Economic Growth and Poverty: In Search of Trickle-Down

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It seems obvious that economic growth should reduce poverty, yet the issue remains controversial. Some scholars assert that economic growth does not eliminate poverty and may exacerbate the problems of the poor (United Nations 1997). For example, Dreze and Sen (1990) claim that economic growth does not generate benefits in terms of numerous nonpecuniary measures of well-being. Calls for increased government spending (Squires 1993) or other redistributions of wealth (Todaro 1997) are the logical extension of the argument that growth does not ensure the elimination of poverty.

Todaro (1997) labels the contention that growth actually reduces poverty as the "trickle-down theory." In the less than idealized state of affairs, there is not even a "trickle" downward. Simply put, general economic progress does not "improve the levels of the very poor" (Todaro 1997: 155). In fact, some development economists contend that the "growth processes" typically "trickle-up" to the middle classes and "especially the very rich" (Todaro 1997: 163).

A largely unexamined issue is the impact of the relative wealth of the rich and poor on the level of well-being. There is a substantial literature that asserts that improving the incomes of the poor has a greater effect on the average level of well-being in a country than on improving the incomes of the rich (Todaro 1997). That proposition, however, has not been exhaustively examined, and more careful analysis constitutes an important research agenda.

Wealth Distribution and Poverty

The first question regarding the relationship between the rich and the poor can be examined by estimating the relation of the incomes

Cato Journal, Vol. 22, No. 2 (Fall 2002).

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of the poor and rich to each other. For example, we can estimate the following equations:

$$Y_{ip} = \alpha + \beta_r Y_{ir} + \tilde{\varepsilon}_i \quad (1)$$

$$Y_{ir} = \alpha + \beta_p Y_{ip} + \tilde{\varepsilon}_i, \quad (2)$$

where Y_p and Y_r represent the per capita incomes of the poor and rich, respectively, and β_p and β_r represent "class income transfer" coefficients. The βs show the proportionate increase in one group's per capita GDP as a function of the other group's per capita GDP. For example, β_r represents the change in the income of the poor attributable to the change in the income of the rich. If trickle-down is true, β_r should be positive. If trickle-up is true, the coefficient should be negative.

In estimating equations 1 and 2, there is the potential problem of additional variables that conceivably also affect incomes. Variables that are important are examined in Barro and Sala-I-Martin (1995), and include human capital, institutions, and other variables. Presumably, those influences are reflected in the income of the other class. Thus, the only required additional variables would be variables often omitted in cross-national growth equations. The most conspicuous variables are geographic. Many of the poor countries of the world are located in tropical environments and are landlocked. Sachs (1997), Sachs and Warner (1997), and Sowell (1994) argue that these factors are especially debilitating for human well-being. Landlocked countries are often isolated from commercial practices, ideas and innovations, and market enhancing institutions. Tropical countries frequently experience diseases, lack of sanitation, and famine. Those conditions threaten the inhabitants' survival, adversely affect incomes, and perpetuate poverty. Finally, Lucas (1988) argues that urban economies entail higher productivity than rural economies because of externalities attributable to more productive human capital.

The second question regarding trickle-down is more direct and entails the relationship between poverty and the relative incomes of the poor and rich. Consider a simple model of the average level of human poverty (HP) in a country:

$$HP_i = \alpha + \beta_p Y_{ip} + \tilde{\varepsilon}_i \quad (3)$$

$$HP_i = \alpha + \beta_r Y_{ir} + \tilde{\varepsilon}_i \quad (4)$$

The βs represent the sensitivity of poverty to income, and p and r represent poor and rich, respectively. Presumably, increasing the wealth of the inhabitants of a country should reduce poverty unless

one presumes a Marxist view that the incomes of the poor are reduced by the gains to the rich—the "trickle-up" arguments of some development economists. In such a world, redistributive policies or policies that enhance the "quality of growth" rather than just growth are preferred because such policies would reduce the average level of poverty in a country.

Despite the assertions of Marxists, there are simple reasons to presume that β_r might exceed β_p. Consider externalities. If the rich inhabitants of a country invest in some infrastructure that helps the rich, it might also help the poor as the effects of infrastructure "spill-over" as benefits to the poor. Investment in education, for example, is widely perceived to produce positive externalities to the community.

Consider also the interaction between the incomes of the rich, economies of scale, and the incomes of the poor. If there are economies of scale in the provision of various services (e.g., health services and sanitation), then the increases in demand associated with higher incomes of the rich would generate a lower price and therefore permit poor people to consume more (increasing their real income), provided the scale economies did not also lead to a higher price due to diminished competition.

Consider the relative consumption versus investment of the rich and poor. Suppose the poor spend most of their income on subsistence consumption, while the rich invest a greater part of their income. Under those circumstances, increasing the incomes of the rich would lead to higher economic growth and could also reduce the average level of poverty in a country.

Empirical Evidence

To examine the relationship between the incomes of the rich and poor, we can estimate equations 1 and 2 for a sample of countries in the United Nations *Human Development Report* (1997) for which the Human Poverty Index (HPI) is calculated and reported. There are 78 countries with the measure. However, missing entries for the rich and poor income categories reduce the sample that is estimated.

The estimation is a simple regression and a regression including the proportion of the population that is urban, the proportion of a country's area that is tropical, and a categorical variable for landlocked countries. The rich are defined as the top 20 percent of the income distribution and the poor are defined as the bottom 20 percent of the income distribution. The estimates are in natural logarithms. The regression results are reported in Table 1.

The data in Table 1 show that a one dollar increase in the incomes

TABLE 1

INCOMES OF THE RICH AND POOR: REGRESSION RESULTS

Independent Variables	Dependent Variables			
	Poor	Poor	Rich	Rich
Constant	–0.20	0.66	3.77	5.17
	(–0.23)	(0.52)	(6.13)	(6.78)
Rich	0.76	0.71		
	(7.83)	(4.38)		
Poor			0.76	0.41
			(8.17)	(3.18)
Landlocked		–0.03		–0.17
		(–0.11)		(–1.05)
Tropics		–0.48		0.15
		(–3.13)		(1.15)
Urban		0.06		2.21
		(–0.08)		(4.90)
Adj. R^2	0.573	0.593	0.573	0.767
S.E.R.	0.521	0.509	0.521	0.386
F statistic	61.46	17.37	61.46	37.73
N	46	46	46	46

NOTE: t-statistics are in parentheses.
SOURCE: United Nations (1997).

of the rich is associated with about a 75-cent increase in the incomes of the poor, and the relationship is symmetric. However, when additional variables are included in the estimates, it is clear that the incomes of the rich and poor are differently affected. For example, the proportion of a country's land and water that is tropical has a strong negative effect on the incomes of the poor but not on the rich, while the proportion of the population that lives in urban areas seems to have a strong positive effect on the incomes of the rich but not on the poor. Increases in the incomes of the rich are strongly associated with increases in the incomes of the poor, even when the geographic variables are included. A one dollar increase in the incomes of the rich increases the incomes of the poor by 71 cents. In contrast, adding geographic variables, with the incomes of the poor as the independent variable, shows that the incomes of the rich are much less sensitive to the incomes of the poor. A one dollar increase in the incomes of the poor would only increase the incomes of the rich by 41 cents. There is a trickle-up in the limited sense that increasing the incomes of the poor increases the incomes of the rich, but the effect of increasing the

incomes of the rich has an even greater positive effect on increasing the incomes of the poor.

In reality, separate estimates of the incomes of the rich and poor, as functions of the other class are nonsensical. The incomes of all classes are jointly determined. However, the essence of the trickle-up story and the normal connotation of the trickle-down term is that there are barriers to joint determination of the incomes of the rich and poor and hence the poor do not benefit from increases in the incomes of the rich. However, even taking the trickle-down assumption of separate income determinants for different income classes at face value, the data do not support either a strong trickle-up or a weak trickle-down.

To examine the impact of the incomes of the rich and poor on measures of poverty, we can estimate equations 3 and 4 and include the effects of geographic variables. An important consideration is how to measure human poverty. One convenient and apparently authoritative measure of human poverty is the HPI developed by the United Nations.

The HPI builds on Sen's (1997) notion of poverty as human deprivation. The United Nations *Human Development Report* explicitly recognizes this "deprivational perspective." The measure attempts to quantify the well-being of the "the most deprived people in the community." The measure was designed both as a tool for advocacy on behalf of the world's poor and as a planning tool to identify areas in need of specific antipoverty policies.

The HPI is constructed using a complex set of formulas. The components include three basic measures of well-being: longevity, knowledge, and a decent living standard. Longevity is measured by the proportion of people in a country not expected to survive to the age 40. Knowledge is measured by the proportion of adults who are illiterate and therefore excluded from the world of reading and written communication. The proportion of the community without a decent living standard is measured as that proportion without access to safe water and health services, and the percentage of malnourished children (underweight) under the age of five.

There is no doubt room to debate whether some other measures of deprivation might not constitute a better measure of poverty. However, it is difficult to imagine that most observers would not agree with the view that these measures do in fact measure diminished human well-being and therefore constitute a valid measure to compare human deprivation.

Given these considerations, it is straightforward to estimate equations 3 and 4 using the HPI as the dependent variable and adding

TABLE 2

INCOMES OF POOR AND RICH AS DETERMINANTS OF HUMAN POVERTY: REGRESSION RESULTS

Independent Variable	Dependent Variables	
	Poor	Rich
Constant	3.08	7.08
	(3.33)	(6.08)
Poor	–0.47	
	(–3.31)	
Rich		–0.91
		(–6.16)
Landlocked	–0.08	–0.20
	(–0.08)	(–1.18)
Tropics	–0.50	–0.29
	(–1.59)	(–1.14)
Urban	–1.80	0.04
	(–3.03)	(0.06)
Adj. R^2	0.498	0.639
S.E.R.	0.579	0.491
F-statistic	12.17	20.92
N	46	46

NOTE: t-statistics are in parentheses.

measures for the proportion of a country that is tropical and the proportion that is urban as well as a categorical variable equal to one if a country is landlocked and equal to zero otherwise.

A direct test of the poverty/income nexus is obtained by estimating the HPI on the incomes of the poor and rich as well as the other variables that are presumed to affect the poverty level in a country. The results of the estimated regressions are shown in Table 2. The data show that the poverty index is negatively related to the incomes of both the poor and the rich. In both cases the effects are palpable and certainly statistically robust. However, the results are much more so for the incomes of the rich versus the poor. The coefficient for the incomes of the rich is nearly double that for the incomes of the poor. Similarly, the explanatory power (adjusted R^2) is greater for the estimate that includes the rich segment's income as an independent variable compared to the estimate that includes the poor segment's income as an independent variable.

One difficulty with the results reported in Table 2 is that the interpretation of the magnitude of effects is difficult. To obtain more readily interpretable results, the components of the HPI are esti-

mated as dependent variables with same independent variables. The dependent variables are the proportion of the economy not surviving to age 40, the proportion of the adult population that is illiterate, the proportion without access to safe water, the proportion of the population without access to health services, and the proportion of undernourished children. The results of those estimates are shown in Table 3.[1]

The pattern that emerges in Table 3 is that the components of the HPI are mostly negatively related to the incomes of the poor and the incomes of the rich, as well as to the geographic variables. Consequently, higher income to either group tends to reduce poverty rates.

The most salient feature in Table 3 is the fact that the coefficients for the rich incomes have a stronger effect on poverty reduction than the coefficients for the poor incomes. That observation is true for all cases. Restricted coefficient estimates (Wald's) tests reveal that the coefficients for the rich income category are (absolutely) greater than the coefficients for the poor income category for survival, illiteracy, and undernourished children. The significance tests for access to safe water and access to health services indicate that while those measures are more sensitive to the incomes of the rich than to those of the poor, the differences are not statistically significant. More generally and more importantly, there is no evidence that the income gains to the rich do not benefit the poor, at least as evidenced by broad and well-established measures of poverty.

The results for undernourished children merit special attention. The coefficient for the rich incomes is negative and significant, indicating that an increase of rich people's incomes reduces this measure of children's malnutrition. The coefficient for poor peoples' incomes is slightly positive but not significant. Presumably, the estimate reflects multicollinearity. Regressing the undernourishment variable on just the incomes of the poor does lead to a reduction in the proportion of undernourished children. However, the comparable simple regression estimate for the incomes of the rich is still substantially greater.[2] Thus, the easiest interpretation is that the relationship between the incomes of the rich and undernourished children is negative and robust, but the relationship between the incomes of the poor and reduced children's malnutrition is weaker and perhaps nonexistent.

It seems clear from our data that increasing the incomes of the rich results in a greater decrease in human deprivation than increasing the incomes of the poor. Another interpretation is that the measurement

[1]The log-odds transformation is used. The number 1 is added to the dependent variable for the safe water and health service variables to avoid taking the log of zero.

[2]The coefficient for poor income is –.46 and the coefficient for rich income is –.82.

TABLE 3

Incomes of Rich and Poor as Determinants of Human Poverty Measures: Regression Results

Dependent Variable	Constant	Independent Variables					Adj. R^2	S.E.R.	F	N
		Poor	Rich	Landlocked	Tropics	Urban				
Death by 40	2.67	–0.56		0.41	–0.30	–1.42	0.669	0.483	23.76	46
	(3.65)	(–5.05)		(2.19)	(–1.36)	(–3.33)				
F = 5.79 (p = .021)	5.52		–0.83	0.33	–0.05	–0.025	0.71	0.452	28.6	46
	(5.62)		(–6.49)	(2.29)	(–0.29)	(–0.05)				
Illiteracy	4.91	–0.67		–0.70	–1.18	–1.67	0.324	0.957	6.41	46
	(3.25)	(–2.96)		(–0.17)	(–2.55)	(–1.66)				
F = 3.75 (p = .059)	9.17		–1.10	–0.19	–0.89	0.36	0.394	0.907	8.31	46
	(4.30)		(–4.11)	(–0.19)	(–2.32)	(0.35)				
Safe Water	4.27	–0.73		0.22	–0.09	–1.39	0.413	0.908	8.94	46
	(2.82)	(–3.08)		(0.65)	(–0.19)	(–1.41)				
F = 0.29 (p = .590)	6.31		–0.86	0.16	0.25	–0.25	0.384	0.931	8.00	46
	(3.17)		(–3.70)	(0.49)	(0.56)	(–0.23)				
Access to Health	4.06	–0.85		–0.23	0.57	–0.71	0.403	0.976	8.60	46
Services	(3.02)	(–4.21)		(–0.57)	(1.28)	(–0.76)				
F = 2.34 (p = .133)	7.64		–1.16	–0.33	0.96	1.12	0.413	0.967	8.93	46
	(3.41)		(–4.23)	(–0.97)	(2.09)	(0.90)				
Undernourished	–1.51	0.16		–0.20	0.58	–3.47	0.460	0.702	10.60	46
Children	(–1.26)	(0.92)		(–0.87)	(1.70)	(–4.43)				
F = 14.64 (p = .000)	3.18		–0.50	–0.36	0.48	–1.61	0.508	0.670	12.64	46
	(1.65)		(–2.12)	(–1.62)	(1.66)	(–1.74)				

Notes: The F-statistic in column one is the test that the coefficient for the incomes of the poor equals the coefficient for the incomes of the rich; t-statistics are in parentheses.

error for the incomes of the poor is greater than the measurement error for the incomes of the rich. There is a host of measurement problems related to income and human well-being in the lower income countries of the world. The problems of measurement are presumed to be more acute for rural residents.[3] Accordingly, it is possible to argue that the weaker relationship between the incomes of the poor versus those of the rich in remedying human poverty is attributable to the difficulty of measuring the true income of the world's poorest peoples. However, that argument itself has some weakness because to the extent the problem is attributable to urban-rural cleavages, the urban variable in the estimates should account for that fact.

The more relevant issue is the role of economic growth in reducing poverty. The trickle-up contention and the jaundiced view of trickle-down—the trickle is just a small trickle—rest strongly on the contention that it is the "quality of growth" and the redistribution of the benefits of growth, not growth itself, that leads to the elimination of poverty. The results documented in Tables 2 and 3 challenge that assertion. For example, suppose the poor countries of the world experienced average economic growth of 5 percent per annum. After 5 years, the compounded income would result in an increase of about 27.62 percent. Ignoring the effect of the other income group, the impact of the rich stratum's income growth would decrease the death rate ("Death by 40") by about 3.76 percent, whereas an increase in the income of the poor stratum would reduce the death rate by about 2.55 percent.[4] Thus, in the *ceteris paribus* sense, the poverty reduction by growth of the richest class's income would generate a greater effect than the poverty reduction attributable to the growth of poor class's income. However, incomes of the rich and poor do not grow in a *ceteris paribus* sense. The incomes of the rich and the poor actually grow together as Table 1 clearly documents. More importantly, the data show that poverty falls as the rich get richer. Thus, economic growth should enhance the well-being of the poor as well as the rich.

We can directly examine the role of economic growth in ameliorating poverty as measured by the HPI. Table 4 contains regression estimates of the impact of economic growth, as measured by the percentage growth rates in per capita GDP for various time periods, on the HPI. For control purposes, the initial per capita GDP levels

[3]The question of measurement error in incomes of the poor nations of the world is discussed by Usher (1968,1978).

[4]The calculation is based on the mean of the sample "Death by 40" measures. See Gujarati (1995) for the calculation procedure.

TABLE 4

GDP, GROWTH, AND THE HUMAN POVERTY INDEX: REGRESSION RESULTS

Independent Variable	Dependent Variable: Human Poverty Index				
	1985–90	1980–90	1975–90	1970–90	1965–90
Constant	2.16	2.40	2.29	2.75	2.71
	(3.09)	(3.47)	(3.19)	(2.86)	(2.76)
Landlocked	0.01	0.04	0.10	0.09	0.06
	(0.07)	(0.29)	(0.64)	(0.63)	(0.40)
Tropics	–0.07	–0.22	–0.21	–0.28	–0.24
	(–0.39)	(–1.19)	(–1.11)	(–1.31)	(–1.09)
Urban	–1.48	–1.49	–0.01	–0.01	–0.01
	(–2.45)	(–2.17)	(–1.86)	(–1.22)	(–1.19)
Initial GDP per capita	–0.37	–0.39	–0.39	–0.47	–0.47
	(–2.98)	(–3.07)	(–3.08)	(–2.77)	(–2.74)
Growth of GDP per capita	–1.49	–1.23	–0.98	–0.84	–0.77
	(–3.32)	(–4.28)	(–5.11)	(–4.83)	(–4.80)
Adj. R^2	0.621	0.648	0.657	0.668	0.653
S.E.R.	0.523	0.509	0.502	0.495	0.504
F-statistic	23.26	24.21	23.94	24.07	21.78
N	69	64	61	58	56

NOTE: t-statistics are in parentheses.

are also included in the estimates to assure that the results deal with growth and not just the dispersion of income across countries.[5] The results show that the growth rates for all periods are significant determinants of poverty rates, and the sign is negative in all cases—i.e., economic growth reduces measured poverty rates. Moreover, the explanatory power of growth rates increases somewhat as the period lengthens, with the maximum explanatory power occurring with the 1970–90 estimate.

The use of the components of the HPI in comparable regressions in Table 5, using only the estimate from Table 4 with the highest adjusted R-squared (the 1970–90 estimate), provides further evidence of the benefits of economic growth to the poor. In particular, if growth increased one standard deviation above the mean for the

[5]The GDP per capita level variable could be viewed as a long-run, "steady-state" rate in the traditional macroeconomic sense, and the actual growth rate can be viewed as the excess growth rate.

TABLE 5

GDP, GROWTH, AND POVERTY MEASURES, 1970–90: REGRESSION RESULTS

Dependent Variable	Constant	Independent Variables					Adj. R^2	S.E.R.	F
		GDP	ΔGDP	Landlocked	Tropics	Urban			
Death by 40	1.84	−0.47	−0.77	0.27	0.05	−0.01	0.757	0.422	36.5
	(2.06)	(−2.93)	(−5.09)	(2.12)	(−0.31)	(−1.52)			
Illiteracy	4.17	−0.58	−1.00	0.08	−0.78	−0.02	0.518	0.873	13.2
	(2.66)	(−1.95)	(−2.90)	(0.25)	(−2.10)	(−1.03)			
Safe Water	3.07	−0.56	−1.29	0.20	0.03	0.00	0.405	0.963	8.7
	(2.50)	(−2.13)	(−5.90)	(0.60)	(0.06)	(−0.26)			
Access to Health	1.17	−0.38	−1.54	−0.05	0.85	−0.01	0.487	0.987	11.8
Services	(0.71)	(−1.19)	(−4.96)	(−0.14)	(1.88)	(−0.72)			
Undernourished	2.06	−0.54	−0.18	−0.35	0.50	−0.01	0.516	0.632	13.1
Children	(1.68)	(−2.22)	(−0.96)	(−1.78)	(0.50)	(−0.84)			

NOTES: ΔGDP is the percentage growth rate in real per capita GDP between 1970 and 1990. t-statistics are in parentheses.

1970–90 period (i.e., by .44), the proportion of the population surviving to age 40 would increase by almost 6 percentage points. At the sample mean, there would be a reduction from about 21 percent not surviving to age 40 to about 15 percent.

A particularly troubling issue is poverty in sub-Saharan Africa. One test of the robustness of economic growth in reducing poverty is to examine the record for 25 African nations. Regressing the HPI on the geographic variables, GDP per capita, and the growth (in logs) of GDP per capita generates the following estimates:[6]

(5) HPI = 1.14 – .04 Landlocked + .02 Tropics – .02 Urban
(0.69) (–0.20) (0.07) (–1.60)

– .20 GDP – .80 GDP Growth
(–0.73) (–4.05)

Adj. R^2 = .464
S.E.R. = .446
N = 25.

Regressing the proportion not surviving to age 40 on the same variables leads to the following estimates:

(6) Death by 40 = 0.67 + .04 Landlocked + .63 Tropics
(0.68) (0.23) (2.99)

– .0178 Urban – .32 GDP – .62 GDP Growth
(–1.36) (–1.89) (-5.04)

Adj. R^2 = .682
S.E.R. = .314
N = 25.

Both estimates reveal that data in Tables 4 and 5 also are consistent with the results for sub-Saharan Africa. In both estimates the coefficient for long-term growth is negative and robust—the strongest predictor of reduced deprivation is economic growth. The F-tests for equality of coefficients indicate that we cannot reject the proposition that the coefficients for the African sample and the full sample are not significantly different.[7]

[6]The log-odds transformation is again used for the dependent variable.

[7]For the poverty index, F = 0.03 and p = .034. For the Death by 40 proportion, F = 1.01 and p = .327.

Conclusion

The incomes of the poor are intimately linked to the incomes of the rich. While the relationship is not one-for-one, it is notable. The incomes of the poor rise more with increases in the incomes of the rich than vice versa. More importantly, the incomes of the rich have a discernable effect in reducing the UN's conventional measure of poverty. Notably, growth in the incomes of the rich reduces the effects of poverty proportionally more than is the case for increases in the incomes of the poor. In addition, economic growth clearly reduces poverty. The results for sub-Saharan Africa are not appreciably different from the rest of the world.

The term "trickle-down" is a misnomer: growth actually entails a cascade, not a trickle. The quality of growth may be important, but growth itself is the surest way to reduce human deprivation around the world.

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