast, the income inequality was relatively high in Mexico and Brazil, the former having the highest inequality in the first period and the latter in the second period. Argentina always fell in the medium category in this respect. Nothing unambiguously can be said about any other country. The findings of Table 3 also suggest that the comparative inequality has increased in Panama for sure, and it seems to have reduced over time in the case of Cost Rica, Sri Lanka, Taiwan, Tanzania, France, Italy and U.S.A. No definite inference about the change in relative inequality can be drawn about the other countries.

III. Determinents of Income Inequality: The Model

On the basis of economic theory and the literature on the subject, the following model was hypothesized:

$$I = \beta_0 + \beta_1 \log Y + \beta_2 (\log Y)^2 + \beta_3 E + \beta_4 A + \beta_5 L + \beta_6 W + \beta_7 U +$$
$$\beta_8 G + \beta_9 P + \beta_{10} Z + \beta_{11} D$$
$$\beta_1, \beta_4, \beta_5, \beta_6, \beta_9 > 0 > \beta_2, \beta_3, \beta_7, \beta_8, \beta_{10}, \beta_{11} \quad \cdots \quad (1)$$

Where I = measure of income inequality (fraction); Y = per capita income (US$); E = literacy rate (%); A = share of agricultural income in GNP (%); L = share of agriculture labour force in total labor force (%); W = share of foreign trade (export + import) in GNP (%); U = urbanization rate (%); G = share of government general consumption (excluding defense expenditures) in GNP (%); P = growth rate in population (%); Z = growth rate in income (%) and D = dummy variable, which takes a value of 1 for developed countries and zero for less developed countries.

Most of these variables have been used in previous studies but not simultaneously by any single researcher. Their detail rationalization is thus not warranted. Suffice it to point out here that the (natural) log Y and its square are in accordance with the Kuznets' hypothesis (7) of the inverted U-shape of the curve between inequality and the level of per capita income (a measure of the stage of development). The variables E, A, L, W and U are the duality variables, one or more of these have been used by several scholars (2-10). Perhaps, the share of foreign trade in GNP (W) is the variable, which does not appear in any

previous work known to the authors. It is hypothesized that an increase in W would tend to increase the inequality, for the foreign trade is expected to bring about more benefits to the rich than to the poor. An increase in the share of government general expenditure in total GNP (G), termed as a socialist variable, is expected to cause greater benefit, to the poor than to the rich sections of the society. Unfortunately, the data reveal that the family size is greater in poor families than in rich families and hence it is expected that an increase in the growth rate of population tends to be a disequalizer. Quite the reverse is true with respect to the income growth, which has accrued more among rich families than the poor families and hence an increase in it is postulated to be an equalizer. The last variable, i.e., the dummy, is expected to enter with a negative coefficient, for the evidence suggests that the inequality is generally more in the less developed countries than in the developed countries.

IV. The Data, Estimation and the Results

The data on the size distribution of income are based on the households income in the country (urban + rural) after tax and are drawn from the World Bank publications, including Jain (6). The per capita income data were taken from United Nations' Statistical Year Book, 1979. The data on all other variables came from the World Bank publication, World Tables. In collecting the data, the maximum effort was made to use the corresponding period data only; however, when this was not at all possible,

the data of the closest possible period were collected and utilized in empirical work. The sample size (i.e., the number of countries included in the study) was dictated primarily by the availability of the comparable data. Again, efforts were made to use data for each country in such a way that the first period data came from the 1960s, while the data for the second period, from the 1970s with a ten-year gap between the two observations for each country. However, data constraints has compelled us to make certain compromises in this respect as well.

The model of equation 1 was estimated by the ordinary least squares (OLS) method under its many alternative specifications. The functional form used was, of course, the same in all cases, but all the six measures of inequality were used one after the other and each with several alternative combinations of the explanatory variables. The equations selected on the basis of the a priori signs for the coefficients and the statistical measures (such as t-values, R^2, $\bar{R}^2$, and simple correlation coefficients) are reported in Table 4.

Commenting on the findings on the measures of income inequality first, it was found that the better regression fits were obtained for the Theil index II than for any other measure. For the lack of space, the results for various measures are not presented here. Only slightly inferior results were obtained with the use of Theil - I or Gini coefficient. The explanatory variables A, J, U and O always secured insignificant and often wrongly signed coefficients. For these reasons, the results in Table 4 have the Theil index-II as the dependent variable

and none of the four explanatory variables just mentioned.

All the regression coefficients in Table 4 have a priori signs. As expected, the proportion of government expenditure in GNP acts as an equalizer, and so does the literacy rate. However, neither of the coefficients of these two causal variables is significantly different from zero at the 5% significance level. The t-value for the coefficient of G ranges between 0.4 and 1.17 while that of E between 0.89 and 1.45. The rate of growth of population and the proportion of total labor force employed in agriculture turned out, as predicted, disequalizing factors in income inequality. Further, the population growth variable is a significant determinant of income inequality, and the t-values of the coefficients of labor force variable, though not significant at any reasonable level, are not too low. The coefficient of log Y and $(\log Y)^2$ support the Kuznets' hypothesis of the inverted U-shaped relationship. The values of various R^2s and F-statistics are low but are comparable, if not more, with those found in the literature. The regression fits are better for the second period than the first period.

It will be interesting to evaluate the turning point of the Kuznets curve. For this purpose, we took the partial derivative of each estimated equation with respect to Y and set that equal to zero. The solution of the so obtained equation yielded the value of the per capita income at which the inequality level was at its peak; the sign of the second partial derivative with respect to Y was checked and it was found to be negative

in all cases. The per capita income at which the inequality took its maximum value was $7,535 for all countries in the first period. The corresponding figures for the second period was $12,582. These figures for per capita income are quite high as compared to Ahluwalia's (1) findings in the range of $1,108 and $1,605. The reason for differences in the two findings must be due to the differences in the sample of countries used, the sample year, and the list of the explanatory variables. Further, the turning point values are greater than the maximum per capita income in the sample countries, which stood at $4,107 (Sweden) in the first period, and $10,543 (Sweden) during the second period. Thus, our findings on the shape of the Kuznets' curve indicate that all the countries in the sample are still operating on the left part of the turning point of the inverted U-shaped curve. This, is turn, implies that, in fact, there has been a conflict between equity and growth.

V.   Conclusions

Income equality varies widely among countries in the world. Countries with comparatively low income inequality are Korea, the Netherlands, Sweden, U.K. and Yugoslavia. Brazil and Mexico have witnessed rather high degree of income inequality. It is moderate in Argentina. Nothing unambiguously can be stated about the other countries in our sample of 27 countries.

In the last decade, the inequality has increased unambiguously in Panama and decreased, at least in comparison to other countries in the

sample, in countries like Costa Rica, France, Italy, Sri Lanka, Taiwan, Tanzania and U.S.A. Nothing conclusive emerges with respect to other countries in the sample.

The findings support the Kuznets' hypothesis of the inverted U-shaped curve between the income inequality and the per capita income. However, it is found that the turning point of this curve is rather at a high level of per capita income and accordingly, all countries in the sample are yet operating to the left side of the turning point. Thus, the evidence from the 27 smaple countries suggests that there is a trade-off between equality and growth. However, we refrain from making any strong generalization on this rather debatable issue.

Other than the per capita income, the government expenditure as a percentage of GNP, the population growth rate, the labor force in agriculture as proportion to total labor force, the literacy rate and the growth rate in GNP are found to be the determinants of income inequality. As per received theory and the general findings reported by other researchers, the government expenditure, the literacy rate and the growth rate in GNP are found to be equalizers, while the growth rate in population and the proportion of labor force in agriculture have the disequalizing effect on the economy.

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Table 1: Inequality Measures by Country

Country	Year	Income Share of Low 20%/Top 20% Population		Gini Coefficient	Indices Theil-I Theil-II		

A. Developing Countries

	Country	Year	Low 20%	Top 20%	Gini Coeff.	Theil-I	Theil-II	
1.	Argentina	1961	.069	.509	.3930	.2698	.2605	.3862
		1970	.044	.503	.4144	.2934	.3185	.3975
2.	Brazil	1960	.035	.621	.5092	.4738	.4965	.5262
		1970	.028	.673	.5572	.5806	.6255	.5912
3.	Costa Rica	1961	.057	.586	.4648	.3963	.3872	.4825
		1971	.033	.548	.4568	.3652	.4078	.4350
4.	Hong Kong	1971	.056	.490	.3916	.2618	.2704	.3762
		1980	.054	.470	.3760	.2392	.2537	.3575
5.	India	1964	.067	.489	.3740	.2443	.2400	.3675
		1975	.070	.494	.3844	.2562	.2523	.3737
6.	Korea	1966	.094	.358	.2488	.1000	.1024	.2375
		1976	.057	.453	.3616	.2190	.2331	.3462
7.	Malaysia	1970	.033	.565	.4792	.4005	.4462	.4650
		1973	.035	.561	.4712	.3879	.4258.	.4550
8.	Mexico	1969	.042	.632	.5156	.4907	.5012	.5400
		1977	.029	.577	.4920	.4246	.4825	.4762
9.	Pakistan	1963	.064	.453	.3536	.2103	.2168	.3375
		1971	.084	.415	.3036	.1539	.1528	.2925
10.	Panama	1962	.064	.427	.3324	.1836	.1945	.3150
		1970	.020	.618	.5376	.5153	.6239	.5225
11.	Phillipines	1961	.048	.559	.4548	.3655	.3739	.4487
		1970	.052	.540	.4304	.3276	.3300	.4250
12.	SriLanka	1963	.045	.521	.4260	.3135	.3329	.4075
		1969	.075	.434	.3272	.1796	.1805	.3137
13.	Taiwan	1961	.044	.518	.4264	.3127	.3354	.4087
		1971	.087	.392	.2804	.1299	.1305	.2687
14.	Tanzania	1964	.048	.614	.4824	.4294	.4278	.0515
		1969	.058	.504	.3948	.2718	.2732	.3800

Table 1 Cont'd

Country	Year	Income Share of		Gini coefficient	Indices		
		Low 20% Population	Top 20%		Theil-I	Theil-II	Kuznets
15. Turkey	1968	.029	.606	.5116	.4672	.5191	.5075
	1973	.035	.565	.4700	.3888	.4232	.4567
16. Yugoslavia	1968	.066	.414	.3252	.1736	.1856	.3112
	1978	.066	.387	.3040	.1515	.1680	.2825
17. Venezuela	1962	.033	.595	.5012	.4431	.4890	.4900
	1970	.030	.540	.4700	.3792	.4438	.4600
B. Developed Countries :							
18. Canada	1969	.050	.410	.3380	.1902	.2225	.3162
	1977	.038	.420	.3652	.2249	.2817	.3450
19. France	1962	.023	.547	.4764	.3938	.4848	.4587
	1975	.053	.458	.3668	.2268	.2450	.3450
20. Germany	1968	.062	.450	.3592	.2146	.2251	.3475
	1974	.069	.448	.3468	.2017	.2052	.3337
21. Italy	1969	.051	.465	.3760	.2385	.2592	.3525
	1977	.062	.439	.3472	.2003	.2117	.3325
22. Japan	1962	.056	.445	.3564	.2120	.2290	.3387
	1971	.038	.463	.3872	.2547	.3010	.3626
23. Netherlands	1967	.065	.428	.3346	.1873	.1955	.3194
	1977	.081	.370	.2696	.1183	.1250	.2537
24. Spain	1964	.060	.455	.3644	.2215	.2331	.3512
	1974	.060	.422	.3348	.1854	.2018	.3787
25. Sweden	1972	.066	.370	.2900	.1379	.1559	.2725
	1979	.072	.372	.2904	.1366	.1495	.2825
26. U.K.	1973	.063	.388	.3052	.1534	.1720	.2837
	1979	.073	.392	.2992	.1461	.1556	.2825
27. U.S.A.	1960	.046	.430	.3568	.2167	.2478	.3387
	1972	.045	.428	.3624	.2186	.2581	.3437

Table 2: Inequality Measures (Mean) by Country Group

Country Group	Income Share of		Gini coefficient	Theil-I	Theil-II	Kuznets
	Low 20%	Top 20%			Indices	
	Population					
A. All Countries						
a. First Period	.0532	.4943	.3980	.2853	.3039	.3718
b. Second Period	.0536	.4773	.3852	.2658	.2911	.3738
B. Developing Countries						
a. First Period	.0526	.5269	.4229	.3257	.3400	.3917
b. Second Period	.0594	.5102	.4136	.3096	.3368	.4020
C. Developed Countries						
a. First Period	.0542	.4388	.3557	.2166	.2425	.3379
b. Second Period	.0591	.4212	.3370	.1913	.2185	.3260

Table 3: Magnitude of Inequality

Inequality Measure	Low	Medium	High
(1) Gini Coefficient (a) First Period (Min value = 0.25) (max value = 0.52)	<u>0.25 - 0.34</u> 6, 10, 16, 18, 23, 25, 26	<u>0.35 - .43</u> 1, 4, 5, 9, 12, 13, 20, 21, 22, 24, 27	<u>0.44-.52</u> 2, 3, 7, 8, 11, 14, 15, 17, 19
(b) Second Period (min value = 0.27) (max value = 0.56)	<u>0.27 - .36</u> 6, 9, 12, 13, 16 20, 21, 23, 24, 25, 26, 27	<u>0.37 - .46</u> 1, 3, 4, 5, 11, 14, 18, 19, 22	<u>0.47 - .56</u> 2, 7, 8, 10, 15, 17
(2) Theil Index - II (a) First Period (Min value = 0.10) (Max value = 0.52)	<u>0.10 - .24</u> 5, 6, 9, 10, 16, 18, 20, 22, 23, 24, 25, 26	<u>0.25 - .38</u> 1, 4, 11, 12, 13, 21, 27	<u>0.39 - .52</u> 2, 3, 7, 8, 14, 15, 17, 19
(b) Second Period (Min value = 0.12) (Max value = 0.63)	<u>0.12 - .29</u> 4, 5, 6, 9, 12, 13, 14, 16, 18, 19, 20, 21, 23, 24, 25, 26, 27	<u>0.30 - .46</u> 1, 3, 7, 11, 15, 17, 22	<u>0.47 - .63</u> 2, 8, 10

The integers in the table refer to country numbers in Table 1.

Table 4:   Income Inequalities Across Nations

Dep. Variable: Theil-II Index

Independent Variable	First Period		Second Period	
	All Countries	LDCs	All Countries	LDCs
Constant	-1.120 (1.40)	-0.424 (0.19)	-1.403 (2.06)	-2.094 (2.02)
Log Y	0.375 (1.47)	0.128 (0.15)	0.340 (1.73)	0.872 (1.76)
$(\log Y)^2$	-0.021 (1.10)	-0.002 (0.02)	-0.018 (1.23)	-0.059 (1.51)
G	-0.007 (0.97)	-0.004 (0.40)	-0.005 (0.85)	-0.013 (1.17)
P	0.048 (1.66)	0.073 (1.64)	0.130 (3.36)	0.129 (2.56)
L	0.003 (1.14)	0.002 (0.60)	0.002 (1.19)	0.004 (1.42)
E	-0.003 (1.45)	-0.002 (0.89)		
Z			-0.008 (0.76)	-0.014 (0.81)
R	0.426	0.399	0.634	0.648
R^2	0.254	0.038	0.524	0.437
F (D.F)	2.47 (6,20)	1.11 (6,10)	5.78 (6,20)	3.07 (6,10)

Numbers in parentheses are t-values.