The Distribution of Primary School Quality within High- and Low-Income Countries

STEPHEN P. HEYNEMAN AND WILLIAM A. LOXLEY

In the literature on economic development, much attention over the last 2 decades has been focused on the association between gross national product per capita and inequality of income distribution. Investigators have been preoccupied with three theories: (1) whether, in the process of development, income distribution first becomes less equal and only later more equal;[1] (2) whether economic growth would be retarded by emphasizing redistributional income policies;[2] and (3) whether the distribution of income is determined by factors external to the local economy—for example, by the degree of state strength, direct foreign financial control, or dependence on external markets.[3]

In each case, however, the answer has been incomplete. Income of individuals is the end product of, at least, ascription (e.g., social status), ambition, available opportunity, capability, and productivity. Some of these factors in turn depend on initial opportunity for education; and within education, the opportunity for secondary and higher education will depend, among other things, on first obtaining "a place" in primary school. Universal school enrollment (grades 1–6) has now been achieved in 35 middle- and upper-middle-income countries since World War II. In the 36 poorest countries of the world, enrollment has increased from

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[1] Simon Kuznets, "Modern Economic Growth: Findings and Reflections," *American Economic Review* 63 (1973): 247–58; Gerhard E. Lenski, *Power and Privilege: A Theory of Social Stratification* (New York: McGraw-Hill, 1966); Irma Adelman and Cynthia T. Morris, *Economic Growth and Social Equity in Developing Countries* (Stanford, Calif.: Stanford University Press, 1973); William R. Cline, *Income Distribution and Economic Development* (Washington, D.C.: Brookings Institution, 1974).

[2] Hollis B. Chenery, Montek S. Ahluwalia, C. L. G. Bell, John H. Duloy, and Richard Jolly, *Redistribution with Growth* (London: Oxford University Press, 1974).

[3] Richard Rubinson, "The World Economy and the Distribution of Income within States: A Cross-national Study," *American Sociological Review* 41 (1976): 638–59.

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48 percent of the age cohort in 1960 to 70 percent in 1978. Since, on an average, there are twice as many children enrolled in grade 1 as in grade 4, this 70 percent figure understates the proportion of children who begin school in low-income countries. By the end of this century, every child born probably will be able to enter first grade of some kind.

Nevertheless, it would be premature to shift the criterion for measuring "opportunity for education" to secondary education. Gross differences remain among and within countries as to what pupils can expect to find in primary school classrooms once entry has been obtained. And where entry to secondary education is governed by competitive examinations, having attended a primary school of high quality can enhance one's chance of doing well on that examination.[4] In sum, the distribution of primary school quality strongly affects the distribution of income later in adult life.[5] As is true with levels of personal income, electricity consumption, miles of highway, and many other factors, there are larger amounts of goods and services available to users in the wealthier countries. The question we wish to ask is whether countries with higher per capita incomes manifest a more equal distribution of whatever level of primary school quality they are able to supply.

Measuring Quality of Schools

Measuring the levels of school quality poses definitional and methodological problems. In education, a high level of quality implies a high level of educational "product," especially of academic achievement among pupils. Academic achievement is affected by both out-of-school and in-school factors. The former is defined by those qualities a person inherits (cohort of birth, sex, intelligence, socioeconomic status, as well as nutrition, housing, character of neighborhood, access to libraries, role models of diligence, honesty, etc.). What we call in-school characteristics also fall into two categories. One consists of "monetary" elements (school budget per pupil, textbooks per pupil, the availability of a library, etc.); the other consists of "managerial" elements (hours of homework, frequency of parent-teacher conferences, etc.). In our definition of school "quality," we will attempt to quantify both categories of in-school characteristics—that is, those characteristics over which those who manage schools have some control.

Each data set consists of information from a large sample of schools, teachers, and pupils. Details include family background, school perform-

[4] Stephen P. Heyneman and William A Loxley, "The Effect of Primary School Quality on Academic Achievement across 29 High- and Low-Income Countries," *American Journal of Sociology* (in press).

[5] Ernesto Schiefelbein and Joseph P. Farrell, "Education and Occupational Attainment in Chile: The Effects of Educational Quality, Attainment, and Achievement," mimeographed (Washington, D.C.: Education Department of the World Bank), 1981.

ance, and a substantial array of school-related facts—books in library, school size, cost of books, teacher salaries, teacher education, time spent preparing lessons, membership in professional organizations, and the like.[6] Variables were removed from the data set for a country if they displayed little variance or if one-fourth or more of the cases were missing. Out-of-school variables (sex, age, and socioeconomic status) were entered first into a stepwise regression, then all of the school variables were entered.[7] These latter variables were only retained in the final regressions if their (standardized beta) coefficient on achievement was greater than .05. The resulting list of the above-minimum predictors of student achievement differed from one country to the next. In Colombia it consisted of the following 20 indicators: the number of books in the school library; the number of times the library was used each week; the degree of activity of the parent-teacher association; whether classrooms contained a map of the world and a teacher's cabinet; whether the school grouped students by ability levels; whether the school had a book club or had a telephone; percentage of absenteeism; whether the school hired contract or permanent teachers; whether the school admitted students by competitive examination; teachers' paternal occupation; the size of teachers' houses; teachers' occupational satisfaction; whether teachers felt that all children—regardless of ability—were just as likely to be "troublesome"; the number of teachers' own offspring; the amount of experience teachers had in other schools; how often teachers graded the student tests and class exercises; and the degree to which principals believed that improving teachers would improve

[6] With the exception of Egypt, the data on schools, teachers, and students were collected between 1971 and 1975. They are derived from six sources: (1) the International Association for the Evaluation of Educational Achievement (IEA) (18 countries); (2) the National Institute of Education, Makerere University (Uganda); (3) the Oficina de Planeamiento y Organizacion in the Ministry of Education (El Salvador); (4) the Programa de Estudos Conjuntos de Integração Ecônomica da América Latina (ECIEL) (seven countries); (5) the National Center for Educational Research (Egypt); and (6) the Research and Testing Centre (Botswana). The particulars for each set of data are given in table 1. The surveys drew heavily on one another for their design. For example, the Uganda survey drew on the Equality of Education Opportunity Report; see James S. Coleman et al., *The Equality of Educational Opportunity* (Washington, D.C.: Department of Health, Education, and Welfare, 1966). The ECIEL and Egyptian surveys borrowed freely from the original IEA instruments. All added their own characteristics, however. The ECIEL surveys contained by far the most complete information on school costs. They also contained measures of student eyesight and family socioeconomic background across two generations. The El Salvador survey contained exact information on private educational expenditures. The Uganda survey contained data on school and teacher quality—duplicating machines, an exact count of textbooks, teacher verbal ability—and on students—intelligence and physical health—which were not included elsewhere. See Stephen P. Heyneman and William A. Loxley, "Influences on Academic Achievement across High and Low Income Countries: A Re-Analysis of IEA Data," *Sociology of Education* 55 (January 1982): 13–21.

[7] In all 29 countries the following variables were used as a measure of student socioeconomic status (SES): mother's education, father's education, father's occupation, the number of books available in the home, and some other measure of consumption such as a record player or a dishwasher. Academic achievement scores for Uganda, Egypt, and Botswana refer to mathematics; all other scores refer to science. In each country the student scores were derived from the last year of the primary school cycle.

TABLE 1
SOURCES OF DATA

Nation and Year of Survey	Age (or Grade Levels) Available*	Sample Representation	Sample Size at Age 14 or Last Year in Primary School		
			Schools	Teachers	Pupils
India (1971)	10, 14, LYS	4 of 23 states, limited to Hindi medium schools	155	311	2,400
Uganda (1972)	Grade 7	6 of 12 districts, all major urban areas	61	598	1,900
Botswana (1976)	Standard 7, form III, form V	National	37	186	870
Bolivia (1975)	Grades 1, 4, 6, LYS	4 out of 9 regions	48	96	528
Thailand (1971)	10, 14, LYS	Bangkok and environs	29	49	2,000
Egypt (1978-79)	Grades 3, 4, 5, 6	National	60	753	1,250
Paraguay (1975)	Grades 1, 4, 6, LYS	National	58	157	909
El Salvador (1975)	Grades 2, 3, 5, 6, 8, 9	National	137	1,100	824
Colombia (1975)	Grades 1, 3, 5, LYS	National random sample of urban education districts	52	207	900
Iran (1971)	10, 14, LYS	Teheran	33	42	1,000
Brazil (1975)	Grades 1, 4, 6, 8, LYS	Brasilia State	42	163	699
Peru (1975)	Grades 1, 4, 6, LYS	Lima and Puno	61	102	648
Mexico (1975)	Grades 1, 4, 6, LYS	Federal District	38	97	1,194
Chile (1971)	10, 14, LYS	National	103	306	1,200
Hungary (1971)	10, 14, LYS	National	210	917	4,200
Argentina (1975)	Grades 1, 4, 6, LYS	Buenos Aires and surrounding regions	61	252	865
Italy (1971)	10, 14, LYS	National	327	616	4,000
Japan (1971)	10, 14	National	196	752	1,945
Scotland (1971)	10, 14, LYS	National	70	399	1,980
England (1971)	10, 14, LYS	National	144	706	3,000
New Zealand (1971)	14, LYS	National	74	520	1,960
Finland (1971)	10, 14, LYS	National	77	280	2,240
Netherlands (1971)	10, 14, LYS	National	49	141	1,200
Australia (1971)	14, LYS	National	221	1,638	5,300
French Belgium (1971)	10, 14, LYS	National	21	60	545
Flemish Belgium (1971)	10, 14, LYS	National	31	95	695
Germany (1971)	10, 14, LYS	National	83	432	2,200
Sweden (1971)	10, 14, LYS	National	95	620	2,300
United States (1971)	10, 14, LYS	National	137	490	3,500

* LYS = Last year in secondary school.

TABLE 2
MEANS, STANDARD DEVIATIONS, AND THE RANGE OF THE SCHOOL-QUALITY INDEX BY COUNTRY

Country	Mean*	Standard Deviation	Range
India	11.4	4.5	1-23
Uganda	6.2	2.0	2-10
Botswana	7.7	2.1	3-14
Bolivia	7.4	3.4	1-13
Thailand	10.4	3.2	3-20
Egypt	10.8	2.3	5-16
Paraguay	9.3	2.0	5-15
El Salvador	8.0	2.0	3-13
Colombia	11.3	2.6	6-17
Iran	8.6	2.4	2-15
Brazil	5.9	1.7	2-10
Peru	9.4	4.1	1-22
Mexico	11.7	2.5	5-16
Chile	12.0	5.0	1-24
Hungary	9.6	2.3	3-17
Argentina	9.4	3.0	2-21
Italy	12.0	4.1	2-25
Japan	5.9	2.4	1-13
Scotland	9.0	2.1	2-19
England	8.4	2.2	3-15
New Zealand	10.5	2.6	4-18
Finland	7.4	2.3	1-14
Netherlands	7.8	2.5	1-15
Australia	4.6	1.4	1-9
French Belgium	9.3	2.6	3-17
Flemish Belgium	7.0	1.7	3-12
Germany	8.6	2.5	1-16
Sweden	5.3	1.1	1-10
United States	10.5	3.5	1-18

* Because the index of school quality was constructed to fit each country in particular, the means of school quality are not comparable from one country to the next.

student test scores. All these factors add perceptible amounts to predicted Colombian elementary school student test scores in science, net of preschool influences; and therefore each factor was included in the school quality index for Colombia.

Though the list varied substantially from one country to the next, whatever its content, we defined "school quality" to be its aggregate.[8] To construct this aggregate we dichotomized each variable at its median point, assigned schools to a 0/1 category on each school quality characteristic,

[8] We attempted to standardize the indicators of quality by using two other techniques. One was to transform the value of each quality variable into standard deviation units. Mean values were subtracted from each raw score for each variable and divided by the standard deviation. Deviations (called Z scores) above the mean ranged between 0 and $+3$, deviations below the mean from -3 to 0. To eliminate negative values, a constant was added, then all school indicators were summed. In this case all variables were in effect standardized in a range from 0 to 6. The procedure proved to be extraordinarily cumbersome; in fact, it exceeded our resources to implement. We tested the results

then summed these.[9] Accordingly, each school, and therefore each pupil, in Colombia was assigned a score for school quality that ranged from zero to 20. Similar indexes were constructed for each of the 29 countries. These scales were based on from 14 to 25 initial items, depending on the number of significant indicators emerging from each country's regressions. Means, standard deviations, and the ranges of school quality have been computed and appear in table 2.

Unit of Analysis

Opinions vary as to whether the pupil, classroom, school, or district should be used as the unit of analysis.[10] Even if data pertaining to all units were available, each has particular advantages and drawbacks. School budgets pertain to the school (or district) as a whole; when the pupil is the unit of analysis, the budget's "influence" will be assigned equally to each. The amount of exposure to science differs from one pupil to the next, but if the school or the region is taken as the unit of analysis, the "influence" of science exposure must be aggregated upward, whereby all pupils in a given school or region are assigned the average. Assigning influences downward to lower units produces misspecifications. A school's budget may particularly affect students in the upper grades; exposure to

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in three countries and compared this method with the one reported in the text. The correlation results (between school quality and student SES, for example) varied to only slight degrees: Colombia, .36 versus .38; Hungary, .35 versus .34; and Sweden, .36 versus .38. A second technique was to assign weights to each variable based on its regression coefficient with achievement. The rationale for this procedure was to allow those school quality characteristics with stronger effects on achievement to have more weight in the index of school quality. This was accomplished by taking the standardized beta coefficient and multiplying it by the zero or 2 value of the achievement indicator. Weighting is a particularly useful technique when the effect of various items is quite dissimilar. But in this case the regression coefficients for school inputs typically varied only between .05 and .25; this limited the degree of differentiation. The results of using this technique were also not significantly at variance with the results reported below. The third procedure—the one we adopted—which standardizes school quality indicators into dichotomies of high (1) or low (zero), follows precedents established in the procedures for test construction. See Lee J. Cronbach, "Coefficient Alpha and the Internal Structure of Tests," *Psychometrika* 16 (1951): 297–334; D. Kolakowski and D. Bock, *Normal Ogive: Maximum Likelihood Analysis and Test Scoring* (Chicago: National Educational Resources, 1973); Benjamin Wright and Nargis Panchapakesan, "A Procedure for Sample-free Item Analysis," *Educational and Psychological Measurement* 29 (1969): 23–48.

[9] We also attempted, but rejected, the use of factor analysis to model school quality. It could not efficiently locate clusters of school variables; more important, factor clusters do not lend themselves to weighting standard scores on school quality items. Factor analysis runs on school quality variables by country demonstrated no major dimension that could capture an acceptable portion of common variance among items. First factors obtained for each country contained only 15–20 percent of the total common variance shared by school quality indicators. This was to be expected, however, since the variables only became candidates as a result of preselection through regression analyses, which by definition do not select variables into the equation if they are highly intercorrelated. When examined for interreliability applying traditional (KR-20) reliability methods, quality measures are found not to have particularly high reliabilities—below 60; school quality seems not to be highly unidimensional.

[10] Leigh Burstein, "The Role of Levels of Analysis in the Specification of Educational Effects," in *The Analysis of Educational Productivity: Issues in Microanalysis*, ed. Robert Dreeben and Alan Thomas (Cambridge, Mass.: Ballinger, 1980), 2:119–90.

science may vary more among individual students than among individual schools. The influence of the school's budget will be misspecified if the pupil is taken as the unit of analysis; the influence of science exposure will be misspecified if the school is taken as the unit of analysis. In sum, when data on educational quality are taken from different levels, the unit of analysis will inevitably involve misspecifications, and it will ultimately depend on one's professional judgment as to which unit is the least inaccurate.

Data for neither classrooms nor regions are available. Since we are interested basically in the final user, we have chosen to discuss the distribution of school quality among individual pupils rather than among pupils averaged by school units. However, we have not limited our statistical tests to analysis at the pupil level; all conclusions, summarized in table 5, were based on patterns of inequality run at both the individual and the school units of analysis, and there is little deviation in the final results using one or the other method.

The Distribution of School Quality

Percentile Shares of School Quality

In no country is primary school quality distributed evenly among students; inevitably some experience better instruction than others. Analogous to studies of income distribution among individuals,[11] we have ranked individual primary school students in each country from high to low on the basis of their access to school quality and have partitioned them into three groups: the bottom 40 percent, the middle 40 percent, and the top 20 percent. Then we estimated the proportion of each nation's quantum of school quality accruing to pupils within each of the three groups (table 3).[12]

In each country, distribution is skewed slightly in favor of the top quintile (20 percent) of students. For example, in India the top 20 percent of students receive 23 percent of school resources; the bottom 40 percent of students receive only 33 percent of school resources; the middle 40 percent receive 44 percent. The pattern prevails for all countries, whether low-, middle-, or high-income. Nevertheless, the distribution of school quality appears less equal, on average, than the distribution of personal

[11] Kuznets; Montek S. Ahluwalia, "Income Inequality: Some Dimensions of the Problem," in *Redistribution with Growth*, ed. Hollis Chenery et al. (n. 2 above).

[12] The scale of school quality is ordinal; the distributional base, pupils, is interval. Ordinal data in this case are treated as though they contained interval properties. Strictly speaking this should be avoided. With ordinal data, only medians and percentiles are valid properties to compare; means, standard deviations, and correlations are statistical properties usually reserved for comparisons among interval data. However, some have argued for bypassing this ordinal/interval distinction in certain instances because the benefits outweigh the drawbacks. See Sanford Labovitz, "The Assignment of Numbers to Rank Order Categories," *American Sociological Review* 35 (1970): 515–24; S. S. Stevens, "On the Theory of Scales of Measurement," *Science* 103 (1946): 677–80.

TABLE 3
THE DISTRIBUTION OF SCHOOL RESOURCES WITHIN COUNTRIES

Country	GNP per Capita (1971 $US)	Percentage of School Resources Available to Each Percentage of Pupils		
		Lowest 40%	Middle 40%	Top 20%
India	110	33	44	23
Uganda	130	27	43	30
Botswana	160	30	42	28
Bolivia	190	22	45	33
Thailand	210	27	49	24
Egypt	220	31	44	25
Paraguay	280	33	40	27
El Salvador	320	31	41	28
Colombia	370	31	43	26
Iran	450	29	44	27
Brazil	460	29	42	29
Peru	480	31	41	28
Mexico	700	31	43	26
Chile	760	29	47	34
Hungary	1,200	31	42	27
Argentina	1,230	29	42	29
Italy	1,860	28	46	26
Japan	2,130	25	44	31
Scotland	2,430	30	43	27
England	2,430	30	42	28
New Zealand	2,470	31	42	27
Finland	2,550	28	41	31
Netherlands	2,620	27	45	28
Australia	2,870	28	43	29
French Belgium	2,960	29	43	28
Flemish Belgium	2,960	30	44	26
Germany	3,210	28	43	29
Sweden	4,240	28	44	28
United States	5,160	27	43	30

income (table 4). Within the poorest countries, the bottom 40 percent of the population, on average, acquires less than its proportional share of either "resource." The bottom 40 percent received 29 percent of the school quality resources but only 14 percent of the income. Conversely, the top 20 percent of the population in low-income countries received only 27 percent of the school quality resources but 53 percent of the personal income. Greater inequality with respect to personal income than with school quality holds true also within both middle- and high-income countries. It seems that countries are able to distribute school quality more equally than personal income.[13]

The Gini Coefficient as a Measure of Equity

A second procedure for estimating the degree of inequality is the calculation of a Gini coefficient: the share of school quality received by a

[13] This could be assumed from the fact that schooling is, in part, a public good; but what is assumed has not always been the case.

TABLE 4
DISTRIBUTIONS OF PERSONAL INCOME AND SCHOOL QUALITY WITHIN HIGH-, MEDIUM-, AND LOW-INCOME COUNTRIES

National GNP Category	Percentage Shared by Bottom 40% of the Population		Percentage Shared by Top 20% of the Population	
	Income	School Quality	Income	School Quality
Low-income countries	14	29	53	27
Middle-income countries	14	30	48	28
High-income countries	17	29	44	28
Average	15.0	29.3	48.3	27.7

NOTE.—Low-income = below US$300; middle-income = $300—$750; high-income = above $750. N = 29 for school quality distribution: N = 66 for income distribution. Twenty-one countries are in common between tables 3 and 4. Source of income distribution figures: M.S. Ahluwalia (see n. 2), pp. 8-9.

given percentage of the school population.[14] These figures are displayed in table 5. This index does not vary greatly among countries. The most even distributional pattern can be found within Brazil (Gini = .309);[15] the most unequal pattern can be found in New Zealand (Gini = .446). Yet there does not appear to be a systematic relationship with level of economic development, for the correlation between these Gini coefficients and GNP per capita is virtually zero (r = .00).

School Quality and Socioeconomic Status of Individual Pupils

Patterns of school quality distribution noted above do not necessarily answer the question of which pupils receive the highest level of school quality. The way to assess this aspect is to note the degree of correlation between exposure to school quality and student socioeconomic status. On this index, countries vary substantially from one another.

In some countries, pupils of lower socioeconomic status do not appear to be at a disadvantage in their access to school quality. In those countries, the correlation of individual socioeconomic status and school quality appears to be quite low—for example, the United States (r = .06), Sweden (r = .05), Flemish Belgium (r = .03), India (r = .06), Thailand (r = .07), and Paraguay (r = .06). In other countries, students from the higher socioeconomic strata appear to have garnered advantages by attending schools of higher quality—for example, Peru (r = .25), Colombia (r = .32), Botswana (r = .33), New Zealand (r = .23), and Germany (r = .24). Countries with higher levels of per capita income are moderately more successful in equally distributing school quality among students from differing social strata. The correlation of GNP per capita and the school quality/SES coefficients reported above (r = −.28 [P < .07]) does indicate

[14] The Gini coefficient ranges from .000 to .999, where a low score represents less inequality.
[15] The survey in Brazil was confined to the state of Brasilia.

TABLE 5
EQUALITY OF DISTRIBUTION OF SCHOOL RESOURCES WITHIN COUNTRIES

Country	National GNP per Capita (1971 US$)	Distribution/Pupil (Gini Coefficient)	Correlation between School Quality/Pupil and Pupil's SES
India	110	.397	.06
Uganda	130	.409	.12
Botswana	160	.342	.33
Bolivia	190	.413	.21
Thailand	210	.427	.07
Egypt	220	.394	.29
Paraguay	280	.368	.06
El Salvador	320	.367	.18
Colombia	370	.381	.32
Iran	450	.310	.05
Brazil	460	.309	.10
Peru	480	.450	.25
Mexico	700	.360	.18
Chile	760	.370	.48
Hungary	1,200	.335	.20
Argentina	1,230		
Italy	1,860	.357	.08
Japan	2,130	.403	.11
Scotland	2,430	.360	.18
England	2,430	.429	.31
New Zealand	2,470	.446	.23
Finland	2,550	.375	.07
Netherlands	2,620	.436	.08
Australia	2,870	.411	.16
French Belgium	2,960	.375	.07
Flemish Belgium	2,960	.351	.03
Germany	3,210	.316	.24
Sweden	4,240	.375	.05
United States	5,160	.372	.06
Correlation with GNP Column[a]	...	.000	−.28*

[a] These correlations were calculated using the pupils as the unit of analysis. When the school is the unit of analysis the correlations are as follows: $r = .10$ (N.S.) for GNP per capita and the distribution of school quality among schools; $r = -.29$ ($P < .06$) for GNP per capita and the correlation between school quality/school and SES/school.

* $P < .07$.

a trend in that direction; but the low level of statistical significance does not engender confidence in the relationship's stability.

Conclusion

Quality of schools is a critical resource in the production of school achievement, both individual and national. Countries with a scarcity of resources—in transportation, administration, and management—could be expected to perform worse in distributing any resource, especially one of such complexity as school quality; but this does not seem to occur. Among the low-income countries, many have managed the distribution

of school resources in a fashion that is every bit as equal as countries with higher levels of income, an abundance of training, and a plethora of facilities to assist in educational management. This is very much to their credit. We must conclude, as does Gustav F. Papanek in his review of income distribution, that "at all levels of per capita income, some countries are quite egalitarian and some have quite unequal distributions. In other words there is nothing inevitable about changes in distribution as average [national] income rises."[16]

More work and higher levels of effort to distribute school quality fairly are appropriate in every country; but it cannot be said that this is systematically more true of countries in Europe than in North America or in Latin America more than in Asia. Furthermore, because school quality consists of both monetary and managerial elements, even in those countries that are experiencing high levels of inequality, the problem is not necessarily amenable to the same solutions as would be the redistribution of land or personal income.

[16] Gustav F. Papanek, "Economic Growth, Income Distribution, and the Political Process in Less Developed Countries," in *Income Distribution and Economic Inequality*, ed. Zvi Griliches, Wilhem Krelle, Hans-Jürgen Krupp, and Oldrich Kyn (New York: Halsted, 1978), pp. 259–73.